UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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DEAD AIR ARMAMENT, LLC d/b/a DEAD AIR SILENCERS,

Petitioner

v.

JARVIS ARMS LLC *d/b/a* MISSION SILENCERS,

Patent Owner

_____

Case: IPR2026-00013

U.S. Patent No. 12,018,906

_____

DECLARATION OF ROBERT S. SILVERS, IN SUPPORT OF PETITION FOR INTER PARTES REVIEW OF UNITED STATES PATENT NO. 12,018,906

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Claim 1, Element [1.1a]: the housing comprising: a first aperture at the first end, a second aperture at the second end; 131

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Claim 1, Element [1.1a]: the housing comprising: a first aperture at the first end, a second aperture at the second end; 223

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CLAIM LISTING

Claim	Recitation
1.PRE	A firearm suppression system comprising:
1.1	a housing comprising a first end and a second end,
1.1a	the housing comprising: a first aperture at the first end, a second aperture at the second end;
1.1b	[the housing comprising:] 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;
1.2	an end cap with a projectile aperture; and
1.3	a core removably attachable to the housing and positioned therein,
1.4	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,
1.5	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.

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Claim	Recitation
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.

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I, Robert S. Silvers, declare as follows:

I. INTRODUCTION

1. I have been retained by Dead Air Armament, LLC *d/b/a* Dead Air Silencers ("Dead Air"), to serve as an independent expert consultant in this proceeding before the United States Patent and Trademark Office ("PTO") against Jarvis Arms LLC *d/b/a* Mission Silencers ("Patent Owner") regarding U.S. Patent No. 12,018,906 B2 ("the '906 patent"). (Ex. 1001).[1] I have been asked to submit this Declaration on behalf of Petitioner.

2. I have been asked to consider whether certain references disclose or render obvious claims 1-7 and 9-11 ("the challenged claims") of the '906 patent, which have been asserted against Petitioners. My opinions are set forth below. Based on my experience and expertise, it is my opinion that the prior art anticipates and/or renders obvious all limitations of the challenged claims, as I discuss in detail below.

3. I am not, and never have been, an employee of Dead Air. I am not receiving compensation for this declaration beyond my normal hourly fees of $475 based on my time actually spent analyzing and documenting my opinions herein on

[1] Where appropriate, I refer to exhibits that I understand are to be attached to the petition for *Inter Partes* Review of the '906 patent.

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the ’906 patent, the intrinsic record, the asserted prior art references identified in the Petition, and the issues related thereto. My compensation is not related to the outcome of this proceeding, and I will not receive any additional compensation based on the outcome of any IPR or other proceeding involving the ’906 patent.

4. All of my opinions set forth below are based on my own personal knowledge and professional judgment. I am over 18 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth in this Declaration.

II. BACKGROUND AND QUALIFICATIONS

5. My academic and professional background is in firearms, firearm components (including suppressor design), and additive manufacturing, and I began working in those fields since 2006, almost twenty years ago. My complete qualifications and professional experience are described in my Curriculum Vitae, a copy of which is marked as Ex. 1009. The following is a brief summary of my relevant qualifications and professional experience.

6. I earned my Bachelor of Science in Computer Science from the University of Massachusetts and my Master of Science from the Massachusetts Institute of Technology, working on the Things That Think team – creating devices for Smart Homes, and advanced photographic processes, including laser-

holographic imaging. I also received formal machining and welding training after pursuing my Master of Science degree. I worked an early career inventing in the computer-aided art space, creating the now well-known Photomosaic™ process before turning to pursue my lifelong passion for firearms and sound suppressor design. I am an inventor with numerous patents worldwide. I am also a Deputy Sheriff law enforcement officer and a Federally licensed manufacturer of firearms, Type 7, Class 2 (manufacture of National Firearms Act restricted Title II firearms including sound suppressors), and an FAA licensed commercial unmanned aircraft pilot.

7. I have 41 years of experience with firearms, with 13 of those years, from 2005 to 2017 and from 2024 to present, working directly in the sound silencer/suppressor industry designing and testing related products such as muzzle devices. In 2005, I launched the silencertests.com website for the purposes of testing firearms sound suppressors. I acquired the proper credentials through a partnership to be a federally licensed manufacturer, and started to test sound suppressors while learning sound suppressor design from leading industry professionals. I then worked with the industry as a whole to carefully test and document comparisons of many of the popular models that were available. I then publicly shared the outcomes, which forced various companies to design better products to earn more favorable results. After learning what design concepts resulted in the most success, I studied computer-

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aided design, and went back to school to more formally learn machining and welding. I then developed and patented a sound suppressor that I licensed to Advanced Armament Corporation ("AAC"), one of the best-known sound suppressor companies. Also in November of 2005, I was invited to Russia to meet with General Michael Kalashnikov, the lead designer of the AK-47, a military rifle of which over 100 million were made. To my surprise, he was coincidently familiar with my work as an artist, and had some of my work at his home. Soon after and still in 2005, I became internationally recognized when Gunner Magazine featured me and my reference collection in Volume 1 of their publication in Japan, France, Hong Kong, Taiwan, Great Britain, China, Australia, and New Zealand. Further, they made me an official firearms reporter for their publication.

8. I then formally joined AAC in 2006, where I developed the Blackout Flash suppressor, a patented design that won an Army contract after competitive testing against the best that the industry could offer. Tens of thousands of my flash suppressors were airlifted into combat to help save soldiers from their muzzle flash being seen by the enemy. This product forever changed the industry, and started a trend toward three-pronged designs, which had not been seen since the Vietnam War when others gave up on this concept. While still at AAC, we won the U.S. Army M-2010 rifle suppressor competition with my patented all-titanium, fully welded TiTAN-QD that was based on my patent that I began working on in 2005. This is a

lightweight, fast-attach silencer for bolt action precision rifles, which then became standard issue within the Army.

9. I later became Director of Research and Development for the Remington Arms Company. While there, and after working at the request of Special Forces groups on the concept in 2009, I led the development of the 300 AAC Blackout cartridge (300 BLK), one of the few successful new cartridge introductions in recent history. The 300 BLK allows for an AR15/M16-platform rifle to shoot 30-caliber projectiles using standard AR15/M16 components, and only requires changing of the barrel. Although changing the barrel is all that is required, I proposed a series of further innovations that ensured the cartridge's enhanced reliability and success. The 300 BLK is specifically designed to be efficient with sound suppressors, and I designed matching silencers to work with it.

10. I also made further improvements to weapon system design by pushing Remington to, at significant expense, create custom projectiles that would have an ogive (curve of the bullet) specifically shaped so that when the cartridge was loaded to normal (5.56mm) magazine length, the projectile would perfectly rest on the magazine rib that was originally designed to support a 5.56mm case neck. Another innovation to the ammunition that allowed it to be reliable with or without a sound suppressor in place and without the need for an adjustable gas port. This is specifically relevant to silencer design because such devices increase bolt carrier

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velocity, which can reduce reliability if the magazine cannot feed new cartridges quickly enough.

11. Because of our improvements and innovations to the 300 BLK platform, it succeeded where previous attempts, such as 300 Whisper™, had not seen commercial success. The 300 BLK has since been put into service by Special Operations groups in the U.S. Army, U.S. Navy, the Netherlands, and the British SAS – among millions of enthusiasts.

12. While at AAC and Remington, I was responsible for the development of a line of both 300 BLK and 5.56mm upper receivers and rifles called the MPW (Multi-Purpose Weapon). I also designed and tested the AAC BrakeOut™ flash-suppressing muzzle brake, which was the first muzzle brake to reduce recoil, while still suppressing flash as well as the standard USGI A2 flash suppressor. I also designed and patented the AAC SquareDrop handguard, and designed other sound suppressors, such as one called the Cyclops for a 50 BMG rifle. During this time, I was acutely aware that silencers would cause increased backpressure, resulting in toxic gases reaching the shooter's face, increased cyclic rate, and the potential for reduced reliability. Methods at the time to reduce backpressure generally involved increasing bore size, lengthening the blast chamber, or porting the baffles.

13. My job also required overseeing firearms and silencers being prepared for manufacturing. This included making and testing prototype parts, and designing

for efficient manufacturing, such as welding, casting, and metal-injection molding. I was first exposed to 3D printers at MIT in 1995. In 2009, I purchased (at work) an Objet Alaris 30 3D printer. This was my first experience using 3D printers for sound suppressor development. A few years later, I would use 3D metal printers – not for production, but for rapid-prototyping muzzle devices. In 2012, I purchased my first 3D printer for home use. Soon after, I developed my own design. Since then, I have owned over 30 different printers to use for self-manufacturing and selling over 12,000 parts.

14. I was a featured speaker at the National Defense Industry Association where I presented my research on the Low Visibility Carbine (later known as the LVAW – Low Visibility Assault Weapon). I managed and developed the gas-system for this rifle project, and it was well known in the industry as the "Honey Badger." My research helped lead to U.S. Special Operations Command (SOCOM) adopting such a weapon in 2017. In 2018, SOCOM awarded a $48 million-dollar, five-year contract for 300 BLK weapon systems to Sig Sauer. The culmination of this work has been the large-scale military adoption of these pioneering engineering projects—the Army's M2010 sound suppressor, the Blackout flash suppressor, the BrakeOut, and the 300 AAC Blackout cartridge.

15. More recently, in 2022 an innovative 3D printer company sent me a pre-production unit three months before they went on sale – seeking my feedback

before sale. I have further consulted in matters of engineering filament design as well as being a 3D printer consulting expert witness for a patent litigation matter. Beginning in November 2024, I have been employed as Director of Research & Development by B&T USA, where I design sound suppressors that are manufactured with DMLS – direct metal laser sintering of metal powder for production use. I also lead other engineering developments related to testing sound suppressors for such performance metrics as sound, muzzle flash, and back pressure. I am also an Expert Witness for Sig Sauer for a case involving patent infringement of pistol magazines.

16. My Curriculum Vitae (Ex. 1009) lists my publication and speaking engagements at various publications, international conferences, and working groups, and further includes a list of granted patents.

17. Based on my experience and education, I consider myself to be an expert at least in the fields of firearms, firearm suppressors, and additive manufacturing. As of the earliest priority date of the ’906 patent, I was at least a person of ordinary skill in the art (“POSITA”) of the ’906 patent, and I had personal knowledge of the technologies involved in the ’906 patent.

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III. MATERIALS REVIEWED

18. The opinions contained in this Declaration are based on the documents I reviewed, my professional judgment, as well as my education, knowledge, and experience in the relevant art.

19. In forming my opinions, I reviewed and relied upon the following materials and information:

Exhibit	Description
Ex. 1001	U.S. Patent No. 12,018,906 B2 ("the '906 patent")
Ex. 1002	Prosecution History of U.S. Patent No. 12,018,906 B2 ("'906 pros history")
Ex. 1003	U.S. Pre-Grant Pub. No. 2021/0207916 A1 ("Belykov")
Ex. 1004	U.S. Patent No. 11,268,776 ("Noonan")
Ex. 1005	U.S. Pre-Grant Pub. No. 2022/0276015 A1 ("Muceus")
Ex. 1006	U.S. Pre-Grant Pub. No. 2021/0381793 A1 ("Slack")
Ex. 1007	U.S. Pre-Grant Pub. No. 2015/0285575 A1 ("Sclafani")
Ex. 1008	Declaration of Robert S. Silvers
Ex. 1009	*Curriculum Vitae* of Robert S. Silvers
Ex. 1010	National Firearms Act Handbook, ATF, April 2009, available at https://www.atf.gov/firearms/docs/guide/atf-national-firearms-act-handbook-atf-p-53208/download
Ex. 1011	Letter dated June 9, 2025 from Brian D. Batt on behalf of Jarvis Arms LLC dba Mission Silencers
Ex. 1012	Complaint for Declaratory Judgment of Non-Infringement, *Dead Air Armament, LLC d/b/a Dead Air Silencers v. Jarvis Arms LLC d/b/a Mission Silencers*, 4:25-CV-00497-BLW-DKG (DID Aug. 29, 2025).

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20. I also reviewed any other materials I refer to in this Declaration in support of my opinions.

21. In forming my opinions, I have considered the materials listed above and any other documents cited in this Declaration. My opinions are based on the documents I reviewed and my knowledge and professional judgment. My opinions have also been guided by my appreciation of how a POSITA would have understood the state of the art, the prior art, and the claims and the specification of the '906 patent at the time of the alleged invention.

IV. LEGAL STANDARDS

22. I am not an attorney, and do not offer opinions on the law in this Declaration.

23. In forming my analyses and conclusions expressed here in this Declaration, I have applied the legal principles described in the following paragraphs, which were provided to me by counsel for the Petitioners.

24. I used my understanding of the following legal principles set forth in this section in reaching my opinions.

25. I understand that, in this proceeding, Petitioner has the burden of proving that the challenged claims are unpatentable by a preponderance of the evidence.

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A. Anticipation

26. It is my understanding that to anticipate a patent claim under 35 U.S.C. § 102, a single asserted prior art reference must disclose each and every element of the claimed invention, either explicitly or inherently, to a POSITA. I understand that a disclosure of an asserted prior art reference can be "inherent" if the missing element is necessarily present or is the inevitable outcome of the process and/or thing that is explicitly described in the asserted prior art reference.

B. Obviousness

27. I have been informed that a claim is unpatentable as obvious under 35 U.S.C. § 103 (AIA) if the differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious at the time of the invention to a POSITA. I have been informed that the following matters are relevant to determining whether the claimed invention would have been obvious: (1) the scope and content of the prior art, (2) the difference or differences between the patent claim and the prior art, (3) the level of ordinary skill in the art at the time of the invention of the patent, and (4) any secondary considerations or objective indicia of non-obviousness.

28. I have been informed that the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. When a claim simply arranges prior art elements with each performing the same function it had been known to perform and yields no more than one would expect from such an arrangement, then such a combination is obvious. When a patent claims a structure already known in the prior art altered by the mere substitution of one element for another known in the field, the combination is likely to be obvious unless the combination yields an unpredictable result.

29. I have been informed that when a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a POSITA can implement a predictable variation, such a variation is likely unpatentable. For the same reason, if a technique has been used to improve one device, and one of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill. One question to consider is whether the improvement is more than predictably using prior art elements according to their established functions.

30. I have been informed that it may often be necessary, in a validity analysis, to consider whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. This can be accomplished by

looking to interrelated teachings of multiple patents or other publications or pieces of prior art; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by one of ordinary skill in the art.

31. I have been informed that a validity analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim; it is appropriate to take account of the inferences and creative steps that a POSITA would employ. I have been informed that a POSITA is a person of ordinary creativity, not an automaton.

32. I have been informed that a claim composed of several elements is not proved obvious merely by demonstrating that each element was, independently, known in the prior art. I have been informed that it can be important to identify a reason that would have prompted a POSITA in the relevant field to combine the elements in the way the claimed new invention does. I am told that one way that subject matter can be proved obvious is by noting there existed at the time of the invention a known problem for which there was an obvious solution encompassed by the patent's claims. I have been informed that any need or problem known in the field of endeavor at the time of the claimed invention and addressed by the patent can provide a reason for combining the elements in the manner claimed.

33. I have been informed that one should not assume that a POSITA attempting to solve a problem will be led only to those elements of prior art designed to solve the same problem. Instead, I have been informed that since familiar items may have obvious uses beyond their primary purposes, in many cases a POSITA will be able to fit the teachings of multiple prior art references together like pieces of a puzzle.

34. I have been informed that, when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, POSITAs have good reason to pursue the known options within their technical grasp. If this leads to the anticipated success, the product was likely not accomplished by innovation but by using ordinary skill and common sense. I have been informed that, in such an instance, the fact that the combination was obvious to try may show that the combination was obvious.

35. I have been informed that, when determining whether a claimed combination would have been obvious, the correct analysis is not whether a POSITA, writing on a blank slate, would have chosen the particular combination of elements described in the claim. Instead, I have been informed that the correct analysis considers whether one of ordinary skill, facing the wide range of needs created by developments in the field of endeavor, would have seen a benefit to selecting the combination claimed.

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36. I have been informed that, when determining whether a claimed invention is obvious, any "secondary considerations" of non-obviousness identified by the patentee should also be considered. These secondary considerations can include:

- commercial success of the invention, causally related to the invention itself rather than to companion factors, such as advertising or attractive packaging;
- the invention taught away from the technical direction followed by those skilled in the art;
- a long-felt but unsatisfied need for the invention while the needed implementing arts and elements had long been available;
- the invention achieves results unexpected to those skilled in the art;
- copying of the invention by competitors as distinguished from their independent development;
- unsuccessful attempts by those skilled in the art to make the invention;
- acquiescence by the industry to the patent's validity by honoring the patent through taking licenses or not infringing the patent, or both; and
- skepticism, disbelief in or incredulity by those skilled in the art that the patentee's approach worked.

37. I have been informed that, for the above information to impact the obviousness of a patent claim, there must be a nexus between the alleged secondary considerations and the claims. In addition, I have been informed that the burden of introducing evidence of secondary considerations generally is on the Patent Owner. If the Patent Owner or its expert should assert secondary considerations of non-obviousness, I reserve the right to provide a Declaration addressing assertions of non-obviousness due to secondary considerations.

C. Claim Construction

38. I have been informed that claim terms are typically given their plain and ordinary meanings, as would have been understood by a POSITA at the time of the earliest alleged priority date. I have further been informed that when considering the meaning of any terms in the challenged claims of the 906 patent, I should apply the plain and ordinary meaning of those terms. I have further been informed that in considering the meaning of the claims, one must consider the language of the claims, the specification, and the prosecution history of record.

39. I have been informed that, in general, a preamble limits the invention if it recites essential structure or steps, or if it is necessary to give life, meaning, and vitality to the claim. I have further been informed that a preamble is not limiting where a patentee defines a structurally complete invention in the claim body and

uses the preamble only to state a purpose or intended use for the invention. I have further been informed that dependence on a particular disputed preamble phrase for antecedent basis may limit claim scope because it indicates a reliance on both the preamble and claim body to define the claimed invention. I have further been informed that clear reliance on the preamble during prosecution to distinguish the claimed invention from the prior art transforms the preamble into a claim limitation because such reliance indicates use of the preamble to define, in part, the claimed invention.

V. PERSON OF ORDINARY SKILL IN THE ART AT THE TIME OF THE ALLEGED INVENTION

40. I have been asked to assume that the '906 patent is entitled to its earliest alleged priority date of October 27, 2022 (*see* Ex. 1001 col. 1 ("Related U.S. Application Data" section)). Based on my knowledge and experience, I was at least a POSITA as of October 27, 2022, and can provide opinions regarding the knowledge of a POSITA as of that time. My opinions herein are, where appropriate, based on my understandings as to a POSITA at that time.

41. I understand that factors that are pertinent to a determination of the level of ordinary skill in the art include: (1) the educational level of the inventor; (2) the type of problems encountered in the art; (3) the prior art solutions to those problems; (4) the rapidity with which innovations are made; (5) the sophistication of the

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technology; and (6) and the educational level of workers active in the field. Based on the materials and information I have reviewed and based on my experience in the technical areas relevant to the '906 patent, a POSITA at the time of the alleged invention of the '906 patent would have been a person with a working knowledge of firearm suppressors. A POSITA at the time of the invention is an individual with a B.S. in Mechanical Engineering or equivalent with at least 2 years' experience in the field of firearm suppressors; or an individual with at least 5 years of experience in firearm suppressors. For example, a person with a different degree but with additional relevant experience could still qualify if the additional experience compensates for the different educational background. A person with less than 2 years of experience working in a field involving firearm suppressors could still qualify if the person has additional education that compensates for their lesser experience. For example, an individual with an advanced degree in a relevant field, such as a Masters or Ph.D. in Mechanical Engineering, Acoustics, Physics, or the like may qualify as one of ordinary skill in the art without having industry experience.

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VI. SUMMARY OF THE ’906 PATENT

A. The ’906 Patent’s Specification

42. The ’906 patent is titled “Firearm suppression system” and “relates to a firearm suppression system that reduces sound, recoil, and back gassing.” Ex. 1001 Abstract.

43. The ’906 patent purports to identify problems related to suppressors, and in particular, notes that “suppressors on the market seek to reduce muzzle flash, noise and back gassing and increase accuracy, many fall short due to their configurations.” Ex. 1001 col. 1, ll. 34-41.

44. The ’906 patent purports to solve the identified problems by “managing gas flows and baffle angles to statistically balance sound, recoil, and back gassing”. Ex. 1001 col. 5 ll. 9-23.

45. The firearm suppression system of the ’906 patent 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.” Ex. 1001 col. 5, ll. 24-28. The housing is described as “cylindrical-shaped”, with an “inner compartment 122 [that] may be configured to receive the core 112.” Ex. 1001 col. 5, ll. 27-28; col. 5, ll. 54-59. The “housing 102 includes a first aperture 118 at the first end 104 and a second aperture 120 at the second end 106.” Ex. 1001 col. 5, ll. 52-54.

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46. The "core 112 may be substantially cylindrical-shaped so as to fit within the housing 102." Ex. 1001 col. 6, ll. 60-62. The '906 patent states that the outer surface 140 of the core 112 may comprise a "plurality of core apertures 144 may be substantially hexagonal shaped and have the appearance of a honeycomb." Ex. 1001 col. 7, ll. 22-26. The '906 patent describes that "the core 112 may include an inner surface 146 that comprises baffles 148 that interact with the plurality of core apertures 144". Ex. 1001 col. 7, ll. 29-31. The '906 patent further specifies that the "baffles 148 may be extruded inward at various prescribed angles". Ex. 1001 col. 10, ll. 51-53. The '906 patent also describes that "the core 604 may be easily removed from the housing 602 and cleaned, thereby making maintenance of the firearm suppression system 600 simple." Ex. 1001 col. 10, ll. 32-36.

47. The '906 patent states that "[b]etween 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", and, according to the specification, that "[t]he 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." Ex. 1001 col. 6, ll. 62-67. The channel, as claimed, "circumscribes" the outer surface of the core. Ex. 1001 col. 12, ll. 37-38. The only use of the term "circumscribe" or its derivatives in the non-claim portions of the specification of the '906 patent are in reference to "a hexagonal-like border circumscribing the baffles". Ex. 1001 col. 7, ll. 47-49, col. 10, ll. 60-62.

48. The ’906 patent further discloses that the channel “equalizes pressure”. Ex. 1001 col. 6, ll. 62-64. It is explained that

> [t]he 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 [sic] 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.

Ex. 1001 col. 6, ll. 66-col. 7, ll. 1-12.

49. The end cap is described as being “threadably coupled to the second end 106 of the housing 102” and that “[o]ther fastening mechanisms may be envisioned.” Ex. 1001 col. 6, ll. 6-9; col. 10, ll. 10-12. The end cap may include “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”

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and "a projectile/bullet aperture 128 where the bullet fired from a cartridge may leave the gun and system 100." Ex. 1001 col. 6, ll. 20-23; col. 8, ll. 41-44.

50. The end cap is described as having "a ledge 136 that rests on and is flush with the second end 106 of the housing 102." Ex. 1001 col. 6, ll. 37-39. "A sidewall 138 that couples to the ledge 136 may be an annular protrusion that contacts the inner surface 114 of the housing 102." Ex. 1001 col. 6, ll. 39-42; col. 12, ll. 50-53. The sidewall of the end cap "may be threaded." Ex. 1001 col. 6, ll. 42-45.

51. The '906 patent defines a "muzzle adapter 108 that is removably attachable to the core and/or housing", which "may be present in the core 112 and/or housing 102 so as to be directly threaded onto a firearm." Ex. 1001 col. 5, ll. 60-66. The '906 patent also describes "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". Ex. 1001 col. 11, ll. 28-31.

52. The '906 patent describes that "the housing 102 may be printed via a three-dimensional printer, milled, or manufactured by any other means known in the art." Ex. 1001 col. 5, ll. 45-47. "[T]he end cap 110 may be printed via a three-dimensional printer out of titanium, plastics, or any other material." Ex. col. 6, ll. 24-26. "[t]he core 112 may be printed via a three-dimensional printer, or manufactured by other means known in the art." Ex. col. 7, ll. 15-17.

B. The ’906 Patent’s Prosecution History

53. Below is a summary of the ’906 patent’s prosecution history. This summary is not intended to address or summarize the ’906 patent’s entire prosecution history. Rather, it is intended to summarize the parts that may be relevant to my analysis below.

54. U.S. Patent Application No. 18/382,845 (“the ’845 application”) was filed on October 23, 2023, and resulted in U.S. Patent No. 12,018,906. The ’845 application is a Non-Provisional Application of Provisional Application No. 63/419,776, filed on October 27, 2022.

55. The ’845 application was filed with original claims 1-20. Ex. 1002 pgs. 37-40.

56. On November 29, 2023, a Non-Final Office Action (the “Office Action”) was issued. Ex. 1002 pgs. 93-101. The Office Action rejected claims 1, 4-7, 9, and 20 as anticipated by U.S. Patent No. 10,605,558 to Marfione, et al. (“Marfione”). Ex. 1002 pgs. 95-96. Claims 2, 8, 10, 12, and 13 were rejected as being unpatentable over Marfione in view of U.S. Patent Pub. No. 2015/0285575 to Sclafani (“Sclafani”). Ex. 1002 pgs. 97-98. Claims 3, 14, and 15 were rejected as being unpatentable over Marfione in view of U.S. Patent No. 9,347,727 to Cler (“Cler”). Ex. 1002 pgs. 98-99. Claim 11 was rejected as being unpatentable over Marfione in view of Sclafani, and further in view of US. Patent Pub. No.

2021/041200 to Kras, et al. ("Kras"). Ex. 1002 p. 99. Claims 16-19 were objected to as being dependent upon rejected base claims, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claim. Ex. 1002 p. 100.

57. On February 16, 2024, the Applicant filed a Response to the Office Action (the "Response"). Ex. 1002 pgs. 103-113. In the Response, the Applicant amended claims 1, 11, 12, 15, and 20, and canceled claims 8, 10, and 16. Ex. 1002 pgs. 109-112. The amendment to claim 1 added the phrase "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." Ex. 1002 pgs. 103, 109. The Applicant asserted that this amendment originated from claims 8 and 10. Ex. 1002 pgs. 103, 109. The amendments to claims 11 and 12 shifted their dependency from claim 10 to claim 1. Ex. 1002 p. 110.

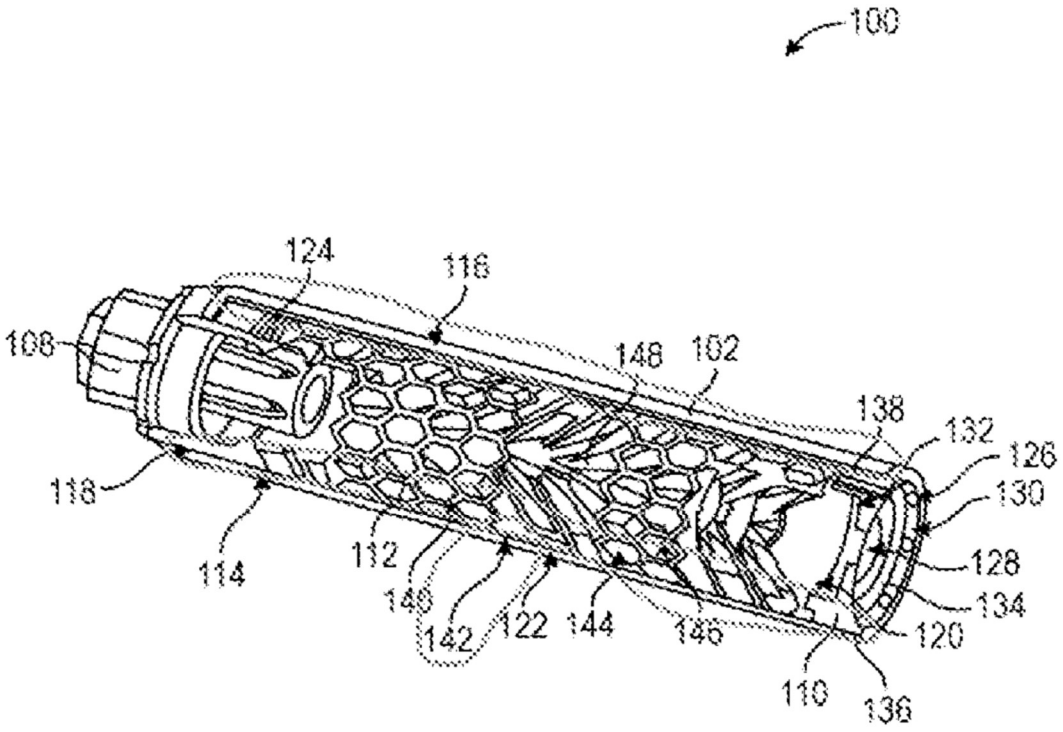
58. In the Applicant's remarks in the Response, the Applicant stated that support for the amendment to claim 1 could:

> […]be found in ¶ [0046] and Fig. 2. Specifically, ¶ [0046] states
>
> "Between an outer surface 140 of the core 112 and the inner

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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 following screenshot of Fig. 2 illustrates the channel 142 that is positioned between the housing and the core and that circumscribes the cores, running the entire length of the core.

Ex. 1002 p. 104. The Applicant provided the following annotation of Fig. 2 of the '845 application along with the foregoing description. Ex. 1002 p. 104.



59. The Applicant provided an annotated version of Fig. 2 of Marfione and Fig. 3 of Scalfani, and argued, based on the annotate Fig. 2 above, that

> the channel as shown in the above illustration is not found [in Marfione], nor is it found in the references cited below under § 103. The Examiner pointed to [Marfione] and the Sclafani reference, discussed below, and stated that [Marfione] includes a plurality of apertures in the baffles to vent into the spaces and Scalfani discloses apertures 34 which vent from one chamber to the next. . [Marfione] and Scalfani fail to teach or even suggest a channel that is positioned between the removable core and an inner surface of the housing. The illustrations . . found in [Marfione] and Scalfani are limited in that they do not illustrate a channel, rather they illustrate projectile apertures passing through the baffles and additional apertures passing from one baffle chamber to another. The configuration of the suppression system as discussed in amended claim 1 is not illustrated or found in any of the prior art references.

Ex. 1002 pgs. 104-105.

60. A Notice of Allowance was mailed February 29, 2024. Ex. 1002 pgs. 123-129.

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C. Claim Construction of the ’906 Patent

61. I have been informed that claim terms are typically given their plain and ordinary meanings, as would have been understood by a POSITA at the time of the earliest alleged priority date. I have further been informed that when considering the meaning of any terms in the challenged claims of the ’906 patent, I should apply the plain and ordinary meaning of those terms. I have further been informed that in considering the meaning of the claims, one must consider the language of the claims, the specification, and the prosecution history of record.

62. I have applied the plain and ordinary meaning of the claim terms as they would have been understood by a POSITA at the time of the alleged invention, in the context of the ’906 patent and its prosecution history. It is my opinion that, for purposes of the grounds set forth in this petition, no term needs to be expressly construed beyond its plain and ordinary meaning.

63. I have been informed that in general, a preamble limits the invention if it recites essential structure or steps, or if it is necessary to give life, meaning, and vitality to the claim. I have further been informed that a preamble is not limiting where a patentee defines a structurally complete invention in the claim body and uses the preamble only to state a purpose or intended use for the invention. I have further been informed that dependence on a particular disputed preamble phrase for antecedent basis may limit claim scope because it indicates a reliance on both the

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preamble and claim body to define the claimed invention. I have further been informed that clear reliance on the preamble during prosecution to distinguish the claimed invention from the prior art transforms the preamble into a claim limitation because such reliance indicates use of the preamble to define, in part, the claimed invention.

VII. SUMMARY OF THE PRIOR ART

A. Belykov (Ex. 1003)

64. U.S. Pub. No. 2021/0207916 ("Belykov", Ex. 1003) is titled "Silencer for a firearm." Belykov was filed July 18, 2018, and published July 8, 2021 (Ex. 1003 Cover). Thus, I have been informed that I should assume Belykov is prior art under 35 U.S.C. §§ 102(a)(1)-(a)(2) (AIA).

65. Belykov is directed to a silencer 1 for a firearm that maintains "sufficient sound absorption". Ex. 1003 ¶ 4. Belykov discloses a silencer 1 comprising an outer tube 3 with a "cylindrical cross-sectional shape" and an inner tube 5 "located on the inside concentrically to the outer tube 3", which defines a projectile channel 21 through which a projectile flies. Ex. 1003 ¶¶ 28, 30; Fig. 3. The silencer includes "a front end wall 7 which defines a projectile exit opening 11" and "a front face 13 with a projectile entry opening 15 to be coupled with the firing arm [sic]". Ex. 1003 ¶ 28; Fig. 3. "Both side wall ends 7, 13 are each screwed with

an end side (screw connection 21) to the inner tube 5." Ex. 1003 ¶ 28; Fig. 3. The outer tube 3 is "axially clamped between the front ends 7, 13." Ex. 1003 ¶ 29; Fig. 2.

66. Belykov discloses that, between the inside of the outer tube 3 and the outside of the inner tube 5, an annular space 23 is formed, which "continuously extends in circumferential direction and in projectile flight direction G", with an "axial distance between the inside of the outer tube 3 and the outside of the inner tube 5 remain[ing] constant in circumferential direction and in axial projectile flight direction G." Ex. 1003 ¶ 31; Fig. 6. "The annular space 23 extends from the front wall 15 continuously without radial barrier or wall indentation" to the front end wall 7. Ex. 1003 ¶ 32; Fig. 3. "[M]ultiple venting openings 25 are formed into the front end wall 7." Ex. 1003 ¶ 32; Fig. 3.

67. At the entry side, Belykov discloses "a channel expansion chamber 31 which is flight upwards margined by the front end 13 and downstream by a sound reflection element which is, in the example illustrated in the Figures, realized as sound impact plate 33." Ex. 1003 ¶ 34; Fig. 3. "The first sound impact plate 33 on the side of the channel expansion chamber is exchangably attached to the inner tube 5 via a mounting pin 35 and extends from the inside of the inner tube 3 in a first arm section radially to the inside to which a central section 37 is connected which is designed as a funnel." Ex. 1003 ¶ 34. The inner tube 5 in the channel expansion

chamber 31 is provided with "a plurality of honeycomb cell-shaped exchange openings 43 which enable a gas transfer between the projectile channel 45 being margined by the inner tube 5, in particular of the channel expansion chamber 31, and the annular space 23." Ex. 1003 ¶ 34; Fig. 3. "Due to the continuous, separating wall-free extension of the annular space 23, the muzzle gas entering the annular space can escape toward the front end wall 7 at the venting openings 25 without necessarily having to return again into the projectile channel 45 over an additional exchange opening". Ex. 1003 ¶ 34. "[T]he venting openings prevent a gas accumulation in the system of a firearm with silencer." Ex. 1003 ¶ 50.

68. Belykov discloses that the honeycomb cell-shaped "exchange openings 43 are arranged in rows axially displaced from each other", with "all distances between the honeycomb cell-shaped exchange openings 43 [being] constant at a minimum distance which ensures that the inner tube 5 is not weakened too much by material removal." Ex. 1003 ¶ 38; Fig. 6. "[T]he special honeycomb hexagonal shape of the exchange openings 43 ensures a high number of relatively large opening cross-sections without substantially destabilizing the inner tube 5." Ex. 1003 ¶ 39; Fig. 6.

69. Downstream from the channel expansion chamber, Belykov discloses that "a channel intermediate chamber 51 is provided which is flight downwards margined by the first sound impact wall 33." Ex. 1003 ¶ 41; Fig. 5. Between the second sound impact wall 53 and the front end wall 7 is a channel end chamber 55.

Ex. 1003 ¶¶ 42, 43. "Muzzle gas within the channel end chamber 55 can reach the outside of the sound body via the projectile exit opening 11." Ex. 1003 ¶ 43. In the channel end chamber 55, second sound reflection elements are arranged, designated as third sound impact walls 57. Ex. 1003 ¶ 44; Fig. 7.

70. Belykov discloses that "the third sound impact wall 57 extends almost completely to the opposite end and forms an axial bypass opening 61 which radially ends in the projectile passage opening 41." Ex. 1003 ¶ 47. "In combination with the axial bypass opening 61, an additional type of exchange opening 67 is formed opposite it in the inner tube 5", designated as second exchange opening 67. Ex. 1003 ¶ 47. "[M]uzzle gas reaching the channel end chamber 55 which enters over the projectile passage opening 41 from the channel intermediate chamber 51 into the channel end chamber 55 is at least partially redirected by the third sound impact wall 57 radially to the outside and reaches the second exchange opening 67 in the annular space 23." Ex. 1003 ¶ 48. "This muzzle gas can also reach via the annular space 23 and the respective venting openings 25 the outside of the silencer 1." Ex. 1003 ¶ 48.

B. Noonan (Ex. 1004)

71. U.S. Patent No. 11,268,776 B1 ("Noonan", Ex. 1004) is titled "Expansion Chamber Assembly and a Method of Manufacturing the Same." Noonan was filed May 23, 2018, and issued March 8, 2022. Ex. 1004 Cover. Thus, I have

been informed that I should assume Noonan is prior art under 35 U.S.C. §§ 102(a)(1)-(a)(2) (AIA).

72. Noonan is directed to an expansion chamber assembly for a firearm that "reduce[s] muzzle flash and/or recoil generated by the firearm when firing the bullet." Ex. 1004 col. 1, ll. 13-16, 26-30. Noonan discloses that "the expansion chamber assembly 10 comprises an outer tube 15, an inner tube 20, a front cap 25, and a rear cap 30." Ex. 1004 col. 2, ll. 58-60; Fig. 1a, Fig. 1b. The outer tube 15 and inner tube 20 are "hollow cylinders", with the outer tube 15 having "a diameter sufficient to accommodate the inner tube 20." Ex. 1004 col. 3, ll. 13-15; Fig. 3a. "[t]he inner tube 20 is retained inside the outer tube 15 with the front cap 25 and rear cap 30", which may be "removably coupled with the outer tube 15." Ex. 1004 col. 3, ll. 16-22; Fig. 3a, 3b.

73. Noonan discloses that the front cap 25 includes a through aperture 26 and an outer thread 28, while the rear cap 30 includes a through aperture 31 and an outer thread 32. Ex. 1004 col. 3, ll. 29-36; Figs. 4a-c, 5a-c. The front and rear ends of the outer tube 15 may include inner screw threads 45 and 50, respectively, to engage the threads of the caps. Ex. 1004 col. 3, ll. 36-44; Figs. 3a-c, 6a. "[T]he inner tube 20 is sandwiched inside the outer tube 15 between the front cap 25 and the rear cap 30." Ex. 1004 col. 3, ll. 45-47.

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74. Noonan further discloses that a bullet fired from a firearm travels through the firearm's barrel 70, through the aperture 31 of the rear cap 30, through the inner tube 20, and out through the aperture 26 of the front cap 25. Ex. 1004 col. 4, ll. 6-16; Fig. 3a-b. "[E]xpanding gasses formed by the firing of the bullet also travel through the firearm's barrel 70 and into the expansion chamber assembly 10". Ex. 1004 col. 4, ll. 9-13. Fig. 3a-b. "[A]at least a portion of the expanding gasses exit with the bullet through the aperture 26 of the front cap 25", while another portion enters the outer tube 15 through one or more through apertures 22 in the inner tube 20. Ex. 1004 col. 4, ll. 14-22; Fig. 3a-b.

75. Noonan discloses that the expanding gases located between the outer tube 15 and the inner tube 20 may exit the expansion chamber assembly 10 through one or more exit apertures 36 in the rear cap 30 or through one or more exit apertures in the front cap 25. Ex. 1004 col. 4, ll. 23-35; Figs. 3a, 5a-c. The exit apertures 36 may be "evenly spaced around the perimeter of the rear cap 30." Ex. 1004 col. 5, ll. 6-8; Fig. 5b. The expansion chamber assembly 10 is "configured to decelerate and cool at least a portion of the expanding gasses thereby reducing the noise and/or flash created when the bullet is fired from the firearm." Ex. 1004 col. 5, ll. 9-13.

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C. Muceus (Ex. 1005)

76. U.S. Pre-Grant Publication No. 2022/0276015 A1 ("Muceus", Ex. 1005) is titled "Suppressor for a Firearm". Muceus was filed May 19, 2022, and published September 1, 2022. Ex. 1005 Cover. Thus, I have been informed that I should assume Muceus is prior art under 35 U.S.C. §§ 102(a)(1)-(a)(2) (AIA).

77. Muceus discloses "[s]uppressors for firearms". Ex. 1005 abstract. Muceus states that the suppressors "achieve superior noise reduction." Ex. 1005 ¶ 34. Muceus describes multiple embodiments of suppressor cores having triply periodic minimal surfaces (TPMS) structure, which Muceus states "provides greatly improved sound suppression performance compared to conventional devices." Ex. 1005 ¶ 36, Abstract. Muceus also notes that "features illustrated or described as part of one embodiment may be used with another embodiment to yield a still further embodiment. Thus, it is intended that the present subject matter covers all such modifications and variations within the scope of the appended claims and their equivalents." Ex. 1005 ¶ 65.

78. Muceus discloses that its suppressors comprise a "cylindrical" body that is an "outer tube", which a suppressor core is positioned within. Ex. 1005 ¶ 51, 59. The suppressors have an entry end 1340 and an exit end 1345 that is opposite of the entry end 1340. Ex. 1005 ¶ 59, Fig. 13. Muceus further discloses that "[in] some embodiments, a noise suppressor for a firearm includes a *cylindrical body extending*

along a longitudinal direction", the inner portions 570 and 670a-c and outer portions 580 are "*annular cylinders*", the TPMS structures of suppressor cores 300a-c and 400 are "*cylindrical*", and the TPMS structure of Figs. 7A-7C are "positioned around a central axis of the cylindrical suppressor and arranged circumferentially, fanning out around the center bore" . Ex. 1005 ¶¶ 4-6, 31-32, 40, 51-53 (emphasis added).

79. Muceus discloses that the cores may be contained within a main body (e.g., main body 1320 shown in Fig. 13) and bounded by a baseplate (e.g., baseplate 1350 shown in Fig. 13) and an endcap (e.g., endcap 1360 shown in Fig. 13). Ex. 1005 Fig. 13, ¶ 56. Muceus discloses that an endcap 1360 "attaches to the exit end 1345", and the "components may be screwed and/or welded to contain the TPMS structure inside the body 1320", as depicted in annotated Fig. 13. Ex. 1005 ¶ 59, Fig. 13. Moreover, Muceus discloses that the "[e]xit end 145 of the suppressor 100, *where the projectile leaves the suppressor 100*, is opposite the entry end 140." Ex. 1005 ¶ 25; Fig. 1 (emphasis added).

80. Specifically, Muceus discloses that "[t]he suppressor core 1330 is inserted into the body 1320". Ex. 1005 ¶ 59. Muceus further discloses that the "suppressor core may be made separate from or integral with other components of the suppressor" and then "screwed" together with the other components (e.g., the main body, baseplate, and/or endcap). Ex. 1005 ¶¶ 59, 63, Fig. 13. Muceus explains that "the suppressor device is assembled by placing the suppressor core inside the

outer body/casing, with a baseplate on the entry end and an endcap on the exit end." Ex. 1005 ¶ 63.

81. Muceus discloses that the ***suppression core***[2] comprises an inner portion that surrounds a center bore, and an outer portion that has a baffle structure that surrounds the inner portion. Ex. 1005 claim 1; ¶¶ 6, 31-32, 36-37. Specifically, Muceus discloses that "[t]he TPMS structures of the present disclosure provide improved performance over conventional suppressors by providing a high surface area-to-volume ratio to slow rapidly expanding gases" and "[b]ecause of *the tortuous, connected pathways* created in TPMS structures, energy is dissipated over a much longer time interval than in conventional suppressors, using the TPMS surfaces to trap the gases in effectively long channels." Ex. 1005 ¶ 33 (emphasis added).

[2] Muceus uses the terms "suppressor core" and "suppression core" interchangeably. Ex. 1005 ¶ 31 ("In this disclosure, suppressor cores (which may also be referred to herein as suppression cores) are the suppressor structures that fill all or some of an annular chamber in a suppression device, to serve as baffles.") Throughout this paper, like Muceus, the terms "suppressor core" and "suppression core" will be used interchangeably.

82. Muceus further describes that "[t]he TPMS structure is formed of walls 402 with wall thickness "T", where open spaces between the walls 402 form channels 404 within the TPMS structure." Ex. 1005 ¶ 32. Muceus explains that "[g]ases in the center bore 410, from firing a projectile, can enter the suppressor core 400 through a plurality of openings 412 at the inner diameter of the suppressor core 400, where the openings 412 are also connected to the channels 404." Ex. 1005 ¶ 32. Muceus also discloses that "[t]he channels 404 provide flow pathways for gases to travel from the entry end 440 of the suppressor core 400, along the center bore 410, radially outward and along the length of the suppressor core 400 as shown by the arrows 460." Ex. 1005 ¶ 32. Muceus describes that the suppressor core can extend partially along the length of the suppressor assembly and/or *partially in the radial volume of the chamber*. Ex. 1005 ¶ 54.

D. Slack (Ex. 1006)

83. U.S. Pre-Grant Publication No. 2021/0381793 A1 ("Slack", Ex. 1006) is titled "Firearm Suppressor". Slack was filed August 17, 2021, and published December 9, 2021. Ex. 1006 Cover. Thus, I have been informed that I should assume Slack is prior art under 35 U.S.C. §§ 102(a)(1)-(a)(2) (AIA).

84. Slack discloses that suppressors "produce[] a tremendous amount of expanding gases and subsequent heat, caused from the combustion of the propellant

used in the firearm to accelerate a projectile" and that suppressors must still "absorb, dissipate and/or reduce the audible frequencies and muzzle flash from firing a firearm". Ex. 1006 ¶¶ 3-4. Slack further notes that there is "a continuing need to develop additional firearm suppressors" because "such configurations are not always as effective as desired". Ex. 1006 ¶ 4.

85. Slack discloses an end cap 160, an external component 22, an internal component 124, and the internal component 124 includes flanges 150 that engage the external components and internal threads to engage a firearm barrel 12. Ex. 1006 Fig. 9, ¶¶ 42-44, 63, 64, 67. The internal component 124 may include a helical portion 44 extending helically around the cylindrical body portion 40. Ex. 1006 Fig. 9.

86. Slack discloses that its end cap has a bore 41 that is axially aligned with a bore 41 of the internal component 124 through which a projectile travels. Ex. 1006 ¶ 44, 45; Fig. 2, Fig. 9. The bore 41 of the end cap 160 is axially aligned with the bore 41 of the internal component and a bore 13 of the barrel of the firearm barrel. Ex. 1006 ¶ 44; Fig. 9.

87. Slack discloses that "[t]he end cap includes a flange 162, and the internal component 124 includes a flange 150[,]" and that a threaded bore 172 of the end cap 160 is configured to "threadingly engage a threaded portion 170 disposed on the distal end of the cylindrical body portion 40" of the internal component 124.

Ex. 1006 ¶ 63. Slack further discloses that when the external component 22 is disposed over the internal component, the end cap 160 can be threaded onto the threaded portion 170 of the internal component, thereby capturing the external component 22 "between the flanges 162 and 150, to thereby couple the external component 22 to the internal component 124." Ex. 1006 ¶ 63.

88. Slack includes a broad disclosure of both a variety of manufacturing techniques and explicitly states that its suppressors or components thereof may be made by the various techniques. See Ex. 1006 ¶ 67. In particular, regarding the manufacturing technique, Slack states that the "suppressor or components thereof may be made by machining, such as CNC machining, lathing, molding, such as injection molding, casting, milling, stamping, die cutting, 3D printing, laser cutting, bending, cold working, drilling, or other desired processes." Ex. 1006 ¶ 67.

E. Sclafani (Ex. 1007)

89. U.S. Pre-Grant Publication No. 2015/0285575 A1 ("Sclafani", Ex. 1007) is titled "Firearm Silencer with a Replacement Core". Sclafani was filed May 29, 2015, and published October 8, 2015. Ex. 1007 Cover. Thus, I have been informed that I should assume Sclafani is prior art under 35 U.S.C. §§ 102(a)(1)-(a)(2) (AIA).

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90. Sclafani discloses that ***silencers*** "attenuate[] the noise level associated with the firing of a round in the rifle" and that its ***silencers*** solve a need for "a silencer that is less costly to manufacture and that can be reused without incurring an additional tax" due to the breakdown of the interior components of the silencer. Ex. 1007 ¶¶ 2-6. Specifically, Sclafani discloses that suppressor components "are typically formed of metal and are subjected to wear and corrosion caused by the explosive gases entering the housing". Ex. 1007 ¶¶ 4. Sclafani further discloses that it may be "necessary to replace the core member after prolonged use", and discloses that "core member can be formed by using a three dimensional printer unit that will create a solid, one piece structure formed of a high strength plastic or metallic material". Ex. 1007 ¶¶ 7-8.

VIII. THE PRIOR ART RENDERS CLAIMS 1-7 AND 9-11 OF THE '906 PATENT UNPATENTABLE

A. Ground 1: Claims 1-6, and 9-11 are rendered obvious by Belykov in view of Sclafani

91. For at least the reasons below, claims 1-6, and 9-11 of the '906 patent are unpatentable as rendered obvious by Belykov in view of Sclafani.

Motivation to Combine Belykov and Sclafani

92. It is my opinion that a POSITA would have been motivated to combine Belykov with Sclafani and would have had a reasonable expectation of success.

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There are numerous reasons why a POSITA would have been motivated to combine Belykov with Sclafani. Belykov and Sclafani are analogous art because they are from the same field of endeavor and address the same problem—improving firearm suppressors.[3] Even if Belykov and Sclafani were not from the same field of endeavor (which they are) and Sclafani would still be reasonably pertinent to the problem addressed by Belykov, and vice versa.

93. Each reference is directed towards improvements in firearm suppressors and thus is in the same field of endeavor. For example, Belykov relates to a silencer 1 (i.e., firearm suppression system) designed to withstand the thermal load of repeated firing while, among other factors, "maintaining a sufficient sound absorption and spark extinguishing". Ex. 1003 ¶ 4. Sclafani discloses that silencers (i.e., firearm suppression system) "attenuate[] the noise level associated with the firing of a round in the rifle" and that its silencers (i.e., firearm suppression system) solve a need for "a silencer that is less costly to manufacture and that can be reused without incurring an additional tax" due to the breakdown of the interior components of the silencer. Ex. 1007 ¶¶ 2-6. Specifically, Sclafani discloses that suppressor

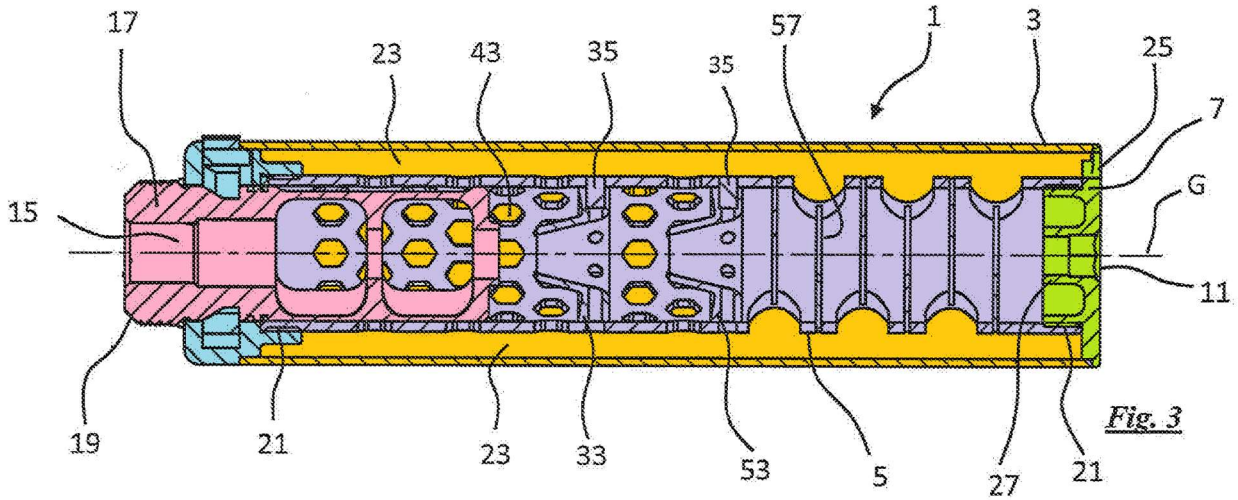
[3] A POSITA would have understood that terms such as "silencer" and "suppressor" are used interchangeably in the industry.

components "are typically formed of metal and are subjected to wear and corrosion caused by the explosive gases entering the housing". Ex. 1007 ¶¶ 4.

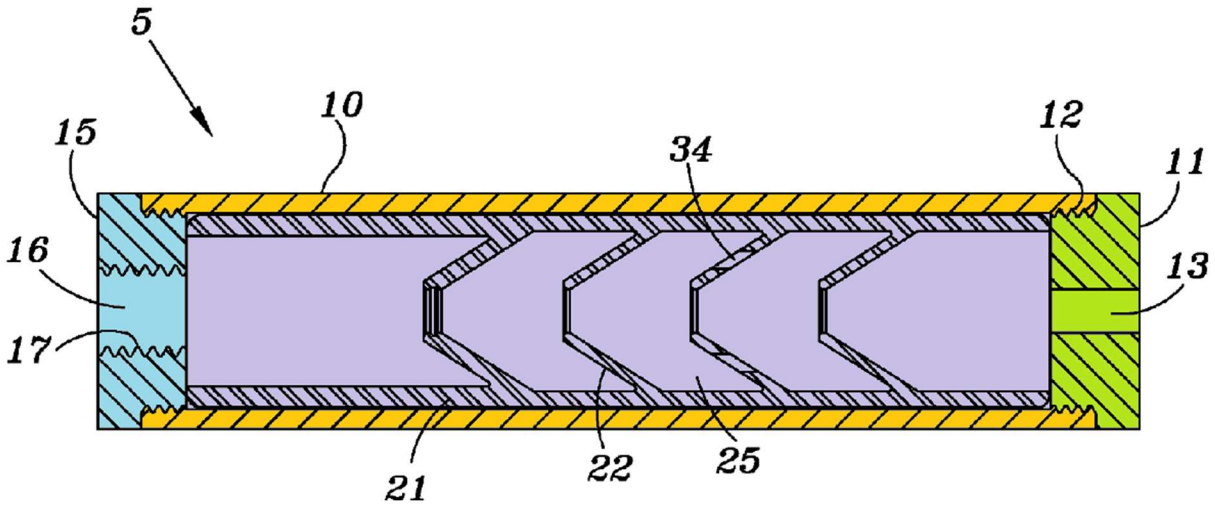
94. Sclafani discloses that it may be "necessary to replace the core member after prolonged use," and discloses that "core member can be formed by using a three dimensional printer unit that will create a solid, one piece structure formed of a high strength plastic or metallic material". Ex. 1007 ¶¶ 7-8. Specifically, Sclafani notes that the "baffles are typically formed of metal and are subjected to wear and corrosion caused by the explosive gases entering the housing" such that "[a]fter a limited number of rounds, the cone baffles fail and the entire silencer must be replaced. Each silencer is subject to an additional federal tax which increases the cost of replacement." Ex. 1007 ¶ 4-5. Sclafani further discloses that its solution to this problem is to integrate the baffles into a "monolithic, one piece, homogeneous core structure, using longer lasting materials such as plastics" and also alternatively discloses a "metallic material." Ex. 1007 ¶ 7. The POSITA would have understood that the replacement of the core, especially a core that is 3D printed, reduces the cost for replacement and increases longevity of the core. Both are reasons a POSITA would have made the proposed combination.

95. Referring to annotated Fig. 3 of Sclafani, reproduced below, Sclafani includes a core member 30 (i.e., core) (highlighted in purple) that is held within the tubular housing 10 (i.e., housing) by the respectively threaded end caps 11, 15 (i.e.,

the "second cap member 11" being an end cap). Ex. 1007 ¶¶ 12-13. This is not materially different from the assembly of Belykov's silencer 1 (i.e., firearm suppression system) in that Belykov's outer tube 3 (i.e., housing) is clamped between the respective side wall ends 7, 13 while the inner tube 5 (i.e., core) is screwed to the respective side wall ends 7, 13. Ex. 1003 ¶ 28-29, Figs. 3, 6, 7. To replace the core member 30 (i.e., core) (highlighted in purple) of Sclafani, either "cap 11 or 15 can be removed and core member 30 withdrawn from tubular housing 10. A new core member may then be placed within the tubular housing 10 and the cap member can be rethreaded into the tubular housing." Ex. 1007 ¶15, Figs. 1-3. Similarly, the POSITA would have been motivated to both use the three dimensional printing of Sclafani with the existing inner tube structure of Belykov and would be motivated to use the "clamping" function of Sclafani by reversing the threading of Belykov as described with respect to Ground 2 below.



Belykov, Fig. 3 (annotated)



Sclafani, Fig. 3 (annotated)

96. In light of this disclosure, including the similarly of components, including the removable end cap like components, the functions of the respective devices, and the teachings of the references summarized herein, it is my opinion that a POSITA would have been motivated to make at least the inner tube 5 (i.e. core) of Belykov using the three dimensional printer of Sclafani to achieve the benefits described by Sclafani, including a strong and replaceable core that would prolong the overall life of the silencer 1 (i.e., firearm suppression system) of Belykov. In addition, three dimensional printing of the inner tube 5 (i.e. core) of Belykov would allow for faster prototyping and more variable structures of the inner tube 5 (i.e. core) of Belykov. For example, three dimensional printing would allow rapid combination of discrete components into a monolithic structure (e.g., the inner tube 5 and its associated components including the sound impact plates 33, 53, 57) that

may be replaced as a single unit or, alternatively, may each be individually printed with a three dimensional printer. Three dimensional printing of the inner tube 5 (i.e. core) of Belykov would allow for more varied materials allowing the manufacturer to optimize performance, weight, and cost. Therefore, the POSITA would have been motivated to print at least the inner tube 5 (i.e., core) of Belykov using the three dimensional printer as taught by Sclafani.

97. Moreover, the POSITA would have also had a reasonable expectation of success when manufacturing at least the inner tube 5 (i.e., core) of Belykov using a three dimensional printer as taught by Sclafani. Indeed, both Belykov and Scalfani's cores are removable and cylindrical with other components of the suppressors cooperating and thus structurally and operationally similar. Thus, the POSITA would have had a reasonable expectation that manufacturing at least the inner tube 5 (i.e., core) of Belykov using the combined three dimensional printing techniques of Sclafani would improve the performance, cost effectiveness, manufacturability, and versatility of Belykov's suppressor. Accordingly, a POSITA would have been motivated to combine, and would have had a reasonable expectation of success in combining, Belykov and Sclafani.

98. Similarly, Sclafani would have motivated the POSITA to make the inner tube 5 (i.e., core) of Belykov removable (which it already is as discussed below) because the suppressor of Belykov would be improved by being able to

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replace the core, whether printed with a three dimensional printer or manufactured by other means, to extend the life of the silencer. A replaceable core as taught by Sclafani would also make the suppressor of Belykov more versatile and modular by allowing the rapid swapping of various core geometries. Therefore, the POSITA would have been motivated to make the inner tube 5 (i.e., core) of Belykov removable (which it already is as discussed below).

99. Moreover, the POSITA would have had a reasonable expectation of success when making the inner tube 5 (i.e., core) of Belykov removable (again, which Belykov's already is) because both describe core structures that are removable and a replaceable inner tube 5 (i.e., core) would predictably apply to the structures of Belykov to extend the life of the suppressor of Belykov in a similar manner to Sclafani. Further, Belykov discloses threads between its inner tube 5 (i.e., core) and its end walls 7, 13 (i.e., end caps) such that there would be a reasonable expectation of success that the suppressor would operate in substantially the same manner by using the preexisting threads to remove the inner tube 5 (i.e., core) from the outer tube 3 (i.e., housing). The POSITA would have had a reasonable expectation that making the inner tube 5 (i.e., core) of Belykov removable, assuming for purposes of argument that it is not, would improve performance, versatility, cost effectiveness, and manufacturability of the suppressor of Belykov.

100. In addition, it is my opinion that modifying Belykov to include at least an inner tube 5 (i.e., core), including the inner tube associated components such as the sound impact plates 33, 53, 57, that is (a) printed with a three dimensional printer and (b) removably attachable to the outer tube 3 (i.e., housing) is obvious as merely combining prior art elements according to known methods to yield predictable results. For example, the references include each element claimed, although not necessarily in a single prior art reference, with the only difference between the claimed invention and the prior art being the lack of actual combination of the elements in a single prior art reference. Namely, Belykov includes all of the features of claims 1 and 2, as discussed below, except for (a) explicitly disclosing 3D printing and (b) solely to the extent it is argued that Belykov does not disclose the inner tube 5 (i.e., core) being removably attachable to the outer tube 3 (i.e., housing).

101. One of ordinary skill in the art would have combined the foregoing elements, including the silencer of Belykov with (a) (i.e., three dimensional printing) and (b) (i.e., the inner tube 5 (i.e., core) being removably attachable to the outer tube 3 (i.e., housing)) by known methods, and as a combination, the combined elements perform the same functions (and are executed using the same techniques) as they would separately.

102. First, regarding (a), Sclafani discloses that three dimensional printing is a known technique for creating a suppressor core (Ex. 1007 ¶ 7, 16), such that the

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teaching is directly applicable to the inner housing 5 (i.e., core) of Belykov. Sclafani discloses that three dimensional printing may be used to make a core "using longer lasting materials such as plastics" and that the core may be made of "high strength plastic or metallic material" (Ex. 1007 ¶ 7), while Belykov discloses that it's components, including the inner tube 5 (i.e., core) may be similarly made of metal (Ex. 1003 ¶ 12). Thus, manufacturing the metal inner tube 5 (i.e., core) of Belykov using three dimensional printing produces the same structure as is already disclosed by Belykov using the known technique of Sclafani's three dimensional printing. Each of the structure of Belykov and the method of Sclafani is used in the same manner as such structure and method are used separately.

103. Second, regarding (b), Sclafani discloses making the core replaceable (i.e., removably attached to the housing) so that it "can be reused without incurring an additional tax" such that "after prolonged use, the core may be removed from the outer housing and simply replaced by a new core member" (Ex. 1007 ¶ 4-8), while Belykov does not describe a fixed inner tube 5 (i.e., core), Belykov does not prohibit the inner tube from being removably attached. The components of Belkyov are all removably attached to each other in some manner (e.g., threading in the case of the attachment of the inner tube 5 (i.e., core) and end walls 7, 13 (i.e., end caps), interference fit in the case of the outer tube 3 and end walls 7, 13 (and thereby the inner tube)) to each other, such that making the inner tube 5 (i.e., core) of Belykov

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removable is simply a new (solely for purposes of this argument) use of the existing structure in Belykov. Each of the structure of Belykov and the method of Sclafani is used in the same manner as such structure and method are used separately.

104. Further, one of ordinary skill in the art would have recognized that the results of the combinations (a) and (b) discussed above would be predictable. In particular, using three dimensional printing is disclosed as a known process for making the equivalent part to Belykov in Sclafani and it is disclosed as being suitable (indeed better) replacement for non-three-dimensionally-printed equivalents (*See* Ex. 1007 ¶¶ 4-8), such that the use of three dimensional printing in Belykov would have predictably produced usable inner tube 5 and associated components in Belykov. Likewise, making the inner tube 5 (i.e., core) removably attachable to the outer tube 3 (i.e., housing) merely involves using the structures that are already existing in Belykov for their known purpose and the removability would not alter the function of Belykov's silencer.

105. Thus, the scope and content of the prior art, as discussed above, includes Belykov's silencer having the structure required by claims 1 and 2 of the '906 patent, and Sclafani's method of improving a silencer by introducing a three dimensionally printed, removable core. The POSITA would have had sufficient experience given the similarity of the references and the explicit nature of their teachings to combine Belykov and Sclafani as discussed herein and would have been

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motivated to do so with reasonable expectation of success for the reasons discussed herein.

106. In addition, it is my opinion that modifying Belykov to include at least an inner tube 5 (i.e., core), including the inner tube associated components such as the sound impact plates 33, 53, 57, that is (a) printed with a three dimensional printer and (b) removably attachable to the outer tube 3 (i.e., housing) is obvious as merely applying a known technique to a known device ready for improvement to yield predictable results and substitution of one known element for another to obtain predictable results.

107. Belykov discloses a base device (i.e., the silencer 1) having every feature of claim 1 and claim 2 as discussed herein with the exception, solely for purposes of this argument, of being (a) printed with a three dimensional printer and (b) removably attachable to the outer tube 3 (i.e., housing). Both of these functionalities and processes are well known in the art as evidenced by Sclafani. In particular, Sclafani discloses that three dimensional printing may be used to make a core "using longer lasting materials such as plastics" and that the core may be made of "high strength plastic or metallic material" (Ex. 1007 ¶ 7) and making the core replaceable (i.e., removably attached to the housing) allows the silencer to be "reused without incurring an additional tax" such that "after prolonged use, the core may be removed from the outer housing and simply replaced by a new core member"

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(Ex. 1007 ¶¶ 4-8). Thus, to the extent the firearm suppression system is seen as an improvement over the device of Belkyov in view of either or both of the two limitations identified above, Sclafani discloses these limitations being directly applicable to the equivalent structure (i.e., the core) in Scalfani.

108. Further, one of ordinary skill in the art would have recognized that the results of the combinations (a) and (b) discussed above would be predictable. In particular, using three dimensional printing is disclosed as a known process for making the equivalent part to Belykov in Sclafani and it is disclosed as being suitable (indeed better) replacement for non-three-dimensionally-printed equivalents (*See* Ex. 1007 ¶¶ 4-8), such that the use of three dimensional printing in Belykov would have predictably produced usable inner tube 5 and associated components in Belykov. Likewise, making the inner tube 5 (i.e., core) removably attachable to the outer tube 3 (i.e., housing) merely involves using the structures that are already existing in Belykov for their known purpose and the removability would not alter the function of Belykov's silencer.

109. It is further my opinion that one of ordinary skill in the art would have recognized that applying the known technique of three dimensional printing and/or a removably attached core would have yielded predictable results and resulted in an improved system that has greater longevity and is able to be easily repaired as disclosed by Sclafani. To the extent it is argued that Belykov includes a different

technique for manufacturing the inner tube 5 and/or a non-removable inner tube 5, it is my opinion that one of ordinary skill in the art could have substituted three dimensional printing and/or a removably attached core for the alleged feature in Belykov and, based on the clear benefits and clear teachings disclosed by Sclafani, the results would have been predictable to one of ordinary skill in the art.

110. Thus, the scope and content of the prior art, as discussed above, includes Belykov's silencer having the structure required by claims 1 and 2 of the '906 patent, but for being printed with a three dimensional printer, and Sclafani's method of improving a silencer by introducing a three dimensionally printed, removable core. The POSITA, given the closeness of the references and the explicit nature of their teachings, would have been motivated to combine Belykov and Sclafani with a reasonable expectation of success, as discussed herein.

111. Sclafani also discloses that it is known to make previously "individually machined" components of the suppressor core as a single monolithic core structure using three dimensional printing. Ex. 1007 ¶¶ 4, 7. Thus, it would also be a known and obvious technique to create the three dimensionally printed inner tube 5 and associated components (e.g., sound impact plates 33, 53, 57) using a monolithic three dimensional printing process to achieve the aforementioned benefits of three dimensional printing to Belykov. One of ordinary skill in the art would have been motivated to implement this monolithic process to achieve the benefits associated

with three dimensional printing for Belykov as discussed above, and the POSITA could have implemented this process with predictable results and a reasonable expectation of success based on the corresponding functions of the respective matching components of Belykov and Scalfani and based on the simple and exclusive instructions given by Sclafani.

112. Further, Sclafani depicts the housing 10 being threaded to the end caps 11, 15 (Ex. 1007 Fig. 3, ¶ 14-15), and Belykov shows the inner tube 5 (i.e., core) threaded to the end walls 7, 13 (i.e., end caps) with the outer tube 3 (i.e., housing) being axially clamped between the end walls (Ex. 1003 ¶¶ 28-29). Thus, to create the removable or three dimensionally printed inner tube 5 (i.e., core), it would also be a known and obvious technique to create the three dimensionally printed inner tube 5 and associated components (e.g., sound impact plates 33, 53, 57) to be held within the outer tube 3 (i.e., housing) and to make the outer tube 3 screwable onto the respective end walls 7, 13 (i.e., end caps) to achieve the aforementioned benefits of three dimensional printing for Belykov as discussed above and to achieve the aforementioned benefits of an inner tube 5 (i.e., core) that is removably attachable to the outer tube 3 (i.e., outer housing). The POSITA could have implemented this process with predictable results and a reasonable expectation of success based on the corresponding functions of the respective matching components of Belykov and Scalfani and based on the simple and exclusive instructions given by Sclafani.

113. Accordingly, a POSITA would have been motivated to combine, and would have had a reasonable expectation of success in combining, Belykov with Sclafani.

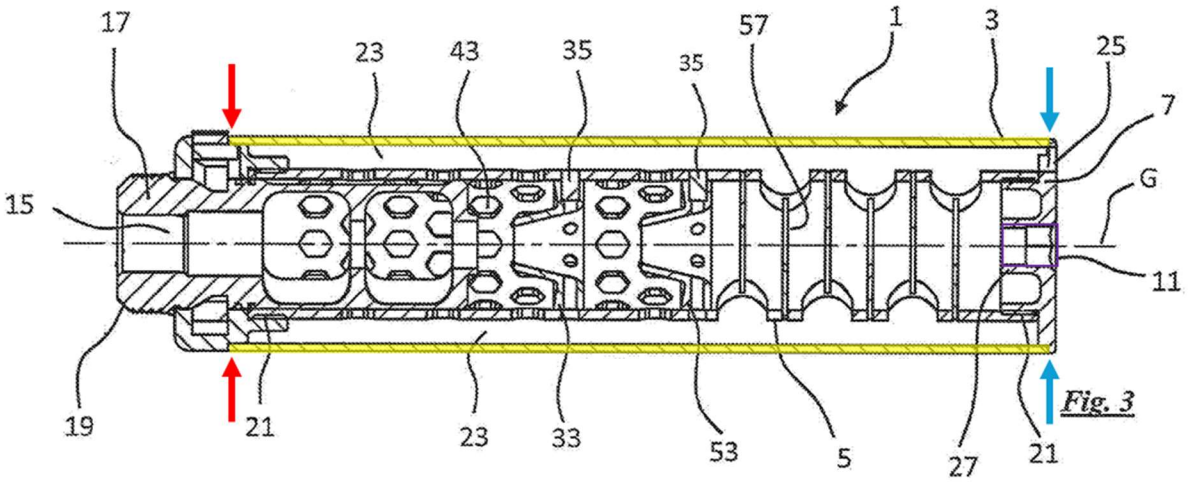
Independent Claim 1

Claim 1, Element [1.pre]: A firearm suppression system comprising:

114. To the extent the [1.PRE] is limiting, Belykov discloses this limitation. Belykov discloses that it "relates to a silencer for a firearm." Ex. 1003 ¶ 1. Figures 1-7 of Belykov depict an assembly that is attached to the muzzle end of a firearm along the projectile path via an intervening muzzle brake 17 and is referred to as a silencer 1. Ex. 1003 Figs. 1-7, ¶ 21-28. Belykov discloses that the invention seeks to provide a silencer that *maintains sufficient sound absorption* in addition to spark extinguishing and other improvements. Ex. 1003 ¶ 4. Similarly, the '906 patent discloses that the invention seeks to provide a firearm suppression system that *reduces noise*. Ex. 1001 col. 4, ll. 51-54. One of ordinary skill in the art would have understood that silencers and suppression systems are simply two terms for the same device. Therefore, Belykov's silencer 1 is a firearm suppression system based both on the terminology and corresponding functions of the devices.

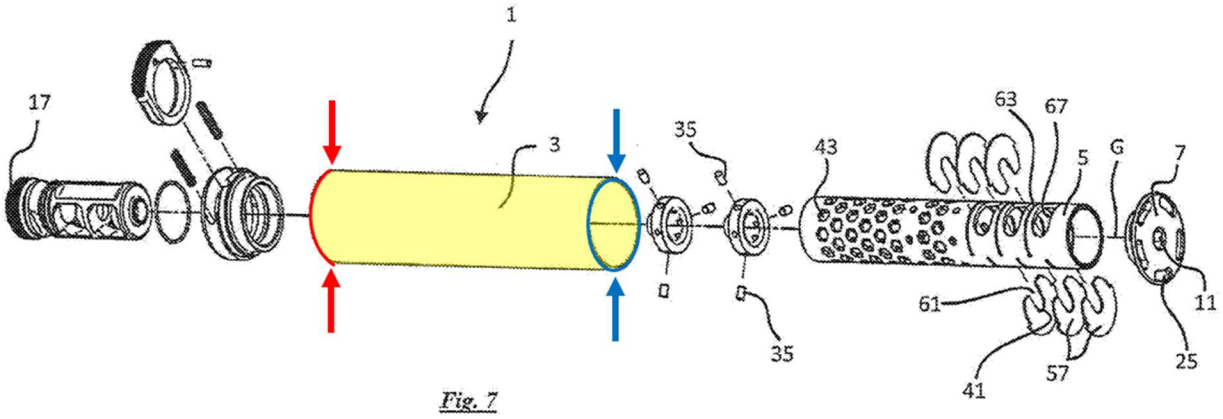
Claim 1, Element [1.1]: a housing comprising a first end and a second end,

115. Belykov discloses this limitation. Belykov discloses an outer tube 3 with cylindrical cross-sectional shape that "… margins on the inside the entire sound body cavity" as illustrated in the annotated excerpt of Fig. 3 of Belykov shown below (outer tube is annotated in yellow, below). Ex. 1003 ¶ 28, 31; Fig. 3. Similarly, the '906 patent discloses that "[t]he housing 102 may be cylindrical-shaped" and that "[t]he core 112 may be removably attachable to the housing 102 and positioned within the inner compartment 122 of the housing 102." Ex. 1001 col. 5, ll. 27-28; col. 6, ll. 53-55. Thus, Belykov includes a housing (highlighted in yellow in annotated Fig. 3) having a first end (red arrows in annotated Fig. 3) and a second end (blue arrows in annotated Fig. 3).



Belykov, Fig. 3 (annotated)

116. Further, as illustrated in the annotated excerpt from Fig. 7 of Belykov below, Belykov shows an outer tube 3 (i.e., housing) (highlighted in yellow) comprising a first end (red arc and red arrows) and a second end (blue circle and blue arrows). Ex. 1003 Fig. 7.



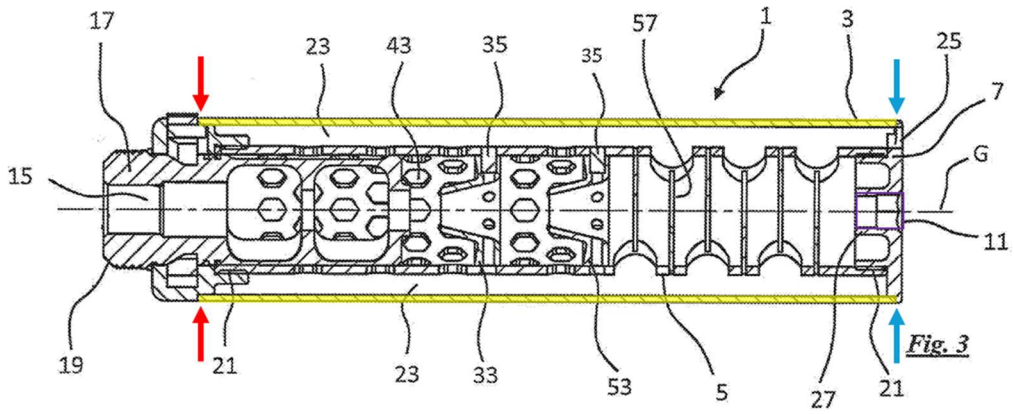
Belykov, Fig. 7 (annotated)

117. As such, Belykov's outer tube 3 is a housing as recited by the '906 patent due to, for example, Belykov's outer tube 3 having a corresponding structure and function to the claimed housing.

Claim 1, Element [1.1a]: the housing comprising: a first aperture at the first end, a second aperture at the second end;

118. Belykov discloses this limitation. Belykov discloses "an outer tube 3 with cylindrical cross-sectional shape . . . ." Ex. 1003 ¶ 28. As illustrated in the annotated Figure 3 below, a first aperture of the outer tube 3 (i.e., housing)

(highlighted in yellow) is at the first end (red arrows) and a second aperture of the outer tube 3 (i.e., housing) is at the second end (blue arrows). Ex. 1003 Fig. 3. Additionally, the annotated excerpt from Figure 7 of Belykov below demonstrates both the first aperture referenced above and a second aperture (within blue circle) at the second end of housing 3 (blue circle and blue arrows). Ex. 1003 Fig. 7. Belykov's disclosure establishes that the outer tube 3 (i.e., housing) includes a first aperture at the first end and a second aperture at the second end, as Belykov refers to this component as a "tube" possessing a "cylindrical cross-sectional shape" Ex. 1003 ¶ 28.



Belykov, Fig. 3 (annotated)

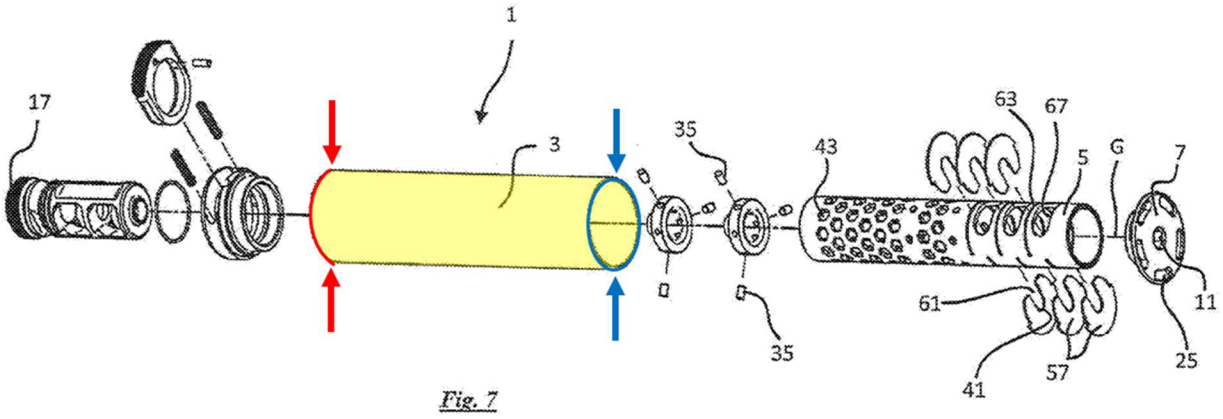


Fig. 7

Belykov, Fig. 7 (annotated)

Claim 1, Element [1.1b]: [the housing comprising:] 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;

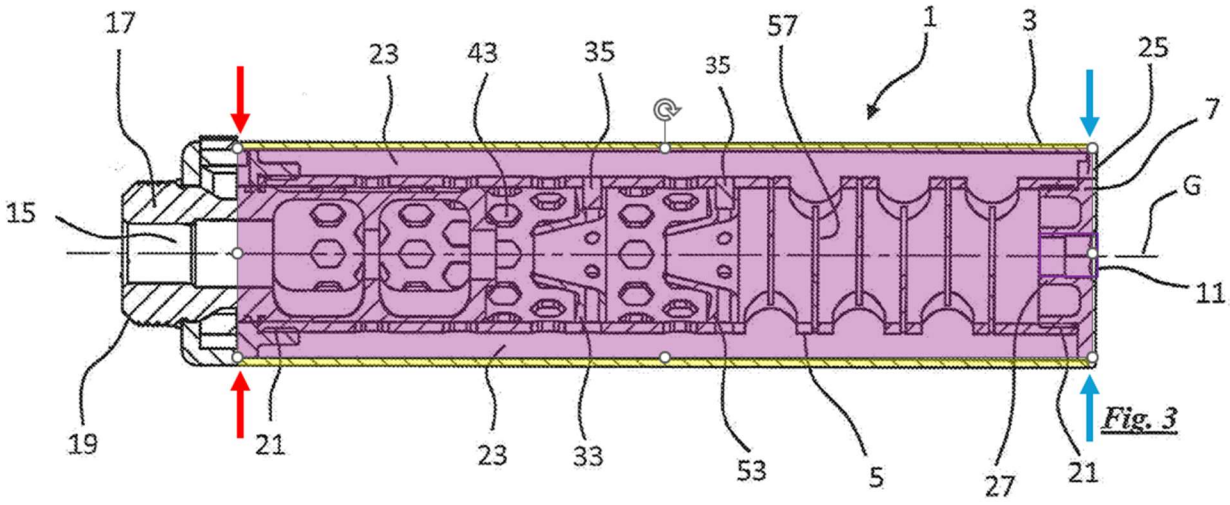
119. Belykov discloses this limitation. Belykov discloses "an outer tube 3 with cylindrical cross-sectional shape[.]" Ex. 1003 ¶ 28. Belykov also discloses that "the annular space extends substantially over its entire length between the front walls, substantially gas permeable and/or barrier free" and that "[p]referably, *no radially protruding*, either arranged *on the inside of the outer tube* or on the outside of the inner tube, *radial annular space compartments* are provided such that an unimpeded flow through of the muzzle gas longitudinal to the annular space is ensured." Ex. 1003 ¶ 9 (emphasis added). Thus, the outer tube 3 is both cylindrical and smooth along its interior.

120. Further, as shown in the annotated Fig. 3, provided below, Belykov discloses an outer tube 3 (i.e., housing) (highlighted in yellow) that has an inner

compartment (highlighted in purple) interposed between the first aperture (red arrow) and the second aperture (blue arrow), the inner compartment being substantially the same circumference from the first end (red arrow) to the second end (blue arrow). Ex. 1003 Fig. 3.

121. As additional confirmation from what is immediately apparent visually, I measured the original Figure 3 from the published publication of Belykov with a caliper and confirmed that the inner compartment has a rectangular cross-sectional shape (i.e., that each vertical side has the same length, each end has the same vertical height, and the lengths between opposing corners are equal), and, as depicted in Fig. 7, the outer tube 3 (i.e., housing) has a circular end viewed within the angled perspective of Fig. 7. Ex. 1003 Figs. 3, 7. Collectively, this confirms Belykov's description of a "cylindrical" tube which is a housing having an the inner compartment being substantially the same circumference from the first end to the second end.

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Belykov, Fig. 3 (annotated)

122. In particular, the outer tube 3 (i.e., housing) of Belykov has a cylindrical shape without radial protrusions on the inside, such that Belykov discloses that the outer tube 3 (i.e., housing) would have an inner compartment that is substantially the same circumference from the first end to the second.

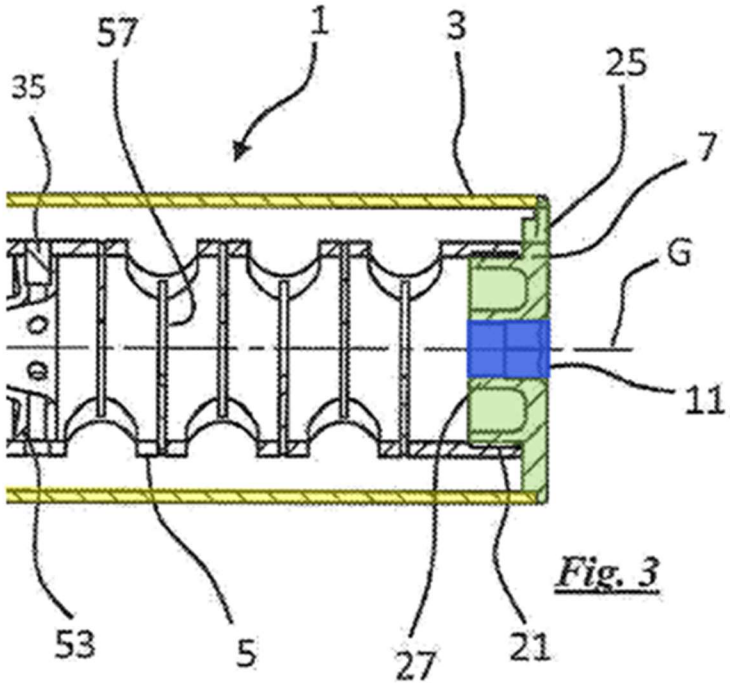
Claim 1, Element [1.2]: an end cap with a projectile aperture; and

123. Belykov discloses this limitation. Belykov discloses "a front end wall 7 which defines a projectile exit opening 11", which is positioned at the farthest end of the silencer 1 from the firearm barrel. Ex. 1003 ¶ 28, Fig. 7. Belykov confirms that this opening bounds the path along which the projectile travels to exit the silencer, describing a "projectile channel 21 through which the projectile (not shown) flies from the projectile entry opening 15 to the projectile exit opening 11."

Ex. 1003 ¶ 30. Thus, the "front end wall 7" of Belykov is an end cap with a projectile aperture. Similarly, the '906 patent also discloses that the end cap has a projectile aperture where the bullet leaves the firearm and system. Ex. 1001 col. 2, ll. 2-4.

124. Belykov's annotated Fig. 3 and annotated excerpt of Fig. 7, both below, show an end wall 7 (i.e., end cap) (highlighted in green) with a projectile exit opening 11 (i.e., projectile aperture) (highlighted in blue). Ex. 1003 Figs. 3, 7.

125. As such, the end wall 7 is an end cap with a projectile aperture since both disclose an end cap that is screwed to (i.e., threadably coupled to) the core, positioned at the end of the housing, and feature a projectile aperture.



Belykov, Fig. 3 (excerpt, annotated)



Belykov, Fig. 7 (excerpt, annotated)

Claim 1, Element [1.3]: a core removably attachable to the housing and positioned therein,

126. Belykov and Sclafani disclose this limitation. First, Belykov discloses a core. Specifically, Belykov discloses an inner tube 5 that is located on the "inside concentrically" to the outer tube 3 (i.e., housing) and defines a projectile channel through which a projectile passes. Ex. 1003 ¶ 30; Fig. 3. Similarly, the '906 patent discloses that "[t]he core 310 may be . . . positioned within the inner compartment 316 of the housing 302." Ex. 1001 col. 8, ll. 32-34; col. 8, ll. 64-col. 9, ll. 3. Belykov discloses an inner tube 5 that is located inside the outer tube 3 (i.e., housing), which corresponds to the '906 core that is within the housing. As such, the inner tube 5 is a core as required by claim 1 of the '906 patent.

127. Second, Belykov discloses that the inner tube 5 (i.e., core) is removably attachable to the housing and positioned therein. Specifically, Belykov discloses that the front end wall 13 and the end wall 7 (i.e., end cap) are each screwed to the inner tube 5 (i.e., core) via screw connections 21. Ex. 1003 ¶ 28. The outer tube 3 (i.e., housing) is "axially clamped" between the front end wall 13 and the end wall 7 (i.e., end cap). Ex. 1003 ¶ 29. Belykov's means of removably coupling the inner tube 5 (i.e., core) with the outer tube 3 (i.e., housing) is similar to the means of removably attaching the core with the housing described in the '906 patent. Specifically, the '906 patent discloses that the "end cap 110 may include threaded fasteners 124 so as to be threadably coupleable to housing 102 and/or the core 112. . . . The end cap 110 may rest against the second end 106 of the housing 102." Ex. 1001 col. 5, ll. 66-col. 6, ll. 9. Thus, the inner tube 5 (i.e., core) of Belykov is removably attachable to the outer tube 3 (i.e., housing).

128. Third, two components that are "screwed" to each other with a threaded interface, as disclosed in Belykov, are removably attached unless permanent methods of attachment are present. In support of my opinion, I reference the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) examples of methods of attachment of a muzzle device that is permanently attached to a barrel of a firearm. These permanent methods of attachment include "full-fusion gas or electric steel-seam welding, high-temperature (1100°F) silver soldering, or blind pinning with the

pin head welded over." Ex. 1010 p. 17. While the ATF definition refers to attachment between a firearm barrel and a muzzle device (e.g., suppressor) and the present analysis relates to a core being removably attachable to the housing, the ATF definition both confirms my understanding and evidences what a POSITA would have understood "removable" to mean in the suppressor arts. The threaded mating of attachments disclosed in Belykov do not meet the ATF definition of permanently attached, and indeed, Belykov does not disclose any of these permanent methods of attachment that would prevent removal of the core from the housing, including at the threaded junctions between at least the inner tube 5 (i.e., core) and the front end wall 7. As such, the components of Belykov that are coupled with threaded interfaces are removably attached.

129. Further, as depicted in the annotated excerpt of Fig. 7, which is below, the inner tube 5 (i.e., core) (highlighted in orange) is removably attachable to the outer tube 3 (i.e., housing) (highlighted in yellow). For example, Belykov discloses that "[i]n a preferred embodiment of the invention, the sound absorbing and/or *reflection element is preferably removably, in particular exchangably, attached to the inner tube* via a dowel pin or a press pin." Ex. 1003 ¶ 16 (emphasis added). Belykov provides an example of "sound reflection elements" as being the third sound impact walls 57. Ex. 1003 ¶ 44 ("sound reflection elements in the form of a second type of sound impact wall are arranged which are designated in the following

as third sound impact walls 57."). To allow the sound impact walls 57 depicted in Fig. 7 to be "removably, in particular exchangably, attached" would require the inner tube 5 (i.e., core) to be removably attached to the outer tube 3 (i.e., housing). Specifically, to remove the third sound impact walls 57 from the inner tube 5 (i.e., core), the third sound impact walls 57 would need to be moved radially outward from the inner tube 5 (i.e., core), which would require the inner tube 5 (i.e., core) to not be positioned within the housing 3 while the third sound impact walls 57 are being removed. Ex. 1003 ¶ 45 ("For mounting the sound reflection element in the inside of the silencer 1, the outer tube 3 is designed in several parts.").

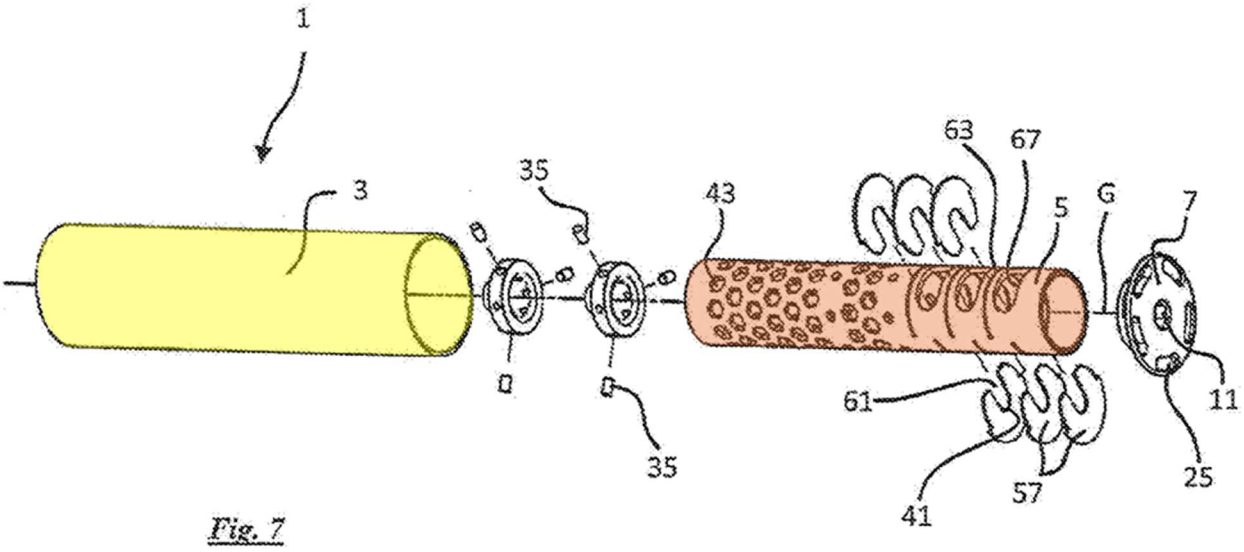
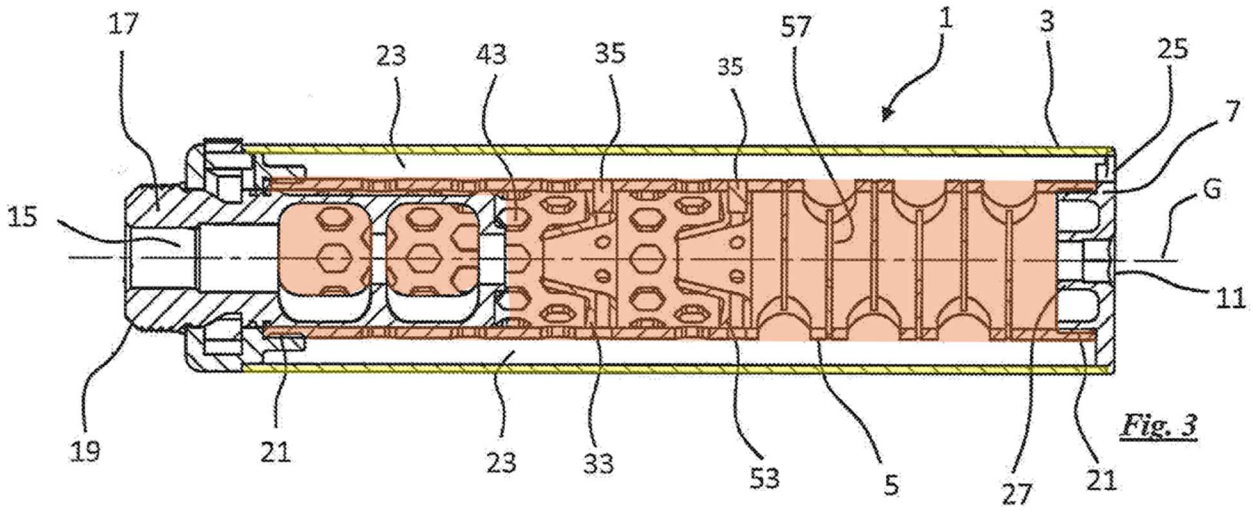


Fig. 7

Belykov, Fig. 7 (excerpt, annotated)



Belykov, Fig. 3 (annotated)

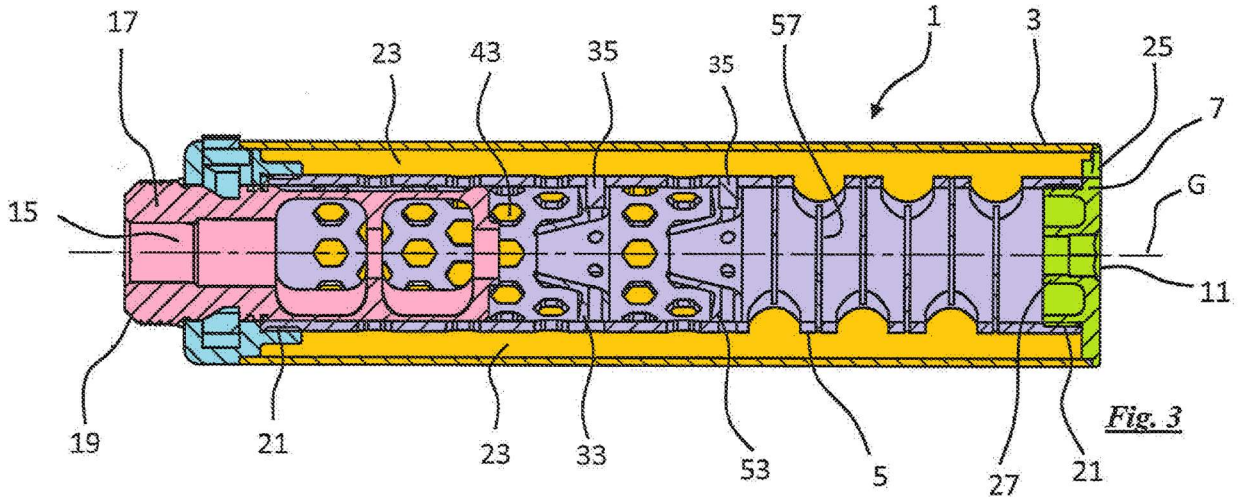
130. Based on the foregoing, both Belykov and the ’906 patent disclose that the core is removably attachable to the housing, in the case of the ’906 patent specification via the end cap being threaded to the housing and/or core but the disclosure and claims of the ’906 patent are not so limited. Thus, Belykov’s disclosure of the end wall 7 (i.e., end cap) being screwed into the inner tube 5 (i.e., core) via threaded connections (screw connection 21), along with the outer tube 3 (i.e., housing) being axially clamped between the front end wall 13 and the end wall 7 (i.e., end cap), would result in inner tube 5 (i.e., core) being removably attachable to the outer tube 3 (i.e., housing).

131. Belykov’s inner tube 5 (i.e., core) is removably attachable to the outer tube 3 (i.e., housing) and is positioned within it. To the extent it is argued that Belykov’s inner tube 5 (i.e., core) is not removably attachable to the outer tube 3 (i.e., housing) and/or is not positioned within it, Sclafani discloses a removable core

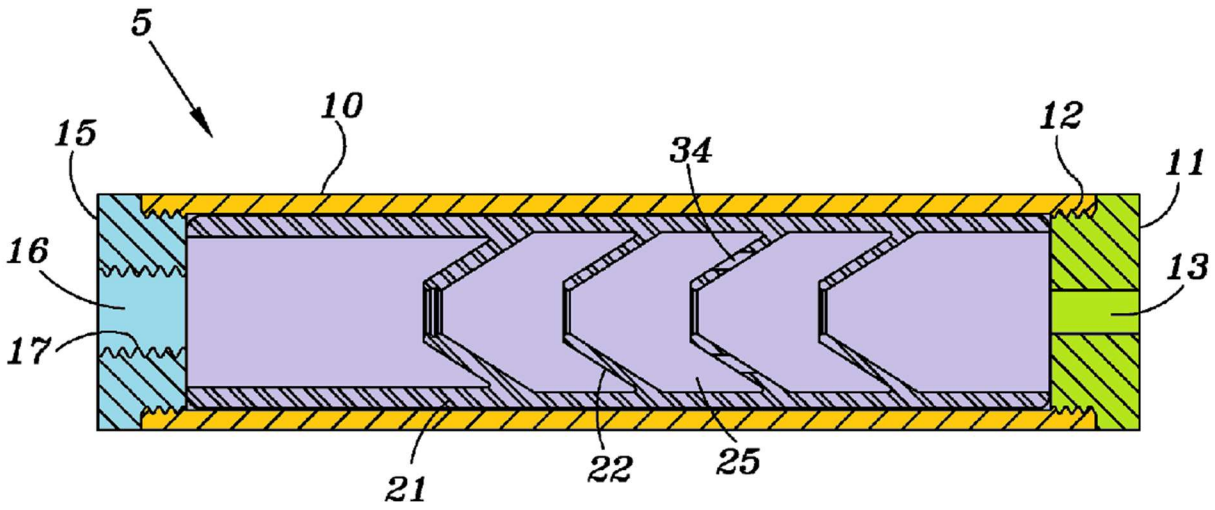
positioned within a housing, and it would have been obvious to modify Belykov accordingly to include an inner tube 5 (core) removably attachable to the outer tube 3 (housing) and positioned within it based on the teachings of Sclafani. In particular, Sclafani discloses that it may be "necessary to replace the core member after prolonged use". Ex. 1007 ¶¶ 7-8. In fact, Sclafani uses the stronger word "when" rather than "if" regarding replacement. Specifically, Sclafani notes that the "baffles are typically formed of metal and are subjected to wear and corrosion caused by the explosive gases entering the housing" such that "[a]fter a limited number of rounds, the cone baffles fail and the entire silencer must be replaced. Each silencer is subject to an additional federal tax which increases the cost of replacement." Ex. 1007 ¶ 4-5. Sclafani further discloses that its solution to this problem is to integrate the baffles into a "monolithic, one piece, homogeneous core structure, using longer lasting materials such as plastics" and also alternatively discloses a "metallic material." Ex. 1007 ¶ 7. The inner body 5 (i.e., core) and associated components (e.g., impact plates 33, 53, 57) may also be made monolithic when three dimensionally printing the inner tube 5, though this is not required by claims 1 or 2 of the '906 patent.

132. Referring to annotated Fig. 3 of Sclafani, reproduced below, Sclafani includes a core member 30 (i.e., core) (highlighted in purple) that is held within the tubular housing 10 (i.e., housing) by the respectively threaded end caps 11, 15 (i.e., the "second cap member 11" being an end cap). This is not materially different from

the assembly of Belykov's silencer 1 (i.e., firearm suppression system) in that Belykov's outer tube 3 (i.e., housing) is clamped between the respective side wall ends 7, 13 while the inner tube 5 (i.e., core) is screwed to the respective side wall ends 7, 13. Ex. 1003 ¶ 28-29, Figs. 3, 6, 7. To replace the core member 30 (i.e., core) (highlighted in purple) of Sclafani, either "cap 11 or 15 can be removed and core member 30 withdrawn from tubular housing 10." Ex. 1007 ¶ 15. A new core member may then be placed within the tubular housing 10 and the cap member can be rethreaded into the tubular housing." Ex. 1007 ¶15, Figs. 1-3.



Belykov, Fig. 3 (annotated)



Sclafani, Fig. 3 (annotated)

133. Therefore, and as discussed above in the motivation to combine section, it was known from Sclafani that integrating the baffles into a single monolithic structure and making a core replaceable is a method for improving the longevity of a suppressor, which would provide motivation for improving the longevity of Belykov's suppressor. *See* Ex. 1007 ¶4-7. Belykov includes a core structure and baffle structures that would wear after prolonged use as described by Sclafani and includes the corresponding wall ends 7, 13 that may be removed to access the core as with Sclafani (and Belykov's existing structure). Sclafani further provides specific instructions for removing the end caps 11, 15, which are similarly threaded (to the tubular housing 10 as discussed above) to replace the core, which shows that there would be a reasonable expectation of success in the combination by either unscrewing the existing end walls 7, 13 of Belykov or by replacing the threading of

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Belykov with the outer tube to end wall type threading of Sclafani. Therefore, it would be obvious to modify Belykov to include a core removably attachable to the housing and positioned therein as taught by Sclafani. While Sclafani is one example, the concept of serviceable silencers to prolong their life is well known to both a POSITA and even the average silencer consumer.

Claim 1, Element [1.4]: 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,

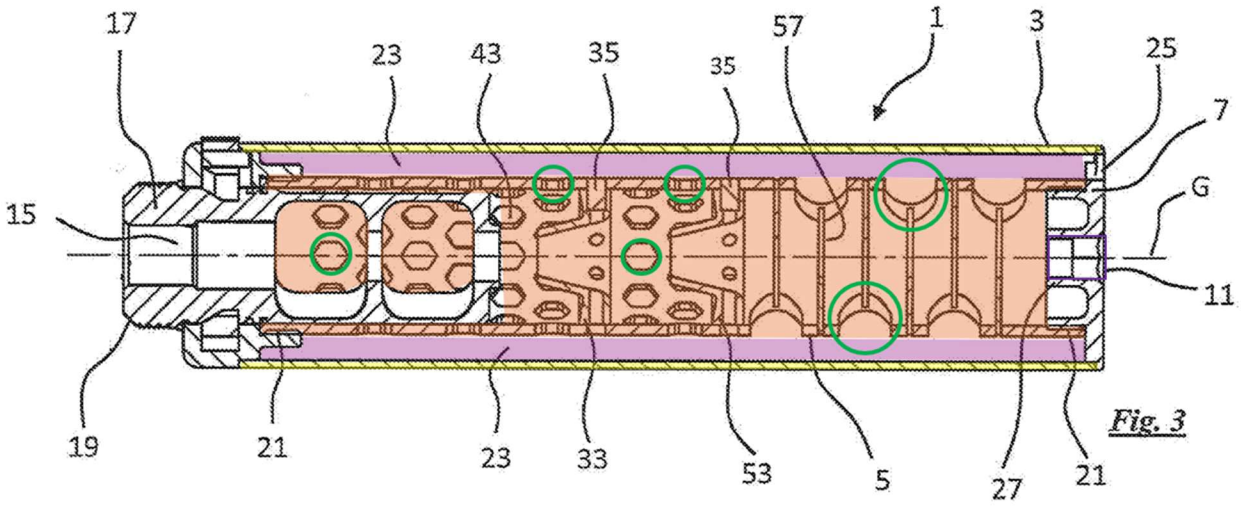
134. Belykov discloses this limitation. Belykov discloses that the inner tube 5 (i.e., core) "is provided with a plurality of honeycomb cell-shaped exchange openings 43 which enable a gas transfer between the projectile channel 45 being margined by the inner tube 5, in particular of the channel expansion chamber 31, and the annular space 23." Ex. 1003 ¶ 34. Belykov also discloses axial bypass openings 61 that radially end in the projectile passage opening 41 and second exchange openings 67 that are formed in the inner tube 5 (i.e., core), each being radially opposite an axial bypass opening 61. Ex. 1003 ¶ 47. Each of these openings is formed on an outer surface that allows communication between the interior and exterior of the inner tube 5 (i.e., core). *See* Ex. 1003 Figs. 3, 5.

135. Belykov discloses that muzzle gas is at least partially redirected "radially to the outside and reaches the second exchange opening 67 in the annular space 23." Ex. 1003 ¶ 48. With reference to annotated Figs. 3, 5, and 7 below, these various openings (e.g., honeycomb cell-shaped exchange openings 43 and axial bypass openings 61, 67) are spaced along the length of the inner tube 5 (i.e., core) and are positioned on the outer surface of the inner tube 5 (i.e., core) and would therefore allow gas transfer between the interior of the inner tube 5 and the annular space 23 between the inner tube 5 and outer tube 3 at numerous locations along the length of the inner tube. See Ex. 1003 Figs. 3, 5, 7.

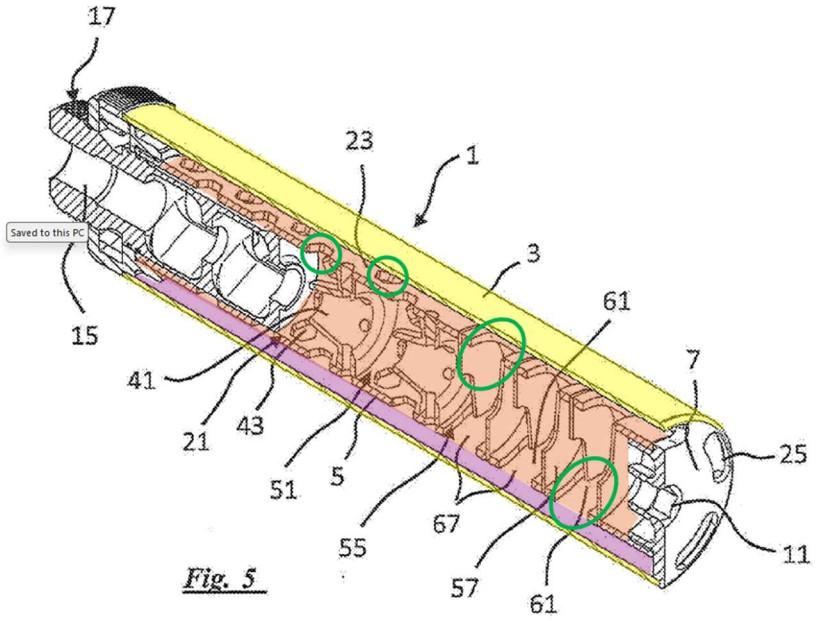
136. Because the gas itself (and thus its source) is not explicitly recited in the claim, it is unnecessary to identify gas in the prior art. In my opinion, the "gas" and "muzzle gas" described in Belykov correspond to the claimed "gas passing from a projectile and cartridge," which refers to the propellant gases produced in modern cartridge-based firearms such as those of the '906 patent and Belykov. For example, Belykov notes earlier designs having "unburned powder" (Ex. 1003 ¶ 2).

137. Further, as depicted in the annotated Figs. 3 and 5 and annotated excerpt of Fig. 7, both below, Belykov discloses that the inner tube 5 (i.e., core) (highlighted in orange) comprises openings 43, 61, 67 (i.e., a plurality of core apertures) (green circles on an exemplary subset of the openings shown below) on an outer surface

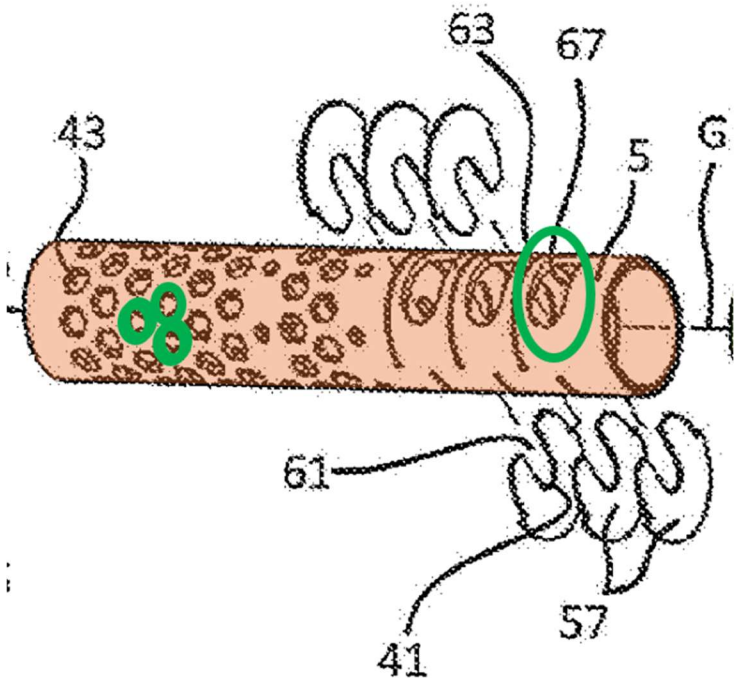
that allow gas passing from a projectile and cartridge to pass to a annular space 23 (i.e., a channel) (highlighted in purple) between the inner surface of the outer tube 3 (i.e., housing) (highlighted in yellow) and an outer surface of the inner tube 5 (i.e., core). Ex. 1003 Figs. 3, 5, 7.



Belykov, Fig. 3 (annotated)



Belykov, Fig. 5 (annotated)



Belykov, Fig. 7 (excerpt, annotated)

138. Belykov discloses a plurality of bypass and exchange openings 43, 61, 67 that allow muzzle gas to exit the inner tube 5 (i.e., core) and enter the annular

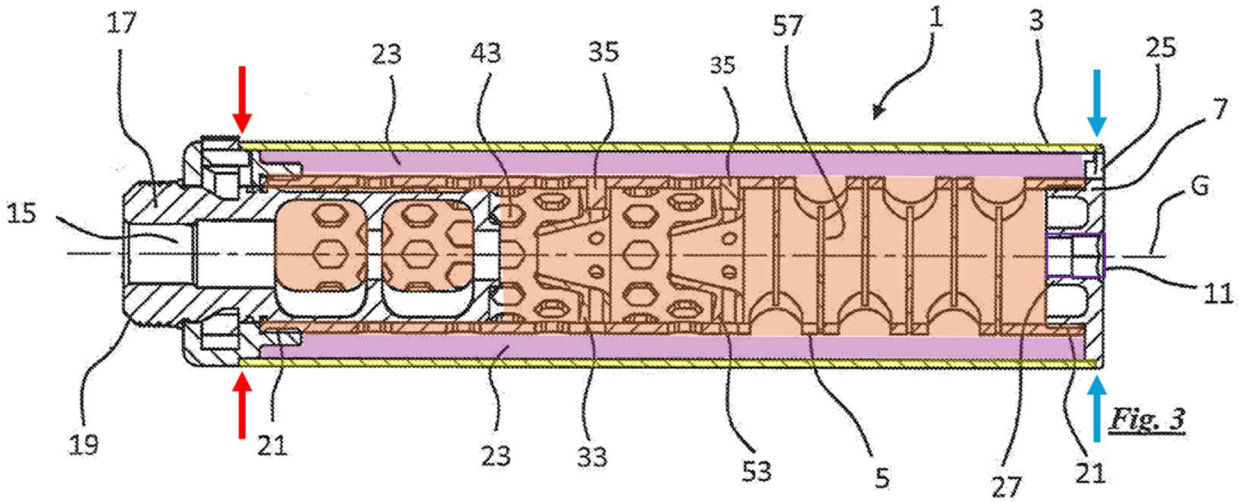
space 23, which is between the inner tube 5 (i.e., core) and the outer tube 3 (i.e., housing), and as such, Belykov discloses that the inner tube 5 (i.e., core) comprises a plurality of core apertures on an outer surface that allow muzzle gas (i.e., gas passing from a projectile and cartridge) to pass to an annular space 23 (i.e., a channel) between the inner surface of the outer tube 3 (i.e., housing) and an outer surface of the inner tube 5 (i.e., core).

Claim 1, Element [1.5]: 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.

139. Belykov discloses this limitation. In particular, the annular space 23 (i.e., channel) extends the full circumference around the inner tube 5 in addition to extending along the length of the inner tube as shown in annotated Fig. 3 below. Ex. 1003 Fig. 3, ¶ 31. Belykov discloses that "[b]etween the inside of the outer tube 3 and the outside of the inner tube 5, an annular space 23 is formed which *continuously extends in circumferential direction and in projectile flight direction G*." Ex. 1003 ¶ 31 (emphasis added). Belykov further explains that "[t]he annular space 23 extends from the front wall 15 *continuously without radial barrier or wall indentation* on the opposite side to the front end wall 7." Ex. 1003 ¶ 32 (emphasis added).

140. Further, as depicted in annotated Fig. 3, provided below, Belykov discloses that the annular space 23 (i.e., channel) (highlighted in purple)

circumscribes the outer surface of the inner tube 5 (i.e., core) (highlighted in orange) and begins at the first end (red arrows) of the outer tube 3 (i.e., housing) (highlighted in yellow) and terminates at the second end (blue arrows) of the outer tube 3 (i.e., housing). Ex. 1003 Fig. 3.



Belykov, Fig. 3 (annotated)

141. As such, because Belykov discloses that the annular space 23 extends continuously in circumferential direction (in addition to the axial direction (i.e., projectile flight direction)) and without radial barrier or wall indentation, Belykov discloses that the annular space 23 (i.e., channel) circumscribes the outer surface of the inner tube 5 (i.e., core).

142. Belykov also discloses a channel that equalizes pressure that begins at the first end of the housing and terminates at the second end of the housing. In particular, the annular space 23 shown in Belykov would equalize pressure that begins at the first end of the housing and terminates at the second end of the housing,

for example, based on the quantity and locations of the openings (e.g., openings 43, and bypass openings 61 (labeled in Fig. 4)) connecting the interior of the inner tube 5 (i.e., core) with the annular space 23 between the inner tube 5 and the outer tube (i.e., housing) as shown in annotated Fig. 3 above. Ex. 1003 Fig. 3, ¶ 5, 34, 47. In addition, the flow paths from those openings (e.g., openings 43, and bypass openings 61) through the annular space 23, with the annular space 23 being open and unimpeded along its length.

143. For example, Belykov discloses that "the annular space is designed such that in the inside of the annular space, muzzle gas flowed in through the at least one exchange opening can leave at the at least one venting opening, without having to leave the annular space […] This direct gas communication between the at least one exchange opening and the at least one venting opening provides an excellent venting of the silencer and thus a cooling- and pressure release mechanism such that even in the event of fast firing salves, the functional elements within the silencer remain damage free, even if being designed in classic manner." Ex. 1003 ¶ 7, *see also* ¶ 34. A POSITA would have understood that gas generally travels from regions of higher pressure to regions of lower pressure. To "equalize" pressure, those regions must be fluidically connected so that pressure differentials can relax through flow communication. In Belykov, that condition is satisfied: the inner tube 5 includes distributed openings 43, 61, 67 into the surrounding annular space 23, and the

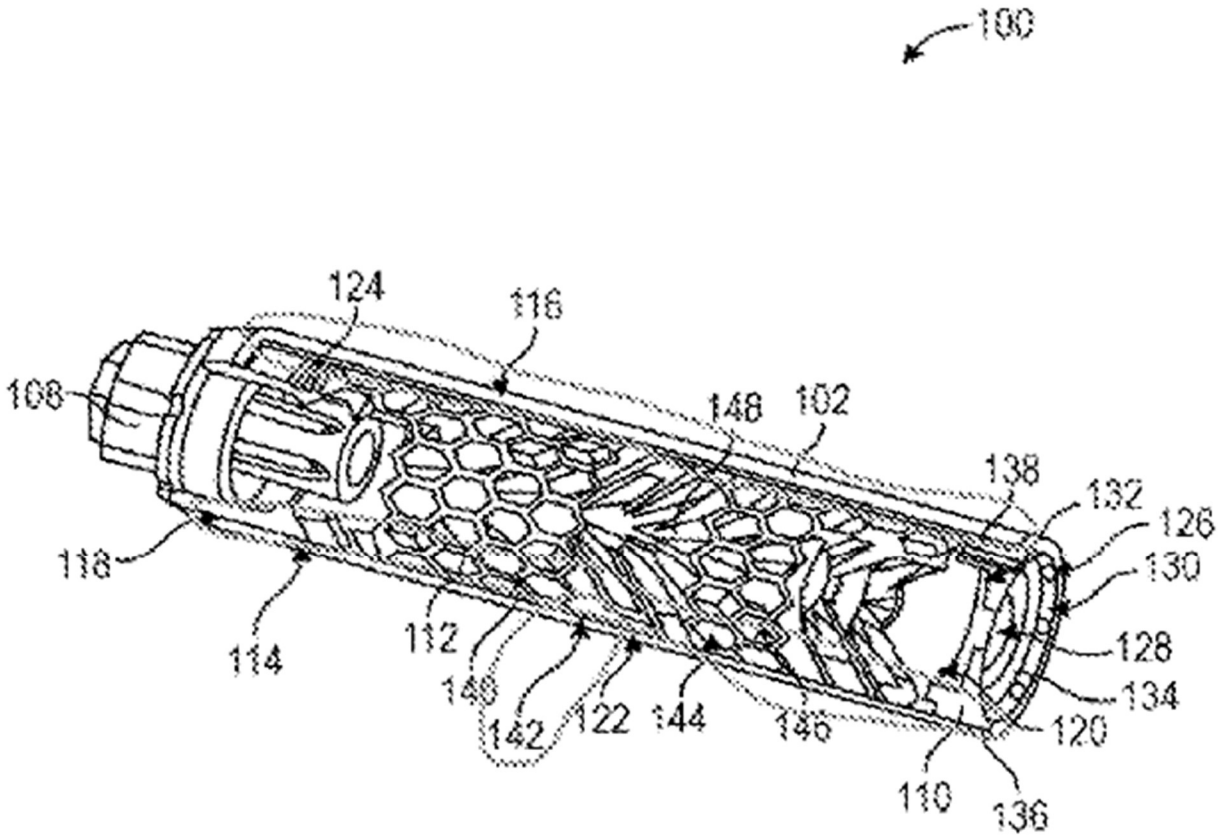
annular space 23 extends continuously along the length of the device between the outer tube 3 and the inner tube 5. For example, gas entering the annular space 23 through the inner-tube openings can migrate longitudinally within 23 and vent through the venting openings 25 as well as muzzle opening 11 at the forward end. Because each point along the core wall communicates laterally into a single continuous annulus that in turn connects to venting openings 25, local pressure peaks at the blast end are dissipated along 23 and discharged at the distal end. Thus, the annular space 23 that circumscribes the core acts as a distributed equalization path: gases passing from higher-pressure regions near the entry end expand into 23, move axially through the uninterrupted circumferential volume, and exit through the forward venting openings 25. Belykov describes the "direct gas communication between the at least one exchange opening and the alt [sic] least one venting opening" as both providing "an excellent venting of the silencer" and as a "pressure release mechanism". Ex. 1003 ¶7. This mechanism allows pressure that begins at the first end of the housing to equilibrate along the channel and terminate at the second end, meeting the "equalizes pressure … from the first end … to the second end" limitation of element [1.5].

144. For the avoidance of doubt, and to the extent it is argued that Belykov does not include a channel circumscribing the outer surface of the core and equalizing pressure that begins at the first end of the housing and terminates at the

second end of the housing, the structure and purpose of Belykov's annular space 23 (i.e., channel) corresponds to the structure and purpose of the channel 142 of the '906 patent, which the '906 patent describes as performing the claimed equalization function, such that the annular space 23 of Belykov also equalizes pressure that begins at the first end of the housing and terminates at the second end of the housing. For example, in Belykov, the annular space 23 (i.e., channel) is between the outside of the inner tube 5 (i.e., core) and the inside of the outer tube 3 (i.e., housing), and Belykov discloses openings 43, 61, 67 (i.e., a plurality of core apertures) that are dispersed along a substantial length of the inner tube 5 (i.e., core) that allow muzzle gas (i.e., gas passing from a projectile and cartridge) to enter the annular space 23 (i.e., channel). Ex. 1003 ¶ 31, Fig. 3.

145. Similarly, the '906 patent's channel is between the core 112 and the housing 102, and the core apertures 144 of the '906 patent are dispersed along a substantial length of the core 112 "that allow gas passing from the projectile and operating system to pass to the channel 142." Ex. 1001 col. 6, ll. 62-34, col. 7, ll. 22-25; Fig. 2. Moreover, the '906 patent states that "[b]etween 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." Ex. 1001 col. 6, ll. 62-67. In the Response to the Office Action

dated February 16, 2024, Patent Owner cited to the preceding passage from its specification for support for the amendment that included Element [1.5] and asserted that "[t]he following screenshot of Fig. 2 illustrates the channel 142 that is positioned between the housing and the core and that circumscribes the core, running the entire length of the core." Ex. 1002 p. 104.



Annotated Fig. 2 of the '906 patent (annotated by Patent Owner in the Response to the Office Action dated February 16, 2024)

146. As can be seen in annotated Fig. 2, above, and annotated Fig. 3, below, the device of the '906 patent includes a threaded fastener 124 (highlighted in red)

connecting the core 112 (highlighted in orange) to the housing 102 (highlighted in yellow) at the first end 104 and includes a sidewall 138 that "may be threaded" to the inner surface 114 of the housing 102. Ex. 1001 col. 6, ll. 39-42, Fig. 2.

147. Belykov discloses that muzzle gas (i.e., gas passing from a projectile and cartridge) entering the annular space 23 (i.e., channel) escapes through the end wall 7 (i.e., end cap) at venting openings 25 that are spaced apart and positioned in an annular formation on the end wall 7 (i.e., end cap). Ex. 1003 ¶ 34; Fig. 1. This muzzle gas originates in the muzzle, which is proximal (i.e., upstream) of the outer tube 3 (i.e., housing), and thus, the annular space 23 of Belykov equalizes pressure that begins at the first end of the housing and terminates at the second end of the housing. Ex. 1003 ¶ 2. Similarly, the '906 patent discloses that gas from the fired cartridge enters the firearm suppression system 100 and escapes through the end cap 110 at vent apertures 126 that are "spaced apart and positioned in an annular formation" on the end cap 110. Ex. 1001 col. 6, ll. 13-20. Therefore, the structure and purpose of the annular space 23 (i.e., channel) of Belykov corresponds to the structure and purpose of the channel 142 of the '906 patent and both would have the same gas equalization properties. For the avoidance of doubt, Fig. 3 of Belykov confirms that the annular space 23 (i.e., core) extends at least the full length of the inner tube (i.e., core), such that any pressure would be equalized within the annular space along the full length of the core and annular space as well.

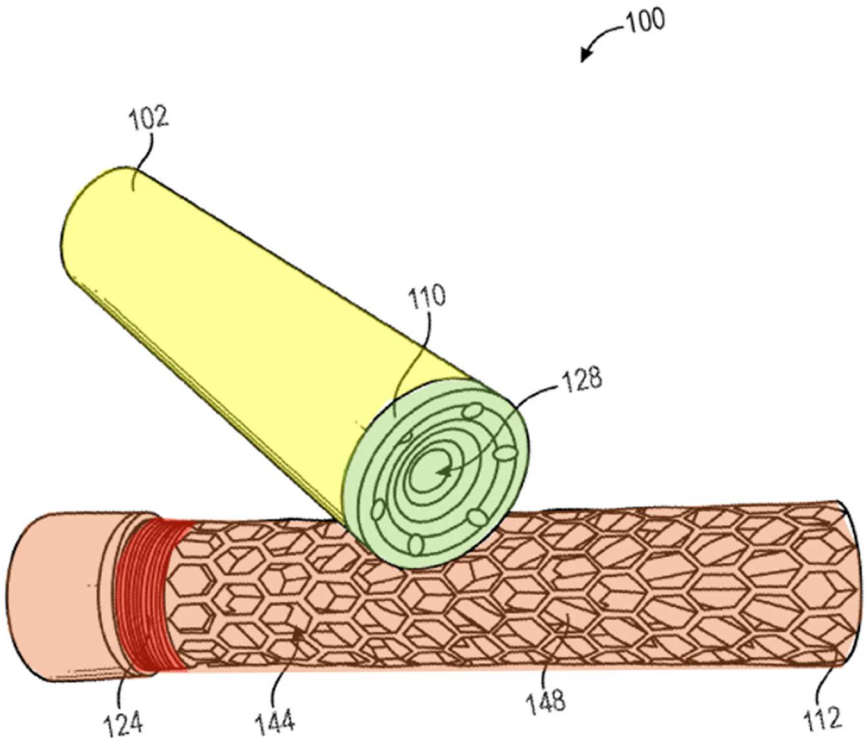
148. Assuming, for purposes of argument, that the channel 142 of the ’906 patent performs the claimed function of equalizing pressure that begins at the first end of the housing and terminates at the second end of the housing, the annular space 23 (i.e., channel) of Belykov would also perform the claimed function of equalizing pressure due to the corresponding structures and purposes of the annular space 23 (i.e., channel) of Belykov and the channel 142 of the ’906 patent.

149. To the extent it is argued that the channel equalizing pressure that begins at the first end of the housing and terminates at the second end of the housing requires the pressure within the channel itself to extend from the first end of the housing to the second end of the housing, this is contrary to the plain and ordinary meaning of the claim and contrary to the disclosure of the ’906 patent and representations made by the Applicant of the ’906 patent during prosecution.

150. The ’906 patent states that “[t]he 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”, which “equalizes the high pressure gas through the entire system 100 rapidly”. Ex. 1001 col. 6, line 67 to col. 7 line 5. As such, the suppressor disclosed by the ’906 patent does not include “immediate” gas transfer to the channel at the first end of its housing despite disclosing and arguing during prosecution that the channel 142 performs the claimed function. As can be

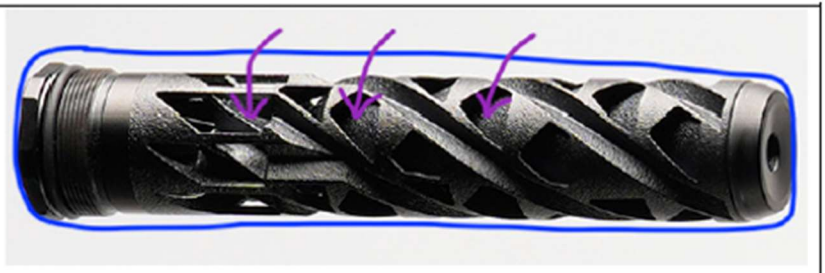
seen in annotated Fig. 3 of the ’906 patent below, the earliest instance that gas would be permitted to flow from the interior of the core 112 to the channel adjacent the housing 102 would be downstream of the threads 124 and downstream of the first end of the housing since the core apertures 144 do not begin until after the threads 124 while the housing 102 extends to the proximal (i.e., to the left in Fig. 3 below) end of the threads.

151. Moreover, in the Office Action response discussed above, and with reference to the Applicant’s annotated Fig. 2 above, the claimed “channel” includes the region that is threaded, which would not, in my opinion, allow pressure to escape through the threads. Thus, it is clear from the Patent Owner’s statements and the corresponding disclosure that the “pressure” which begins at the first end of the housing and terminates at the second end of the housing does not “begin” within the channel at the first end of the housing and the claims do not require it. Further, the structure of the core of the ’906 patent does not include core apertures at a first extremity of the core, and the claim language does not require a specific radial location for the pressure. Instead, for the pressure of the ’906 patent to “begin[] at the first end of the housing”, the pressure may begin within the core (e.g., along the projectile path into the suppressor) and may enter the channel through core apertures that are not at a first extreme end of the core.



'906 Patent, Annotated Fig. 3

152. For further avoidance of doubt, it is also my understanding that Patent Owner believes and has asserted in a claim chart (excerpt provided below) that a suppressor design that allows a "core to slide into the housing" would inherently include a channel meeting the requirements as recited in claim 1. Ex.1011 p. 32.

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.	 Company's Suppressor includes a core (blue), a plurality of core apertures (purple arrows), and a channel. While the channel is not shown, it is inherent in the design so as to allow Company's core to slide into the housing. As such, a channel surrounds the core and is positioned between an outer surface of the core and an inner surface of the housing/shell.

core apertures (purple arrows), and a channel. While the channel is not shown, it is inherent in the design so as to allow Company's core to slide into the housing. As such, a channel

Patent Owner's Claim Chart (excerpt, annotated)

153. The Belykov silencer 1 features an inner tube 5 (i.e., core) that slides into an outer tube 3 (i.e., housing). Ex. 1003 Fig. 7. As such, according to Patent Owner's definition, the Belykov device would have a channel 23 that surrounds (i.e., circumscribes) the core, is positioned between the outer surface of the core and the inner surface of the housing/shell, and equalizes pressure that begins at the first end of the housing and terminates at the second end of the housing. Ex. 1003 Fig. 3; Ex. 1011 p. 32.

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

154. Sclafani discloses the limitations added in dependent claim 2. As described above in this Ground 1, Belykov and Sclafani disclose all of the limitations of independent claim 1. Claim 2 merely recites how the core is made (i.e., printed from a three-dimensional printer). However, the specification of the '906 patent does not describe a structural difference in the core itself created by the three-dimensional printer, and claim 2 does not claim the manufacturing process explicitly. To the extent it is argued that printing the core from a three-dimensional printer further limits the subject matter of claim 2 relative to claim 1, it is my opinion that it would be obvious to make at least the inner tube 5 (i.e., core) of Belykov using a three-dimensional printer based on the teachings of Sclafani.

155. In particular, Sclafani discloses that "[c]ore member may be formed by a three dimensional printer such that the core member consist of a one piece, monolithic and homogeneous body." Ex. 1007 ¶ 14. Further, the core member of Sclafani corresponds to the inner tube 5 (i.e., core) of Belykov as described previously.

156. Sclafani provides a known technique for manufacturing various components of a suppressor, including explicitly the core in the case of Sclafani. Thus, it would be obvious to combine Belykov and Sclafani to create a suppressor

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having the features of claim 1 wherein the core is additionally printed from a three-dimensional printer, and this combination would have had motivation and a reasonable expectation of success based on the improvements and teachings of the respective references described above. In printing the inner tube 5 (i.e., core) of Sclafani using a three dimensional printer, it would also be obvious to make the inner tube 5 (i.e., core) and associated components (e.g., sound impact plates 33, 53, 57) separately from three dimensional printing or to make the combined assembly as a single, monolithic three dimensional print. Regardless of the final manufacturing process used, a POSITA who owned a printer would, at the earliest relevant priority date of the '906 patent, if not over a decade earlier, have produced some copies of a new silencer, and components thereof, at least for prototype purposes, and the POSITA would be motivated to print the silencer of Belykov for the same prototype purposes.

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

157. Belykov discloses the limitations added in dependent claim 3. As discussed, Belykov discloses an end wall 7 (i.e., end cap) (highlighted in green) shown in annotated excerpts of Figs. 3 and 5 below. Ex. 1003 Figs. 3, 5. Belykov discloses that "[s]ubstantially on the *radial height of the annular space 23*, *multiple venting openings 25* are formed into the front *end wall 7*." Ex. 1003 ¶ 32 (emphasis

added). The "venting openings 25 extend *concentrically around* the projectile exit opening 11 and are completely formed into the material of the *front end wall 7*." Ex. 1003 ¶ 32 (emphasis added). "Due to the continuous, separating wall free extension of the annular space 23, the muzzle gas entering the annular space 23 *can escape towards the front end wall 7 at the venting openings 25…*". Ex. 1003 ¶ 34 (emphasis added). As such, the venting openings 25 (i.e., plurality of vent apertures) are formed in the front end wall 7 (i.e., end cap) at the same radial height as the annular space 23 (i.e., channel), extend concentrically around the projectile exit opening 11 (i.e., projectile aperture), and allow muzzle gas (i.e., gas passing from a projectile and cartridge) to escape.

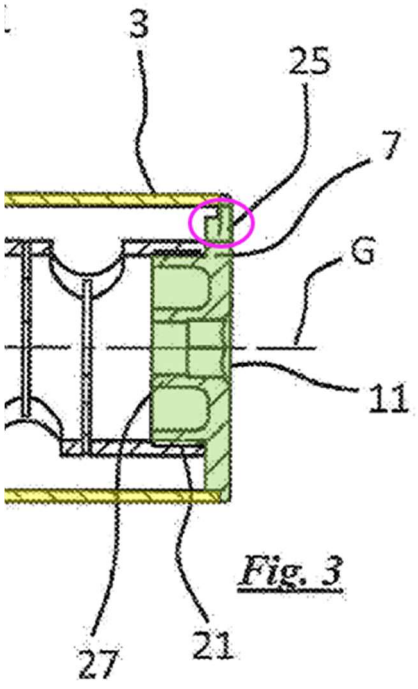
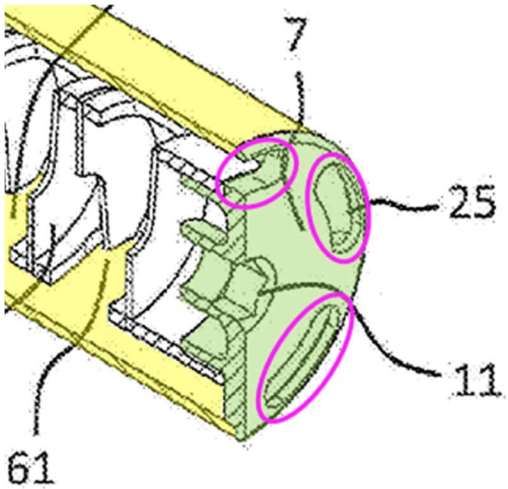


Fig. 3



Belykov, Fig. 3 (excerpt, annotated) **Belykov, Fig. 5 (excerpt, annotated)**

158. Similarly, the '906 patent discloses that "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 that "the pressure *channel 142* equalizes pressure and moves the pressure towards and *out of the vent apertures 126*." Ex. 1001 col. 6, ll. 13-16, col. 7, ll. 10-12 (emphasis added). "The plurality of vent apertures 126 may be spaced apart and positioned in an *annular formation* on the end cap 110". Ex. 1001 col. 6, ll. 17-19 (emphasis added). As such, the vent apertures 126 are in annular formation and allow gas to exit the firearm suppression system 100, which is similar to the structure and function of the venting openings 25 (i.e., plurality of vent apertures) of Belykov. As such, the front end wall 7 (i.e., end cap) of Belykov comprises the claimed plurality of vent apertures.

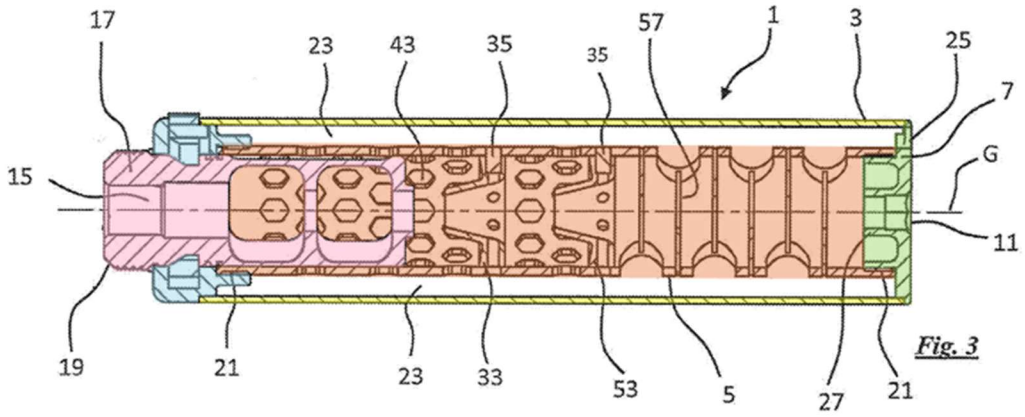
Dependent Claim 4: The firearm suppression system of claim 1, further comprising a muzzle adapter.

159. Belykov discloses the limitations in dependent claim 4. Specifically, Belykov discloses:

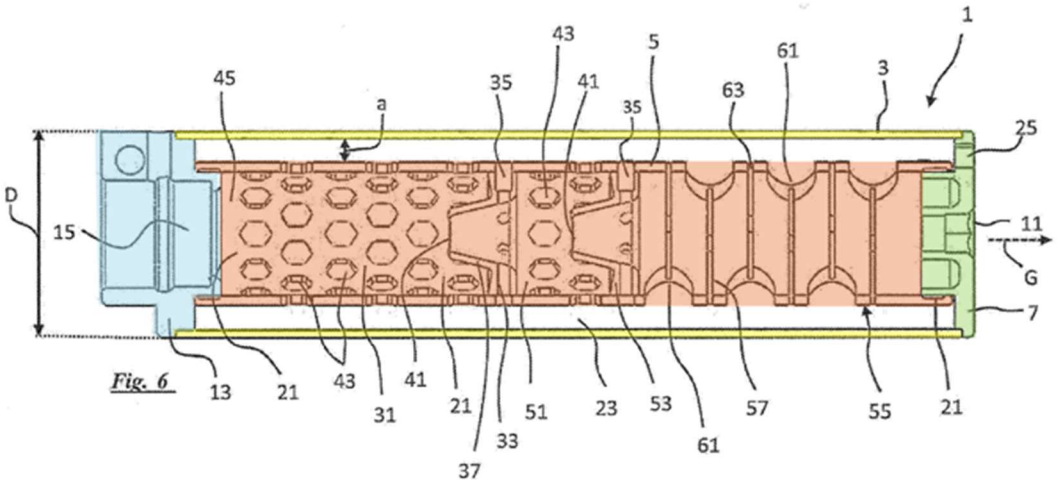
> [t]he silencer 1 according to the invention has as main components an outer tube 3 with cylindrical cross-sectional shape, an inner tube 5 with cylindrical cross-section being interspersed with recesses, a front end wall 7 which defines a projectile exit opening 11, and *a front face 13* with a projectile

entry opening 15 *to be coupled with the firing arm* [sic] (not shown), wherein *the face wall 13* on the side of the firearm can *optionally be replaced* by silencer-unrelated components, such as a *muzzle brake 17* which can be coupled to the silencer 1 via a detachable fastening device 19."

Ex. 1003 ¶ 28 (emphasis added).



Belykov, Fig. 3 (excerpt, annotated)



Belykov, Fig. 6 (excerpt, annotated)

160. A muzzle adapter is a silencer component that is typically removably installed into the rear of the silencer such that it allows for a mating to either a threaded barrel on a firearm or onto another component, such as a flash suppressor or muzzle brake, that is already installed onto the barrel of a firearm. They may be removable so as to allow them to be swapped to adapt to other types of firearms – for example to one with a different thread pitch or muzzle device. From the '906 patent:

> 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.

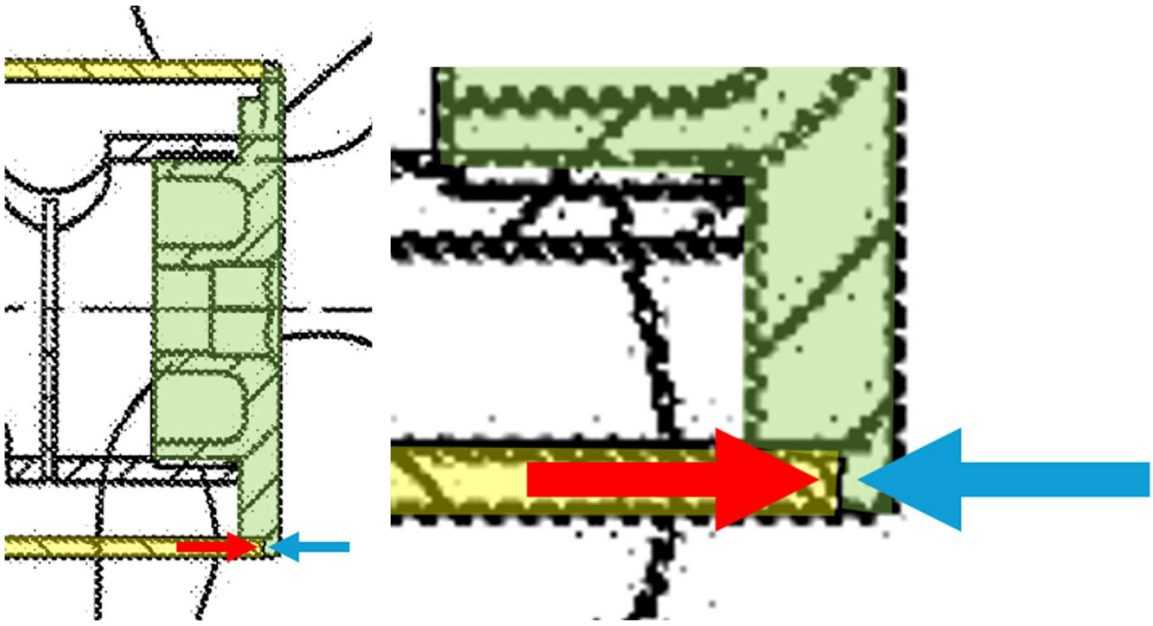
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Ex. 1001 col. 5, line 60 to col. 6, line 5. Belykov discloses that the front face 13 (i.e., muzzle adapter) (highlighted in blue) can be coupled with the firearm. Ex. 1003 ¶ 28. In particular, Belykov notes "… and a front face 13 with a projectile entry opening 15 to be coupled with the firing arm [sic] (not shown), wherein the face wall 13 on the side of the firearm can optionally be replaced by silencer-unrelated components, such as a muzzle brake 17 which can be coupled to the silencer 1 via a detachable fastening device 19." Ex. 1003 ¶28. Therefore, the front face 13 (i.e., muzzle adapter) corresponds to the claimed muzzle adapter. Further, the front face 13 could be replaced by the muzzle brake 17 (highlighted in pink) and the muzzle brake 17 is held onto the suppressor 1 by the unlabeled component shown above in annotated Fig. 3 (highlighted in blue), which is described as a "detachable fastening device 19" in Belykov's specification, and as such, this holding component also equates to at least a portion of the claimed muzzle adapter. The modularity and removability of the components being able to be swapped to adapt the silencer 1 (e.g., firearm suppressor assembly) to engage multiple structures further supports the conclusion that the depicted components (highlighted in blue) are each muzzle adapters. Moreover, in the embodiment depicted in Belykov's Fig. 3 above, the muzzle brake 17 mates with the muzzle adapter, which therefore is engaged with and adapts and attaches the silencer to the muzzle of the firearm. The component highlighted in blue that replaces the front face 13 equates to the claimed muzzle

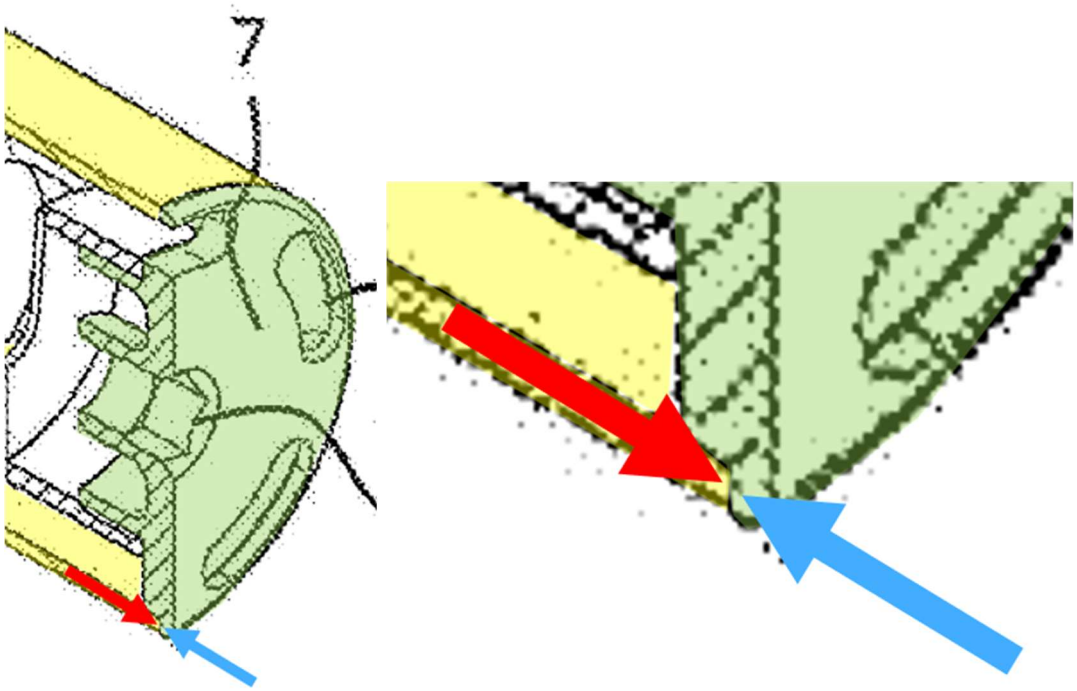
adapter because it makes it so that the silencer may be coupled to numerous different types of firearms, which is language that later appears in the '906 patent, "Accordingly, the firearm suppression system 100 may be coupled to numerous different types of firearms." Ex. 1001 col. 6, ll. 4-5.

Dependent Claim 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.

161. Belykov discloses the limitations added in dependent claim 5. As discussed, and as shown in the annotated excerpts of Figs. 3 and 5, below, Belykov discloses a front end wall 7 (i.e., end cap) (highlighted in green) and an outer tube 3 (i.e., housing) (highlighted in yellow) that comprises a second end (red arrow). Ex. 1003 ¶ Figs. 3, 5.



Belykov, Fig. 3 (excerpts, annotated)



Belykov, Fig. 5 (excerpts, annotated)

162. Belykov discloses that the outer tube 3 (i.e., housing) is "axially clamped between the front ends 7, 13." Ex. 1003 ¶ 29. As shown in the annotated excerpts of Figs. 3 and 5, the front end wall 7 (i.e., end cap) includes a radially-extending flange (indicated by the blue arrow), which facilitates clamping of the outer tube 3 (i.e., housing). Ex. 1003 ¶ 29, Figs. 3, 5. As depicted, the surface of the flange that the outer tube 3 (i.e., housing) rests upon faces inwards (i.e., in a rear or aft direction). Ex. 1003 ¶ 29, Figs. 3, 5.

163. Similarly, the '906 patent discloses that "[t]he second side 132 of the end cap 110 includes a ledge 136 that rests on and is flush with the second end 106

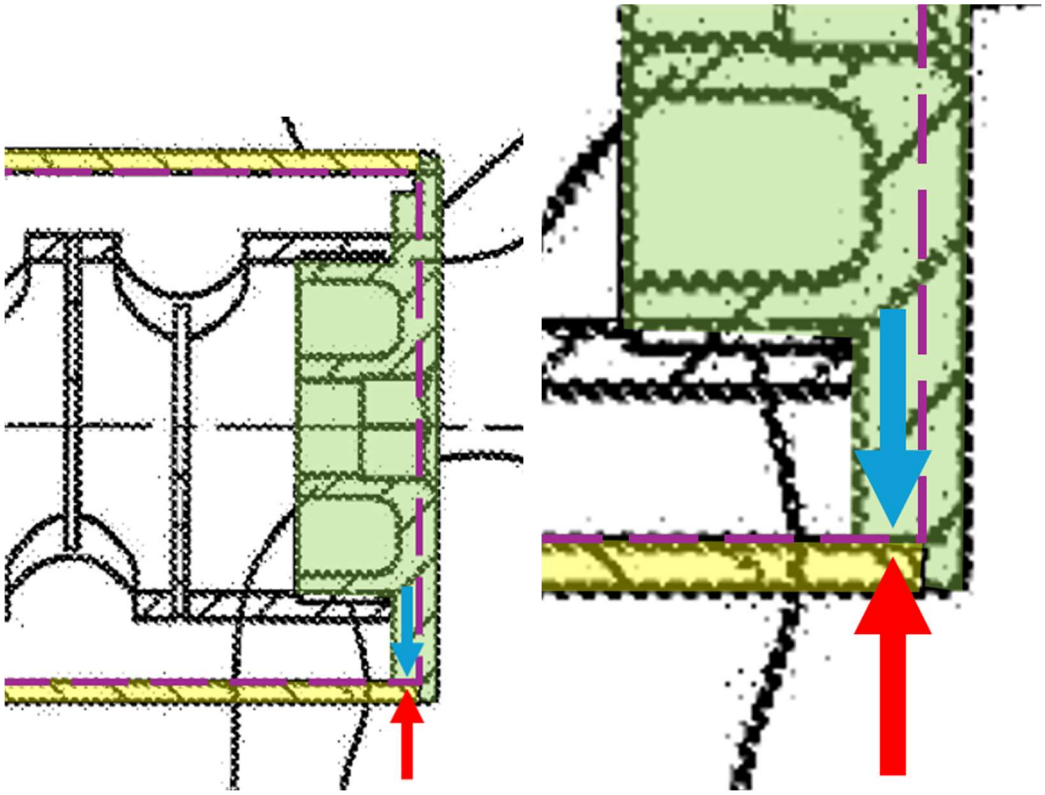
of the housing 102." Ex. 1001 col. 6, ll. 37-39. The '906 patent explains that the "… second side 132 facing inward towards the inner compartment 122 and firearm's muzzle." Ex. 1001 col. 6, ll. 26-29.

164. The flange of Belykov rests upon and is flush with the second end of the outer tube 3 (i.e., housing) since it facilitates the clamping of the outer tube 3 (i.e., housing). Also, like the '906 patent, the surface of the front end wall 7 (i.e., end cap) that the outer tube 3 (i.e., housing) rests upon faces aft (i.e., towards the shooter). As such, the flange of Belykov's front end wall 7 (i.e., end cap) is the claimed ledge.

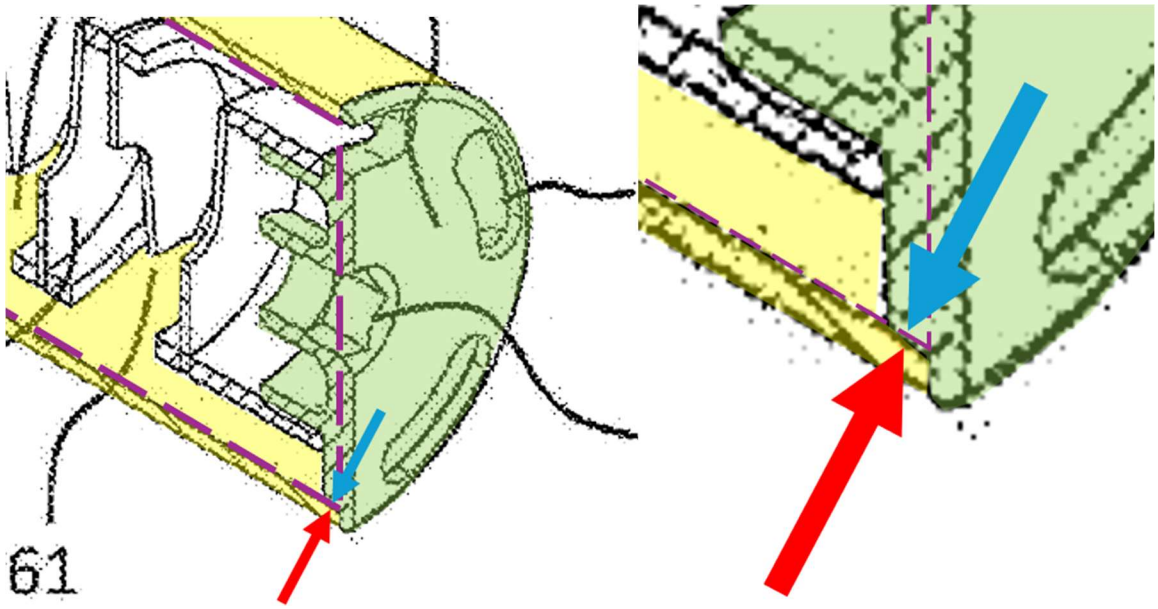
Dependent Claim 6: The firearm suppression system of claim 1, wherein the end cap comprises a sidewall that is positioned in the inner compartment and rests against an inner surface of the housing.

165. Belykov discloses the limitations added in dependent claim 6. As discussed, and as shown in the annotated excerpts of Figs. 3 and 5, below, Belykov discloses an outer tube 3 (i.e., housing) (highlighted in yellow) that comprises an inner compartment (a portion shown with purple dashed lines) that is substantially the same circumference from the first end to the second end, and a front end wall 7 (i.e., end cap) (highlighted in green) having a sidewall resting against the inner surface of the outer tube 3 (i.e., housing) within the inner compartment. Ex. 1003 ¶ 29, Figs. 3, 5. As can be seen in annotated excerpts of Fig. 5 below, the top side of

the illustrated front end wall 7 (i.e., end cap) includes a bisected vent opening in the cross-section, which accounts for the difference between the top and bottom of the depicted cross-section of Fig. 3.



Belykov, Fig. 3 (excerpts, annotated)



Belykov, Fig. 5 (excerpts, annotated)

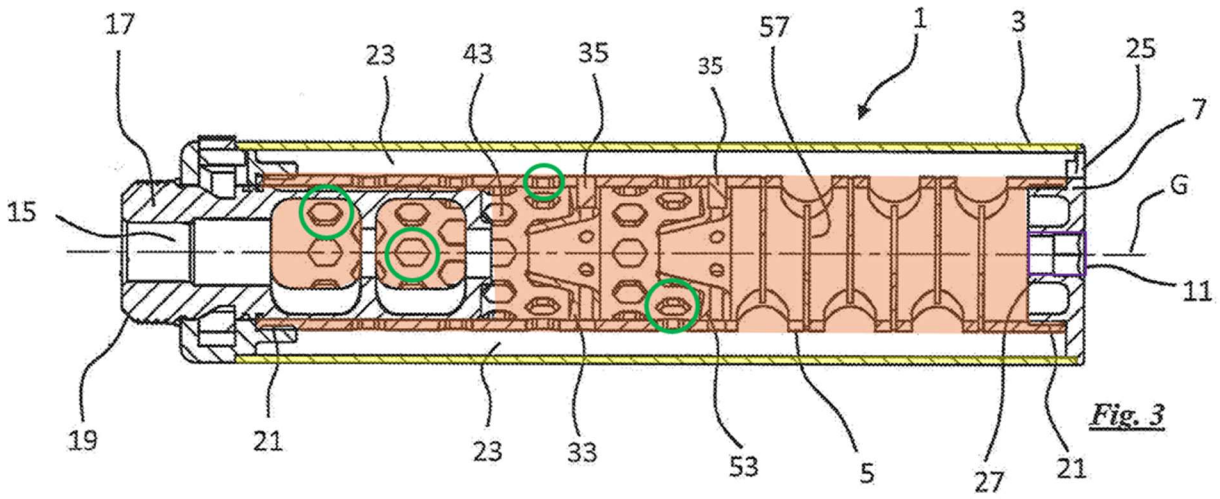
166. Belykov discloses that the outer tube 3 (i.e., housing) is "axially clamped between the front ends 7, 13." Ex. 1003 ¶ 29. As shown in the annotated excerpts of Figs. 3 and 5, and as discussed in reference to claim 5, the end wall 7 (i.e., end cap) includes a radially-extending flange (i.e., ledge), which facilitates clamping of the outer tube 3 (i.e., housing). Ex. 1003 ¶ 29, Figs. 3, 5. As shown in the annotated excerpts of Figs. 3 and 5, the front end wall 7 (i.e., end cap) has an axially-extending surface (blue arrow), which rests against an inner surface (red arrow) of the outer tube 3 (i.e., housing). Ex. 1003 ¶ 29, Figs. 3, 5. The axially-extending surface (i.e., sidewall) (blue arrow) is coupled to the radially-extending flange (i.e., ledge). Ex. 1003 ¶ 29, Figs. 3, 5.

167. Similarly, the ’906 patent discloses that “[a] sidewall 138 *that couples to the ledge 136* may be an annular protrusion that contacts the inner surface 114 of the housing 102.” Ex. 1001 col. 6, ll. 39-42 (emphasis added).

168. The axially-extending surface (blue arrow) of Belykov is coupled to the radially-extending flange (i.e., ledge), and faces radially outward to rest against an inner surface (red arrow) of the outer tube 3 (i.e., housing) within the inner compartment of the outer tube 3 (i.e., housing), such that Belykov’s axially-extending surface (blue arrow) is the claimed sidewall that is positioned in the inner compartment and rests against an inner surface of the housing.

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

169. Belykov discloses this limitation. As discussed, and as shown in annotated Fig. 3, Belykov discloses an inner tube 5 (i.e., core) (highlighted in orange) that comprises a plurality of bypass and exchange openings 43, 61, 67 (i.e., plurality of core apertures). Ex. 1003 Fig. 3.



Belykov, Fig. 3 (annotated)

170. Belykov discloses that "… the special honeycomb *hexagonal shape* of the exchange openings 43 ensures a high number of relatively large opening cross-sections without substantially destabilizing the inner tube 5." Ex. 1003 ¶ 39 (emphasis added). As such, the exchange openings 43 (i.e., plurality of core apertures) (circled in green in annotated Fig. 3, above) that are "the special honeycomb hexagonal shape" are the plurality of core apertures that are substantially hexagonal shaped.

Dependent Claim 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.

171. Belykov discloses this limitation added in dependent claim 10. As discussed, and as shown in annotated Fig. 3 and the annotated excerpt of Fig. 5, below, Belykov discloses a core that comprises openings 43, 61, 67 (i.e., a plurality

of core apertures) (green circles on an exemplary subset of the openings shown below). Ex. 1003 Figs. 3, 5.

172. Belykov also discloses baffles. Specifically, and as shown below in the annotated Fig. 3 and the annotated excerpt of Fig. 5, Belykov discloses a first sound impact wall 33 (i.e., baffle) (highlighted in green), a second sound impact wall 53 (i.e., baffle) (highlighted in purple), and third sound impact walls 57 (i.e., baffle) (highlighted in blue). Ex. 1003 ¶¶ 41, 43, 44; Figs. 3, 5. The sound impact walls are described as "sound-reflecting and or -absorbing element[s]" that each have a "projectile passage opening" that is "coaxial to the projectile entry opening 15 and the projectile exit opening 11." Ex. 1003 abstract, ¶ 46. As shown in the annotated Fig. 3 and the annotated excerpt of Fig. 5, each of the sound impact walls 33, 53, 57 are within the inner tube 5 (i.e., core) (highlighted in orange) at the inner surface of the inner tube 5.

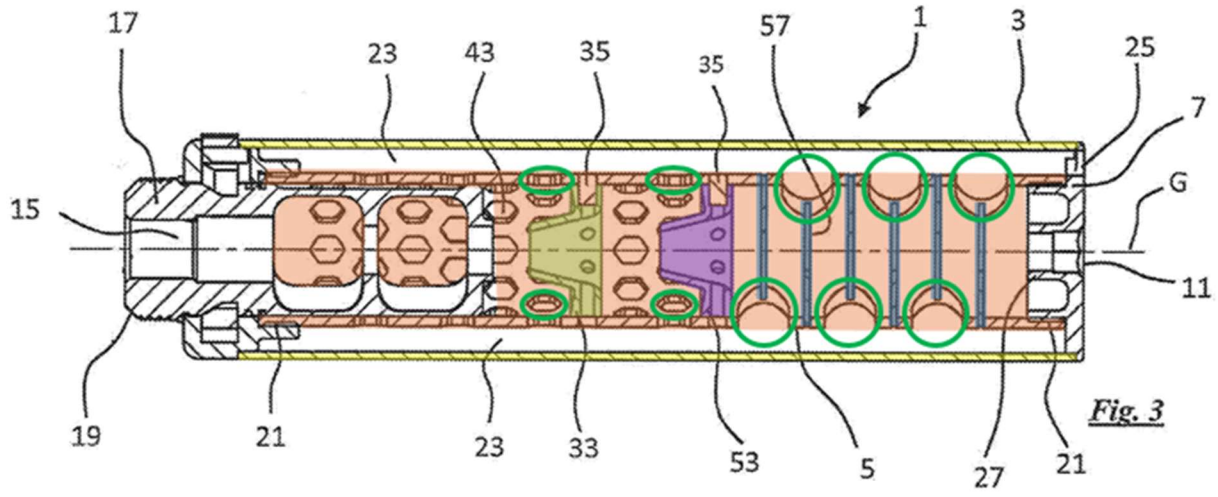
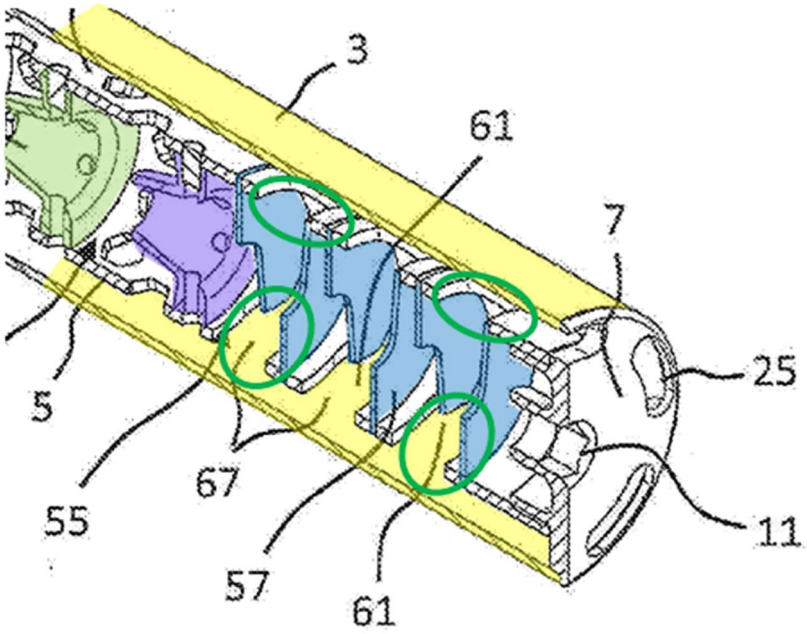


Fig. 3

Belykov, Fig. 3 (annotated)



Belykov, Fig. 5 (excerpt, annotated)

173. The term "baffles" refers to an internal component of a firearm suppression system, which improve the suppression effect of the suppression system by, for example, disrupting and/or slowing down high-pressure gases that follow a

projectile out of a barrel of the firearm suppression system. *See e.g.*, Ex. 1005 ¶ 2 ("Baffles inside the silencer decrease the speed and pressure of propellant gases produced from firing a projectile by trapping gases in chambers formed by the baffles."). Thus, the sound impact walls 33, 53, 57 are baffles in the plain and ordinary meaning of the term, and the inner surface of the inner tube 5 (i.e. core) includes the baffles.

174. Belykov also discloses that the baffles interact with the plurality of core apertures. For example, Belykov discloses that the third sound impact walls 57 (i.e., baffles) (highlighted in blue) interact with the openings 61, 67 (i.e., a plurality of core apertures). Specifically, Belykov explains that:

> [f]rom the slit mounting, the *third sound impact wall 57* extends almost completely to the opposite end and forms there an axial bypass opening 61 which *radially* ends in the projectile passage opening 41. In combination with the axial bypass opening 61, an additional type of exchange opening 67 is formed opposite it in the inner tube 5 which is *radially opposite the bypass opening 61* of the sound impact wall 57, wherein the additional exchange opening is designated as second exchange opening 67. The second exchange opening 67 has a long form *extending in circumferential direction* which ends are rounded off.

> The muzzle gas reaching the channel end chamber 55 which enters over the projectile passage opening 41 from the channel intermediate chamber 51 into the channel end chamber 55 is at least partially *redirected by the third sound impact wall 57 radially to the outside and reaches the second exchange opening 67 in the annular space 23*. This muzzle gas can also reach via the annular space 23 and the respective venting openings 25 the outside of the silencer 1.

Ex. 1003 ¶¶ 47-48 (emphasis added). The third sound impact walls 57 (i.e., baffles) redirect muzzle gas from the channel end chamber 55, which is "margined by the second sound impact wall 53 and in circumferential direction by the inner tube 5," radially outward, through the openings 61, 67 (i.e., a plurality of core apertures), and to the annular space 23 (i.e., channel). Thus, the third sound impact walls 57 (i.e., baffles) interact with the openings 61, 67 (i.e., a plurality of core apertures). Ex. 1003 ¶ 43.

175. Also, the first and second sound impact walls 33, 53 (highlighted in green and purple, respectively) interact with the openings 43 (i.e., a plurality of core apertures). For example, Belykov discloses that:

> [t]he first sound impact plate 33 on the side of the channel expansion chamber is exchangably attached to the inner tube 5

> via a mounting pin 35 and *extends from the inside of the inner tube 3* in a first arm section radially to the inside to which a central section 37 is connected which is *designed as a funnel*. The funnel-formed central section 37 *extends in a tapering manner contrary to the projectile flight direction G* to the front wall 13 and defines coaxially a first passage opening 41.

Ex. 1003 ¶ 34 (emphasis added). Belykov also discloses that "… second sound impact wall 53 which is designed identical to the first sound impact wall 33 in form and mounting." Ex. 1003 ¶ 41.

176. As shown in the annotated Figs. 3 and 5, at least a portion of the muzzle gas would move forward (left-to-right in Fig. 3), impact the first and second sound-impact walls 33 and 53, and then be redirected by those walls toward and through the openings 43 (i.e., the plurality of core apertures). The openings 43 are positioned adjacent to both the first sound-impact wall 33 and the second sound-impact wall 53, allowing diverted gas to pass through them. Because of this redirection of the muzzle gas by the sound impact walls 33, 53, the first and second sound impact walls 33, 53 (highlighted in green and purple, respectively) interact with the openings 43 (i.e., a plurality of core apertures).

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

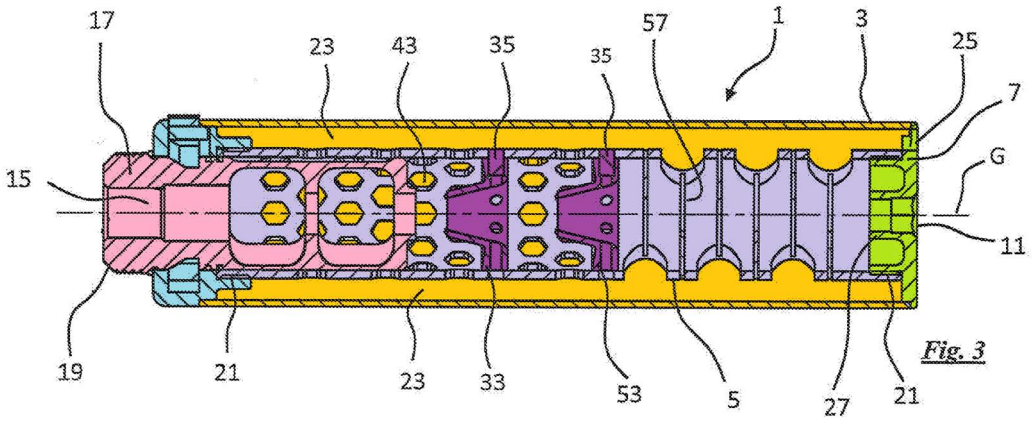
177. Belykov discloses this limitation with the illustrations of the sound impact walls 33, 53, 57 (i.e., baffles). The ’906 patent uses the term in the description as follows: “The core may include an inner surface that comprises baffles that interact with the plurality of core apertures. These baffles may be extruded inward at various prescribed angles.” Ex. 1001 col. 3, ll. 14-17. We can see that the ’906 patent means that the shapes protrude inward at an angle. In computer-aided design (“CAD”), extrusion is a tool for generating or expanding a three dimensional part from a two dimensional pattern by displacing it along a path. For example, Solidworks - probably the most commonly used CAD tool for silencer design - calls this tool “Extrude Boss/Base.” Fusion (formerly known as Fusion 360), simply calls it “Extrude.” Alternatively, in the manufacturing context, “extrusion” may refer to a high-pressure die-based forming process (i.e., not 3D printing).

178. In either of the foregoing instances, “extrusion” refers to the method by which the shape of the component is formed or designed to achieve a resulting shape, and not a manufacturing method for the final product. Given that the ’906 patent discloses three dimensional printing but not a high-pressure die-based manufacturing process, the POSITA would have understood that the baffles being “extruded” inward refers to the baffles “extending” inwardly, such as might be created by using the “extrude” function for the CAD model of the part. The plain

and ordinary meaning of "inwardly" in the firearm suppressor arts could either refer to the direction toward the shooter (e.g., aft towards the firearm muzzle), or radially inward. For example, the '906 patent describes, with respect to the end cap 110, that the "end cap 100 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." Ex. 1001 col. 6, ll. 26-29 (emphasis added). With respect to the baffles, the '906 patent states that "[t]hese baffles 608 may be extruded inward, *toward a muzzle when coupled to a firearm*, at various prescribed angles" thus confirming my understanding of the term "inward" as used in the '906 patent. Ex. 1001 col. 10, ll. 51-53 (emphasis added). Belykov's baffles are extruded both inward toward the shooter and also inward radially.

179. Belykov discloses that at least the third sound impact walls 57 (i.e., baffles) are extruded radially inward. Ex. 1003 Figs. 3, 5. Belykov discloses that at least the first and second sound impact walls 33, 53 (i.e., baffles) are extruded inward toward the shooter and radially inward. Specifically, Belykov discloses that "[t]he first sound impact plate 33 on the side of the channel expansion chamber is exchangably *attached to the inner tube 5* via a mounting pin 35 and extends *from the inside of the inner tube 3* in a first arm section *radially to the inside* to which a central section 37 is connected which is designed *as a funnel*." Ex. 1003 ¶ 34 (emphasis added). Belykov then explains that the "funnel-formed central section 37

extends in a tapering manner *contrary to the projectile flight direction G to the front wall 13* and defines coaxially a first passage opening 41." Ex. 1003 ¶ 34 (emphasis added). Said differently, the funnel extends inwardly towards the front wall 13, the muzzle of the firearm, and the shooter. Referring to annotated Fig. 3 of Belykov below, the funnel shape of the sound impact plates 33, 53 (i.e., baffles) (highlighted in dark purple) extends both radially towards the center axis of the silencer 1 (e.g., firearm suppression system) and rearward (i.e., inwardly) towards the muzzle end of the suppressor.



Belykov, Fig. 3 (annotated)

B. Ground 2: Claims 6 and 7 are rendered obvious by Belykov and Sclafani in view of Noonan

180. For at least the reasons below, claims 6 and 7 of the '906 patent are unpatentable as rendered obvious by Belykov and Sclafani in view of Noonan.

Motivation to Combine Belykov, Sclafani, and Noonan

181. It is my opinion that a POSITA would have been motivated to combine Belykov and Sclafani for the reasons provided with respect to Ground 1. It is further my opinion that a POSITA would have been motivated to combine Belykov, Sclafani, and Noonan, and would have had a reasonable expectation of success. Each are directed to suppressors for firearms that reduce the noise, flash, and other effects of firing the firearm. Ex. 1003 ¶ 6; Ex. 1004 col. 1, ll. 19-30; Ex. 1007 ¶ 2. For example, Belykov, which is in the field of endeavor of firearm suppressors, relates to a silencer 1 (i.e., firearm suppression system) designed to withstand the thermal load of repeated firing while, among other factors, "… maintaining a sufficient sound absorption and spark extinguishing". Ex. 1004 ¶ 4. Noonan, which is in the same field of endeavor of firearm suppressors, discloses a need for further reducing noise levels, flash and/or recoil when firing a firearm. Ex. 1004 col. 1, ll. 19-30. Sclafani, which is in the same field of endeavor of firearm suppressors, discloses that silencers "attenuate the noise level associated with the firing of a round in the rifle" and discloses more cost effective, replaceable core members of such silencers. Ex. 1007 ¶ 2-6.

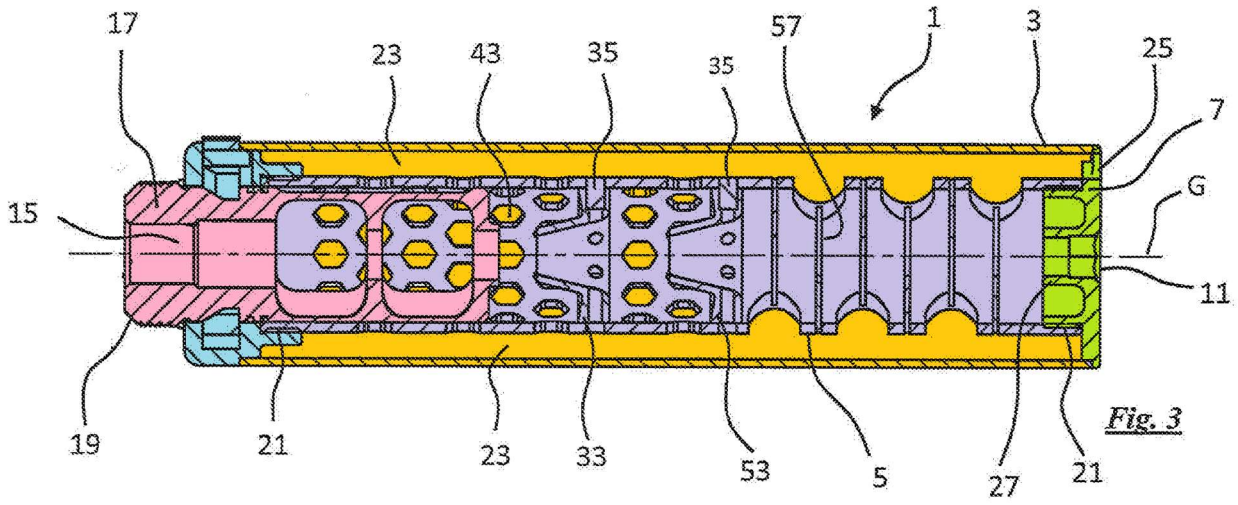
182. Belykov, Sclafani, and Noonan are analogous art because they are from the same field of endeavor and address the same problem—improving firearm

suppressors. Even if one were to argue otherwise, Noonan would still be reasonably pertinent to the problems addressed by Belykov and Sclafani, and vice versa.

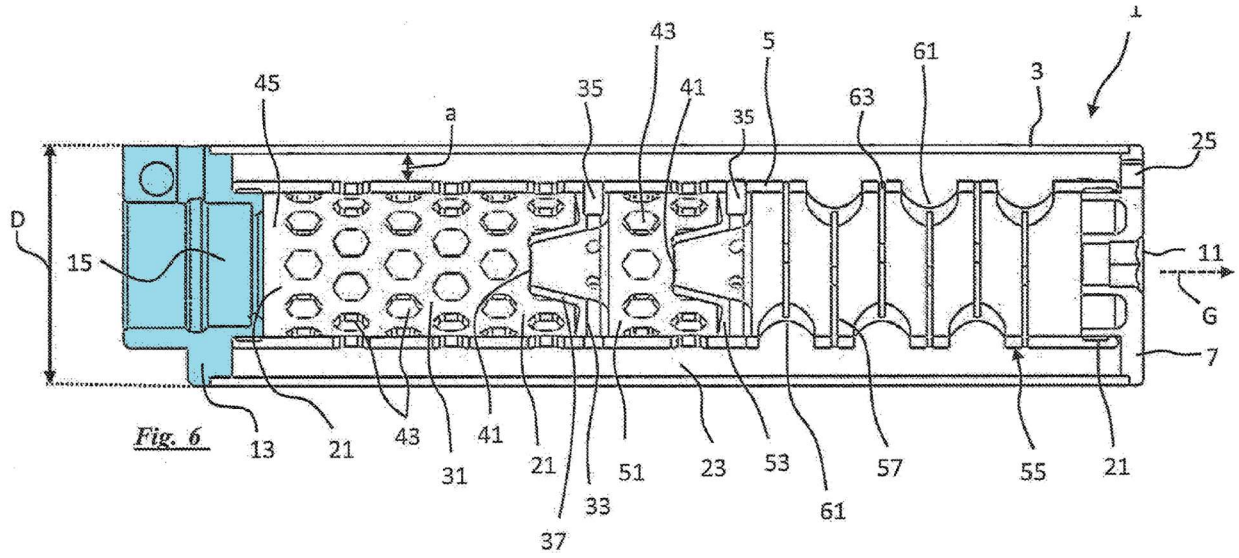
183. Each reference shows similar components and assembly processes with a difference in how the core components and housing components are held by the respective end components. For example, Belykov, with reference to annotated Figs. 3 and 6 below, discloses that the outer tube 3 (i.e., housing) (highlighted in orange) is clamped between two respective side wall ends 7, 13 (highlighted in blue and green). Ex. 1003 Figs. 3, 6. In Fig. 3, the rear wall end 13 is replaced with a similar component (highlighted in blue) that further receives the muzzle brake 17 (highlighted in pink). Ex. 1003 Figs. 3, 6. In Belykov, the inner tube 5 (i.e., core) (highlighted in purple) is shown attached (e.g., screwed) to the respective side wall ends 7, 13. Ex. 1003 ¶ 28-29, Figs. 3, 6, 7. In particular, Belykov states that "the outer tube 3 is, depending on the screwing situation, *axially clamped* between the front ends 7, 13." Ex. 1003 ¶ 29 (emphasis added). Sclafani, referring to annotated Fig. 3 below, includes a core member 30 (i.e., core) (highlighted in purple) that is held within the tubular housing 10 (i.e., housing) by the respectively threaded end caps 11, 15 (i.e., the "second cap member 11" being an end cap). Ex. 1007 ¶¶ 12-15, Fig. 3. Noonan, referring to annotated Fig. 3c below, discloses that "the inner tube 20 is retained inside the outer tube 15 by screwing the front cap 25 in the front end 35 and screwing the rear cap 30 in the rear end 40." Ex. 1004 col. 3, ll. 42-45, Fig.

3c. Said differently, Noonan screws the end components (highlighted in green and blue) to the outer tube 15 (i.e., housing). Thus, according to Noonan, "the inner tube 20 *is sandwiched inside the outer tube 15 between the front cap 25 and the rear cap 30*." Ex. 1004 col. 3, ll. 45-47, Fig. 3c (emphasis added). Sclafani discloses a similar "clamping" arrangement to the "sandwich" structure of Noonan as also described with respect to Ground 1 above.

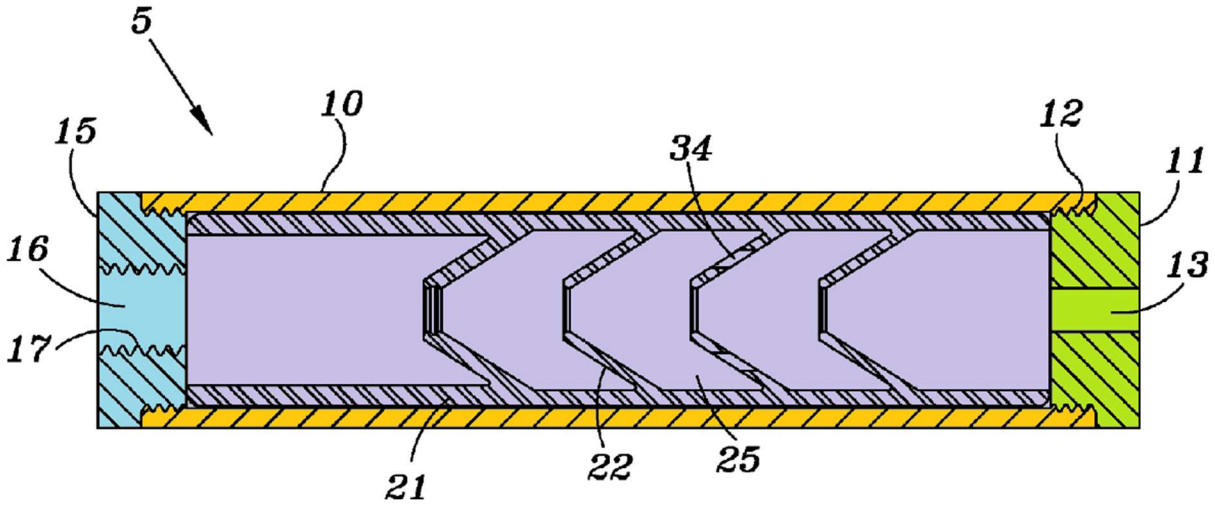
184. Thus, the depicted embodiments of Noonan and Sclafani, on the one hand, and Belykov are threaded inversely to each other, with the outer tube 15 (i.e., housing) of Noonan being threaded to the end caps 25, 30; the tubular housing 10 of Sclafani being threaded to the caps 11, 15; and the inner tube 5 (i.e., core) of Belykov being threaded to the end components 7, 13, which components are otherwise analogous to each other between Noonan and Belykov (including as modified by Sclafani) at least for purposes of assembly and their general function within the respective assemblies. The remaining components that differ between the assemblies (e.g., the sound impact plates/walls 33, 53, 57 of Belykov) would not be affected by the threading of the inner tube 5 (i.e., core).



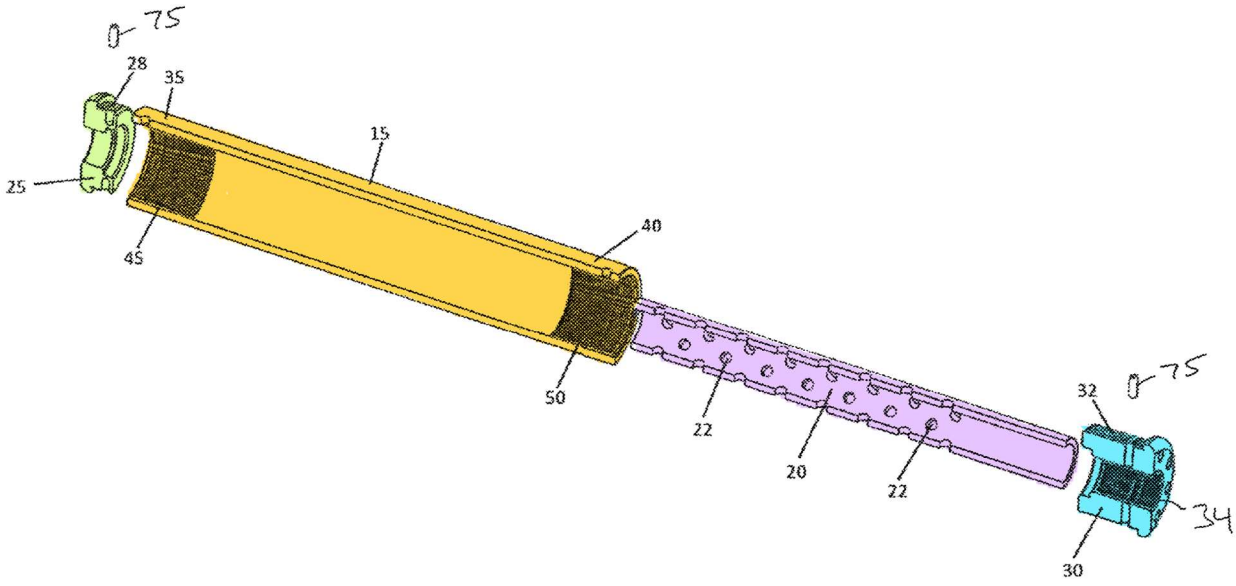
Belykov, Fig. 3 (annotated)



Belykov, Fig. 6 (annotated)



Sclafani, Fig. 3 (annotated)



Noonan, Fig. 3c (annotated)

185. In light of the foregoing teaching, the POSITA would have been motivated to replace the threading positioning of Belykov from between the inner tube 5 (i.e., core) and end walls 7, 13 (i.e., end caps) to instead be between the outer tube 3 (i.e., housing) and the respective end walls 7, 13. In particular, Noonan's

attachment method (as well as Sclafani's) allows the threading to be on the exterior to provide an improved solid seal for the interior compartment of outer tube of the silencer of Belykov to prevent unwanted leakage of gas out of the silencer. The threading configuration of Noonan and Sclafani may also simplify the manufacture of inner tubes 5 (i.e., cores), which may fail faster than the outer tube 3 (i.e., housing) as disclosed by Scalfani, leading to more cost effective replacement parts. The POSITA would have likewise been motivated to extend the sidewall of the end walls 7, 13 of Belykov as needed to accommodate the threads, which would produce a better seal and more solid engagement. Thus, the POSITA would have been motivated to combine Belykov as modified by Sclafani and Noonan to include the silencer of Belykov in which one or both end walls 7, 13 (i.e., end cap) include threading on a sidewall thereof to engage and rest on the inner surface of the outer tube 3 (i.e., housing) of Belykov as disclosed by each of Noonan and Sclafani. In addition to these teachings, the POSITA would further have been motivated to omit the threading arrangement of Belykov in favor of the threading of Sclafani and/or Noonan based on the clamp like securing arrangement shown by Sclafani and Belykov. As such, a silencer designer would consider both options and would be motivated to choose the outer threading shown in Noonan and Sclafani for the silencer of Belykov based on the benefits discussed above.

186. Moreover, the POSITA would have also had a reasonable expectation of success in the combination of Belykov as modified by Sclafani and Noonan because each discloses a silencer usable for the same function and having the same relevant components (e.g., comparable core, housing, and opposing end cap structures) that would have had a reasonable expectation of being operable within each other's assemblies. Indeed, the POSITA would have had a reasonable expectation that modifying Belykov to include one or both end walls 7, 13 (i.e., end cap) having threading on a sidewall thereof to engage and rest on the inner surface of the outer tube 3 (i.e., housing) of Belykov as disclosed by Noonan and Sclafani would strengthen the suppressor of Belykov and improve the operational performance and manufacturability of the silencer of Belykov.

187. A POSITA would have recognized that Noonan, Sclafani, and Belykov disclose similar assembly processes and structures—specifically, alternative implementations of the same, known technique for threading either the housing components (e.g., outer tube 3 of Belykov, outer tube 15 of Noonan, and tubular housing 10 of Sclafani) or the core components (e.g., inner tube 5 of Belykov, inner tube 20 of Noonan, and core member 30 of Sclafani) to the respective end components. Thus, replacing the threading positioning of Belykov (e.g., threading Belykov's outer tube 3 (i.e., housing) to the respective end walls 7, 13) would be obvious as recognized equivalents to each other and would amount to a simple

substitution of one known element to another to obtain predictable results. Indeed, to the extent Belykov is deemed to differ from the Challenged Claims based on a lack of a threaded sidewall that is positioned in the inner compartment and rests against an inner surface of the housing, Noonan and Sclafani both disclose these features and their functions as known substitutes.

188. Moreover, the results of such a modification would be predictable because both Noonan and Sclafani disclose the same structural and functional relationships—threading either the housing or the core to the end components. The modification of Belykov to adopt that threading configuration would therefore represent a simple substitution of known assembly techniques and would not require undue experimentation. Thus, the POSITA would have had a reasonable expectation of success with the combination of Belykov with Noonan's threading disclosure and Sclafani's threading disclosure because the structure and assembly process are predictable and known from Noonan and Sclafani and the structures of Belykov, Sclafani's, and Noonan's devices are otherwise materially similar. Belykov and Noonan are further structurally compatible as both also include a space between the exterior of the core component and the interior of the housing component. Thus, it is my opinion that modifying Belykov's side wall end 7 (i.e., end cap) to comprise a sidewall (in the event it is determined that Belykov does not disclose a sidewall)

would be obvious, and modifying Belykov's side wall end 7 (i.e., end cap) to comprise threads that couple to an inner surface of the housing would be obvious.

189. Both modifications (e.g., applying Noonan and/or Sclafani's teachings to Belykov) would also be obvious because they are applying a known technique to a known device ready for improvement to yield predictable results. MPEP § 2143(I)(D). Specifically, the modification is a known technique, as shown in each of Noonan and Sclafani, being applied to the known device of Belykov. The device of Belykov is ready for improvement to yield predictable results. For example, Belykov contains a "base" device (side wall end 7 (i.e., end cap) and outer tube 3 (i.e., housing)) upon which the claimed invention (the sidewall comprising threads that couple to an inner surface of the housing) is an improvement. Belykov discloses that the side wall end 7 (i.e., end cap) is "screwed with" the inner tube 5 (i.e., core). Ex. 1003 ¶ 28. If an additional threaded connection was incorporated between the side wall end 7 (i.e., end cap) and the outer tube 3 (i.e., housing), incorporating the threads would more securely couple the side wall end 7 (i.e., end cap) with the outer tube 3 (i.e., housing), and the side wall end 7 (i.e., end cap) would be less likely to detach from the other components of the silencer 1 due to the forces experienced by the expanding gases being distributed between the threaded connections between the side wall end 7 (i.e., end cap) and both the inner tube 5 (i.e., core) and the outer tube 3 (i.e., housing).

190. If a threaded connection was incorporated between the side wall end 7 (i.e., end cap) and the outer tube 3 (i.e., housing) in lieu of the threaded connection between the side wall end 7 (i.e., end cap) and the inner tube 5 (i.e., core), the inner tube 5 (i.e., core) would be, if properly toleranced as would be done by a POSITA, allowed to expand due to thermal expansion from the hot gases, which would prevent thermal stress (internal stress developed in a material due to temperature changes when expansion or contraction is restricted) that may lead to cracking, warping, or material fatigue, or thermal fatigue (stress caused by repeated cycles of heating and cooling, especially when constrained) that may lead to microcracks and failure.

191. Further, incorporating threads between the side wall end 7 (i.e., end cap) and the outer tube 3 (i.e., housing) would result in a tighter seal between the side wall end 7 (i.e., end cap) and the outer tube 3 (i.e., housing). Having a tighter seal would prevent gas from escaping the silencer 1 and, therefore, prevent visible leaks that would be undesirable to the end user of the product – and if especially bad, even make the silencer louder.

192. Noonan contains a known technique (threads on the front cap 25 (i.e., end cap)) and Sclafani contains a known technique (threads on the caps 11, 15), each of which is applicable to Belykov's side wall end 7 (i.e., end cap). As discussed, the structure of Belykov and Noonan are nearly identical between devices, and differ in how the core and housing couple with their respective end cap. Belykov already

shows that its side wall end 7 (i.e., end cap) has a sidewall that rests against an inner surface of the housing. As such, applying Noonan's known technique and Sclafani's known technique of using threads to couple the sidewall of the end cap is applicable to Belykov.

193. A POSITA would have recognized that applying the threads of either Noonan's front cap 25 (i.e., end cap) or Sclafani's caps 11, 15 (i.e., end cap) to Belykov's side wall end 7 (i.e., end cap) would have yielded predictable results and resulted in an improved system if the goal was, for better sealing gas from leaking visible to the outside of the silencer. These benefits would have been a predictable result of incorporating threads to couple two adjacent components that were otherwise coupled with only a clamping force.

194. Modifying Belykov's side wall end 7 (i.e., end cap) to comprise a sidewall (in the event it is determined that Belykov does not disclose a sidewall) would be obvious, and modifying Belykov's side wall end 7 (i.e., end cap) to comprise threads that couple to an inner surface of the housing would also have been obvious as a combination of known prior-art elements according to known methods to yield predictable results. *See* MPEP § 2143(I)(A). Specifically, Belykov, as modified by Sclafani, and Noonan included each element claimed, with the only difference between the claimed invention and the prior art being the lack of actual combination of the elements in Belykov. Belykov as modified by Sclafani only lacks

an end cap with a sidewall that comprises threads that couple to the housing. One of ordinary skill in the art, knowing both the clear structure shown by Belykov, Sclafani, and Noonan and knowing that it is common to use threads with end caps, could have combined with Belykov and Sclafani the threads of Noonan's sidewall and the threads of Sclafani's cap sidewall by known methods, and that in combination, each element merely performs the same function as it does separately. For example, the outer tube 15 (i.e., housing) of Noonan is threaded to its front cap 25 (i.e., end cap) to couple the outer tube 15 (i.e., housing) to the front cap 25 (i.e., end cap), and the tubular housing 10 (i.e., housing) of Sclafani is threaded to the caps 11, 15 (i.e., end cap) to couple the tubular housing 10 (i.e., housing) to the caps 11, 15 (i.e., end cap). If threads were incorporated into Belykov, the threads would couple the end wall 7 (i.e., end cap) with the outer tube 3 (i.e., housing), which is the same function as Noonan's threads and Sclafani's threads. One of ordinary skill in the art would have recognized that the results of the combination were predictable.

195. Modifying Belykov's side wall end 7 (i.e., end cap) to comprise a sidewall (in the event it is determined that Belykov does not disclose a sidewall) would be obvious, and modifying Belykov's side wall end 7 (i.e., end cap) to comprise threads that couple to an inner surface of the housing would also be obvious because it is a simple substitution of one known element for another to obtain predictable results. MPEP § 2143(I)(B). Specifically, Belykov contains a

silencer 1 which differed from the claimed device by the substitution of the end cap comprising threads that couple to the core instead of threads that couple to the housing. End caps that comprise a sidewall to rest against an inner surface of the housing, and the sidewall comprising threads that couple to the housing and their functions were known in the art, as evidenced by Noonan and Sclafani and as discussed above. One of ordinary skill in the art could have substituted Belykov's contact interface between the side wall end 7 (i.e., end cap) and the outer tube 3 (i.e., housing) with a threaded interface, and the results of the substitution would have been predictable. For example, the predictable result of the substitution would be that the side wall end 7 (i.e., end cap) would be threadably coupled with the outer tube 3 (i.e., housing).

196. Modifying Belykov's side wall end 7 (i.e., end cap) to comprise a sidewall (in the event it is determined that Belykov does not disclose a sidewall) would be obvious, and modifying Belykov's side wall end 7 (i.e., end cap) to comprise threads that couple to an inner surface of the housing would also be obvious because the modifications are the use of a known technique to improve similar devices in the same way. For example, Belykov contains a "base" device (side wall end 7 (i.e., end cap) and outer tube 3 (i.e., housing)) upon which the claimed invention (the sidewall comprising threads that couple to an inner surface of the housing) is an improvement. Noonan contains a "comparable" device (front

cap 25 (i.e., end cap) and outer tube 15 (i.e., housing) that has been improved in the same way as the claimed invention. Specifically, the front cap 25 (i.e., end cap) of Noonan has outer threads 28 that engage inner screw threads 45 of the outer tube 15 (i.e., housing). Similarly, Sclafani discloses a "comparable" device having caps 11, 15 (i.e., end cap) and a tubular housing 10 (i.e., housing) that has been improved with threading between a sidewall of the caps and the tubular housing. One of ordinary skill in the art could have applied the known "improvement" technique in the same way to the "base" device and the results would have been predictable to one of ordinary skill in the art. For example, each of the outer threads 28 of Noonan and the threads of Sclafani could be applied to Belykov's side wall end 7 (i.e., end cap) in the same way that Noonan's outer threads 28 are applied to Noonan's front cap 25 (i.e., end cap), which would predictably result in Belykov's side wall end 7 (i.e., end cap) being threadably coupled to its outer tube 3 (i.e., housing).

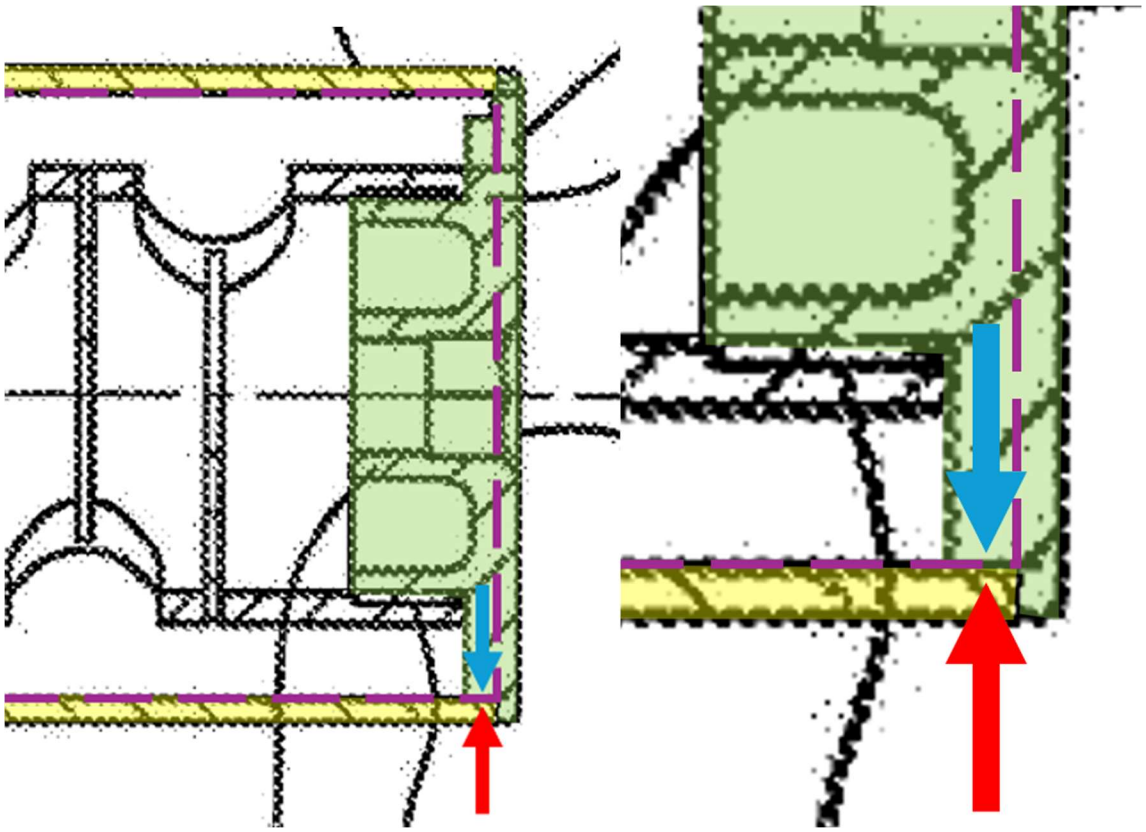
197. Modifying Belykov's side wall end 7 (i.e., end cap) to comprise a sidewall (in the event it is determined that Belykov does not disclose a sidewall) would be obvious, and modifying Belykov's side wall end 7 (i.e., end cap) to comprise threads that couple to an inner surface of the housing would also be obvious because it would be an "obvious to try" combination, selecting from a finite number of identified, predictable solutions with a reasonable expectation of success. MPEP § 2143(I)(E). Specifically, at the relevant time, there had been a recognized

problem or need in the art. For example, cores of suppressors often need to be removed from their housings to be cleaned or replaced due to damage. If the cores were monolithic with or rigidly coupled to their housings, the cores would not be able to be removed for cleaning, which would make cleaning difficult, or replaced when damaged, resulting in the entire suppressor being disposed. There are a finite number of identified, predictable potential solutions to the recognized need or problem of removeable cores. For example, the core could be removably coupled, directly or indirectly, to the housing with threaded connections, pins, screws, bolts, or clamps. One of ordinary skill in the art could have pursued the known potential solutions with a reasonable expectation of success. For example, incorporating threaded connections, pins, screws, bolts, or clamps into a suppressor to removably couple, directly or indirection, a suppressor core to its housing would be reasonably expected to successfully result in the housing being removably coupled to the core such that the core could be removed from the housing, which is evidenced by both Noonan and Sclafani.

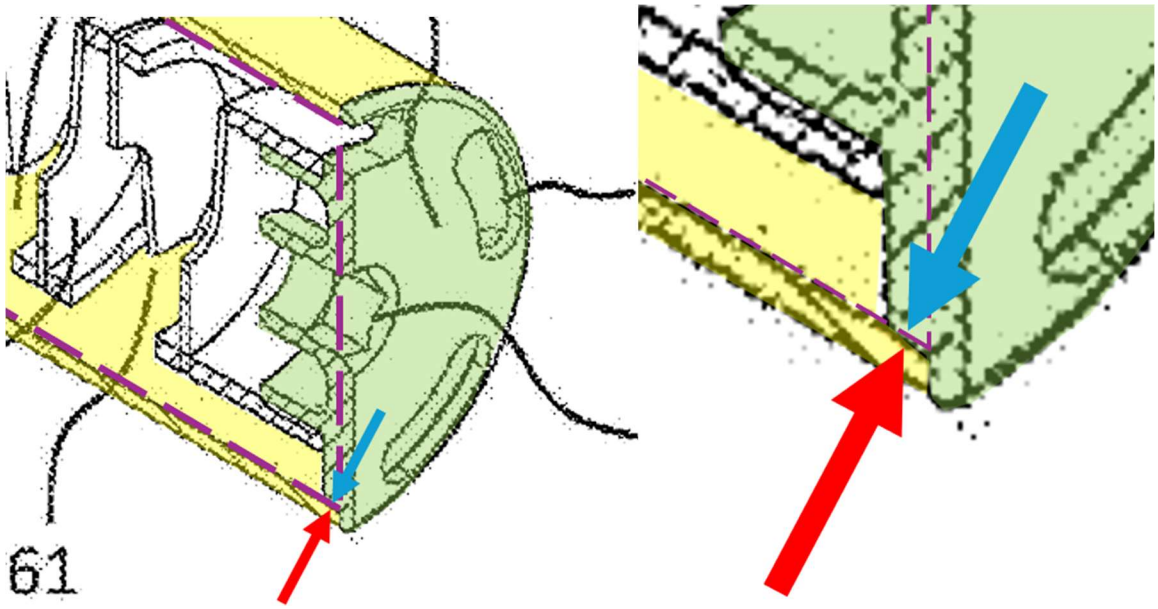
Dependent Claim 6: The firearm suppression system of claim 1, wherein the end cap comprises a sidewall that is positioned in the inner compartment and rests against an inner surface of the housing.

198. Belykov, as modified by Sclafani, and Noonan each disclose the limitations added in dependent claim 6. With reference to the annotated excerpts of

Figs. 3 and 5, below, Belykov discloses an end wall 7 (i.e., end cap) (highlighted in green) and an outer tube 3 (i.e., housing) (highlighted in yellow) that comprises an inner compartment (a portion shown with purple dashed lines) that is substantially the same circumference from the first end to the second end. Ex. 1003 ¶ Figs. 3, 5.



Belykov, Fig. 3 (excerpts, annotated)



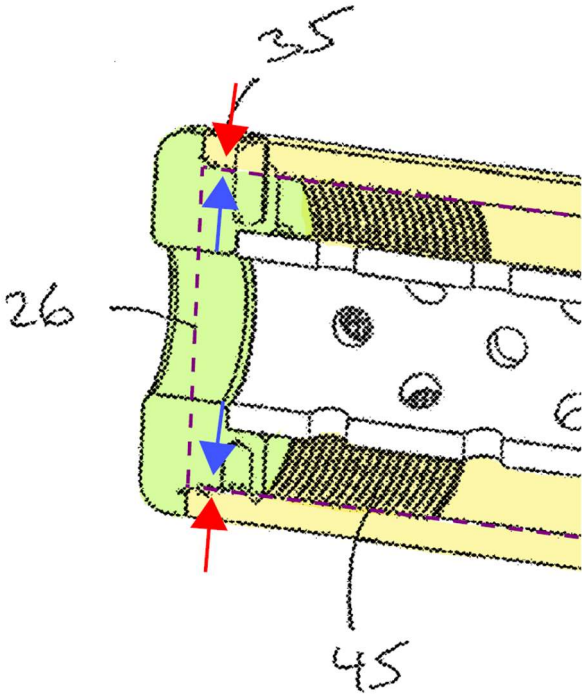
Belykov, Fig. 5 (excerpts, annotated)

199. As shown in the annotated excerpts of Figs. 3 and 5 above, the ***end wall 7*** (i.e., end cap) of Belykov has an axially-extending surface (blue arrow), which rests against an inner surface (red arrow) of the outer tube 3 (i.e., housing). Ex. 1003 ¶ Figs. 3, 5. The axially-extending surface (i.e., sidewall) (blue arrow) extends rearward near the radially-extending flange (i.e., ledge) discussed above with respect to dependent claim 5. Ex. 1003 ¶ Figs. 3, 5.

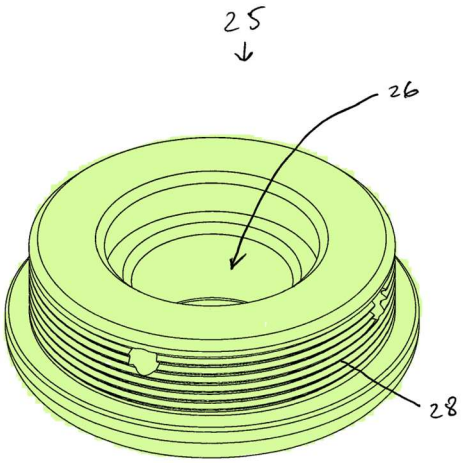
200. For the avoidance of doubt, referring to annotated Figs. 3a and 4a of Noonan below, Noonan also discloses this limitation and it would be obvious to add a further sidewall to the end wall 7 (i.e., end cap) of Belykov at least to facilitate threading between the outer tube 3 (i.e., housing) and the end wall 7 (i.e., end cap). With reference to the annotated excerpt of Fig. 3a, below, Noonan discloses a front cap 25 (i.e., end cap) (highlighted in green) and an outer tube 15 (i.e., housing)

(highlighted in yellow) that comprises an inner compartment (a portion shown with purple dashed lines). Ex. 1004 Figs. 3a, 4a, col. 3, ll. 16-22. As described in Noonan, "The front end 35 may comprise an inner screw threads 45 (shown in cutaway Figs. 3a-c) configured to accommodate and/or engage the outer thread 28 of the front cap 25." Ex. 1004 Figs. 3a, 4a, col. 3, ll. 36-39. Thus, the front end 35 (i.e., end cap) threads onto the inner facing screw threads 45 of the inner surface of the outer tube 15 (i.e., housing) of Noonan.

201. Comparing Fig. 3a and Fig. 4a, the threads 28 of the front end 35 (i.e., end cap) (highlighted in green) are positioned on a sidewall (blue arrows in annotated Fig. 3a) that is positioned in the inner compartment (purple dashed lines) and rests against an inner surface (red arrows in annotated Fig. 3a) of the outer tube 15 (i.e., housing). Therefore, applying the threads and corresponding structure of Noonan to the end wall 7 (i.e., end cap) of Belykov would disclose that the end cap comprises a sidewall that is positioned in the inner compartment and rests against an inner surface of the housing.

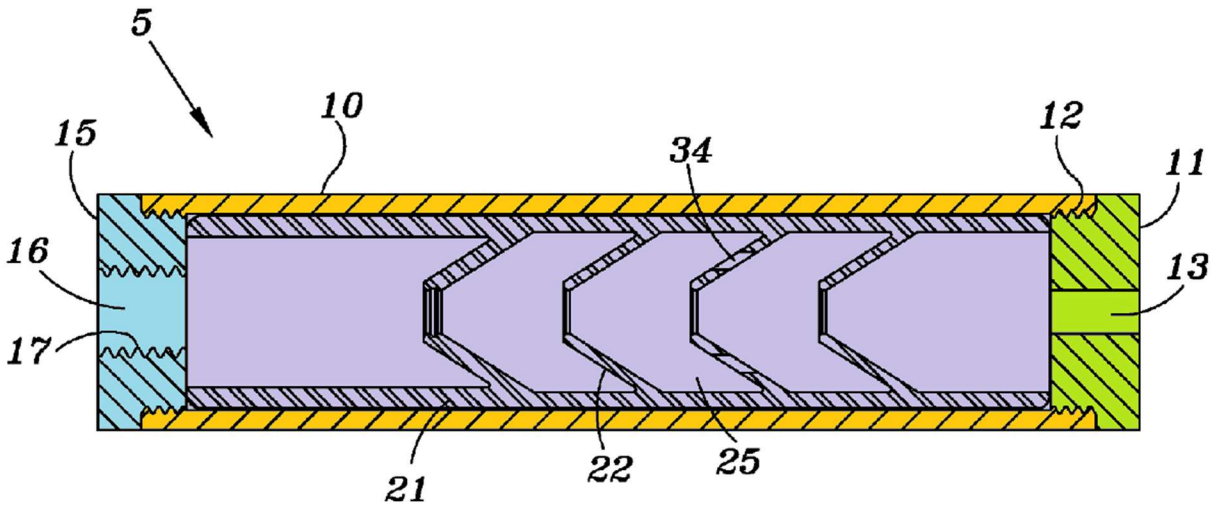


Noonan, Fig. 3a (excerpt, annotated)



Noonan, Fig. 4a (annotated)

202. Similarly, with reference to annotated Fig. 3 of Sclafani below, applying the threads 12 and corresponding structure of Sclafani (e.g., the sidewall of the cap 11 (highlighted in green) on which threads 12 are positioned within the inner compartment of the tubular housing 10 (highlighted in orange)) to the end wall 7 (i.e., end cap) of Belykov would disclose that the end cap comprises a sidewall that is positioned in the inner compartment and rests against an inner surface of the housing. *See* Ex. 1007 ¶¶ 12-13, Fig. 3.

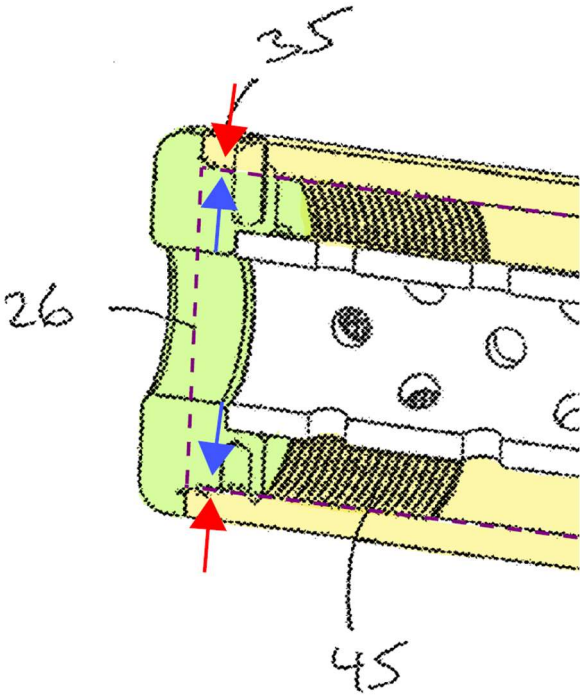


Sclafani, Fig. 3 (annotated)

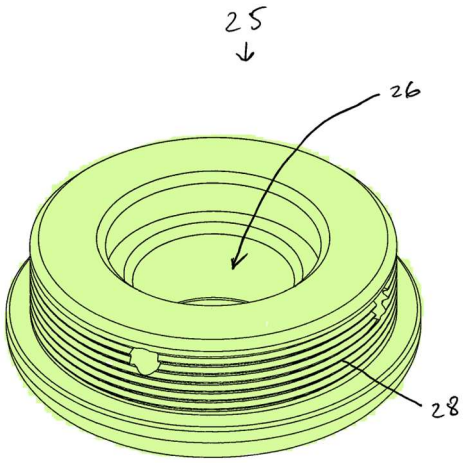
Dependent Claim 7: The firearm suppression system of claim 6, wherein the sidewall comprises threads that couple to the housing.

203. Belykov, as modified by Sclafani, and Noonan disclose the limitations added in dependent claim 7. In particular, with reference to annotated excerpts of Figs. 3a and 4a of Noonan below, as a result of the combination discussed in the foregoing section, Belykov as modified by Noonan includes a front cap 25 (i.e., end cap) (highlighted in green) with a sidewall (blue arrows) that is positioned in the inner compartment (bounded by the purple dashed lines) and rests against an inner surface (red arrows) of the outer tube 15 (i.e., housing) (highlighted in yellow). As depicted in annotated Figs. 3a and 4a, the resulting sidewall (blue arrows) may further include threading 28 for engaging the corresponding threading 45 on the

inner surface of the outer tube 15 (i.e., housing). *See* Ex. 1004 Figs. 3a, 4a, col. 3, ll. 36-39.

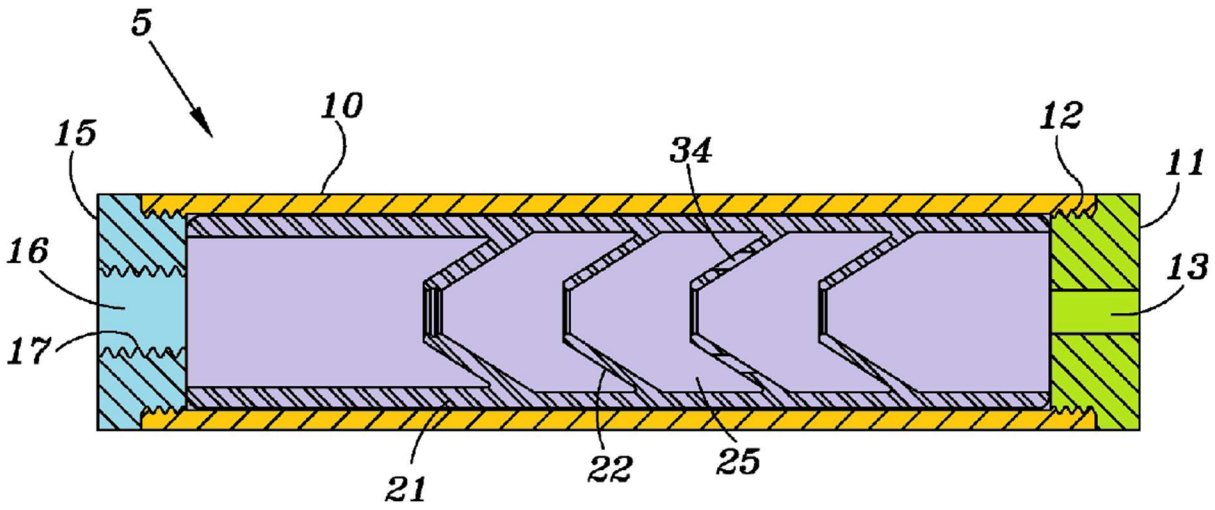


Noonan, Fig. 3a (excerpt, annotated)



Noonan, Fig. 4a (annotated)

204. Similarly, with reference to annotated Fig. 3 of Sclafani below, applying the threads 12 and corresponding structure of Sclafani (e.g., the sidewall of the cap 11 on which threads 12 are positioned) to the end wall 7 (i.e., end cap) of Belykov would disclose that the end cap comprises a threaded sidewall that is positioned in the inner compartment and rests against an inner surface of the housing. Ex. 1007 ¶¶ 12-14, Fig. 3.



Sclafani, Fig. 3 (annotated)

C. Ground 3: Claims 1 and 3-7 are anticipated or rendered obvious by Noonan.

205. For at least the reasons below, claims 1 and 3-7 of the '906 patent are unpatentable as anticipated or rendered obvious by Noonan.

Independent Claim 1

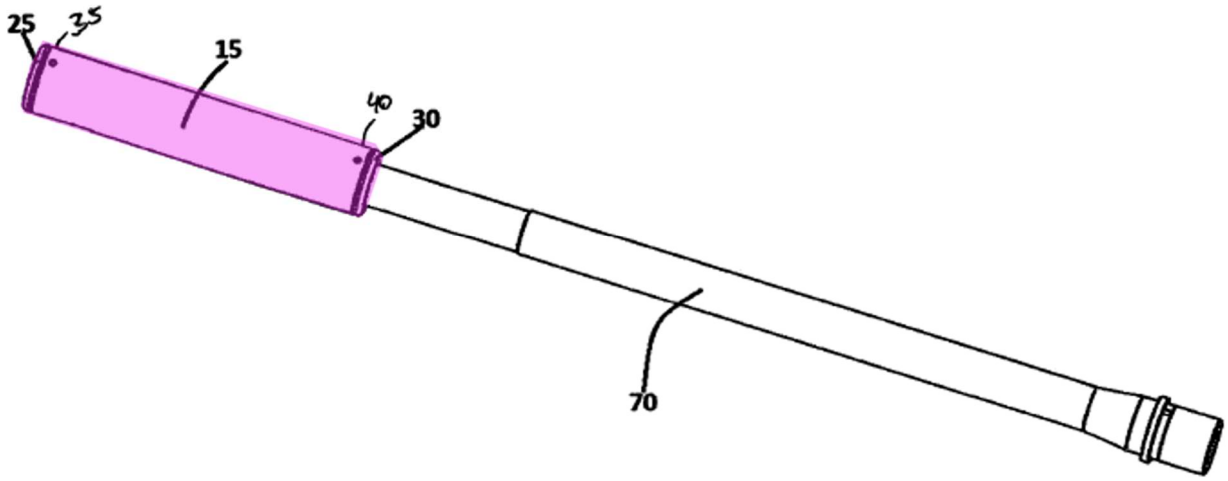
Claim 1, Element [1.pre]: A firearm suppression system comprising:

206. To the extent the [1.PRE] is limiting, Noonan discloses this limitation. Noonan discloses that it "relates to an expansion chamber assembly for a firearm" (i.e., firearm suppression system) and notes various insufficiencies with "firearm silencers known in the art". Ex. 1004 col. 1, ll. 13-15, 19-30. The expansion chamber assembly 10 (i.e., firearm suppression system) is configured to "decelerate and cool at least a portion of the expanding gasses thereby reducing the noise and/or flash created when the bullet is fired from the firearm." Ex. 1004 col. 5, ll. 10-13.

Similarly, the ’906 patent discloses that the invention seeks to provide a firearm suppression system that *reduces noise*. Ex. 1001 col. 4, ll. 51-54 (emphasis added). Thus, a POSITA would have understood that Noonan’s expansion chamber assembly is a firearm suppression system, for example, because the devices of the ’906 patent and Noonan serve the same functions. The Bureau of Alcohol, Tobacco, Firearms and Explosives (“ATF”) Technical Branch defines a “firearm silencer”, via the Gun Control Act under 18 U.S.C. § 921(a)(24), as any device “for silencing, muffling, or diminishing the report of a portable firearm,” including “any combination of parts” designed or intended for such use. Noonan’s patent expressly describes the assembly as “for a firearm,” identifies the problem of “firing a bullet from a firearm creates a loud noise,” and states that prior silencers attempt “to decrease the noise level created by the firearm when firing a bullet.” Ex. 1004 col. 1, ll. 13-15, 19-22. A POSITA would have recognized that an “expansion chamber assembly” performing that noise-reducing function falls squarely within U.S. government definition of a firearm silencer, and thus would be regulated as such by the Firearms Technology Industry Services Branch (FTISB).

207. Moreover, Noonan’s Figs. 1a-3c show an expansion chamber assembly 10 (i.e., firearm suppression system) (highlighted in pink). Ex. 1004 col. 1, ll. 34-45. Annotated Fig. 2, provided below, shows an expansion chamber assembly 10 (i.e., firearm suppression system) “coupled with a barrel of a firearm” in the same location

(i.e., at the muzzle end of the barrel) and for the same purpose as the firearm suppression system of the ’906 patent. *See* Ex. 1004 Fig. 2, col. 1, ll. 38-39. Therefore, Noonan discloses a firearm suppression system.



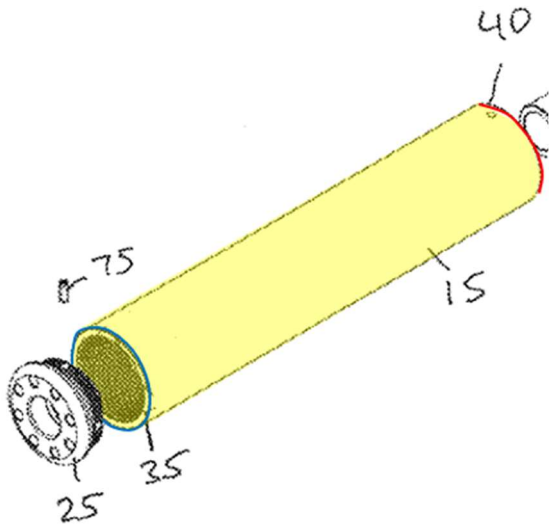
Noonan, Fig. 2 (annotated)

Claim 1, Element [1.1]: a housing comprising a first end and a second end,

208. Noonan discloses this limitation. Noonan discloses that “the expansion chamber assembly 10 comprises an outer tube 15.” Ex. 1004 col. 2, ll. 58-60. The outer tube is described as a *hollow cylinder*, which *accommodates an inner tube 20* and comprises a front end 35 and a rear end 40. Ex. 1004 col. 3, ll. 12-15, 35-36 (emphasis added). Similarly, the ’906 patent discloses that “[t]he housing 102 may be *cylindrical-shaped*” and that “[t]he core 112 may be removably attachable to the housing 102 and *positioned within the inner compartment 122 of the housing 102*.”

Ex. 1001 col. 5, ll. 27-28; col. 6, ll. 53-55 (emphasis added). Thus, Noonan's outer tube 15 is a housing.

209. Noonan's annotated excerpt of Fig. 1b shows an outer tube 15 (i.e., housing) (highlighted in yellow) comprising a rear end 40 (i.e., first end) (red arc) and a front end 35 (i.e., second end) (blue arc). Ex. 1004 Fig. 1b.



Noonan, Fig. 1b (excerpt, annotated)

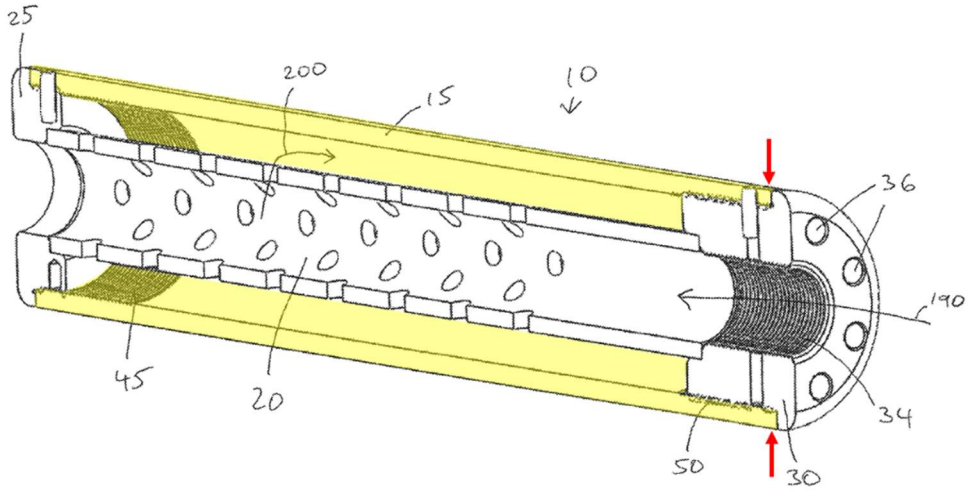
210. As such, Noonan's outer tube 15 is a housing due to Noonan's outer tube 15 having a corresponding structure and function as the claimed housing.

Claim 1, Element [1.1a]: the housing comprising: a first aperture at the first end, a second aperture at the second end;

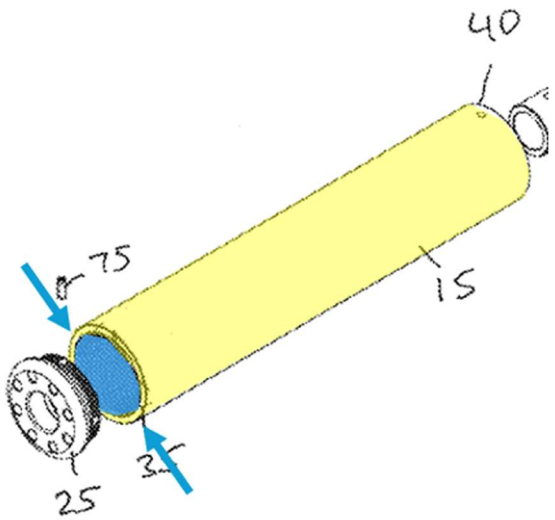
211. Noonan discloses this limitation. Noonan discloses that the front end 35 (i.e., second end) of the outer tube 15 (i.e., housing) *accommodates* a front cap 25 and the rear end 40 (i.e., first end) of the outer tube *accommodates* a rear cap 30. Ex. 1004 col. 3, ll. 34-42. To accommodate a front cap 25 and a rear cap 30, the

outer tube 15 (i.e., housing) has corresponding apertures at the front end 35 (i.e., second end) and the rear end 40 (i.e., first end).

212. Noonan also refers to the outer tube 15 as a "tube" that is a hollow cylinder. Ex. 1004 col. 3, ll. 14. Noonan's annotated Fig. 3b shows a first aperture at the rear end 40 (i.e., first end) (red arrows). Ex. 1004 Fig. 3b. Noonan's annotated Fig. 1b shows a second aperture (highlighted in blue) at the front end 35 (i.e., second end) (blue arrows). Ex. 1004 Fig. 1b.



Noonan, Fig. 3b (annotated)



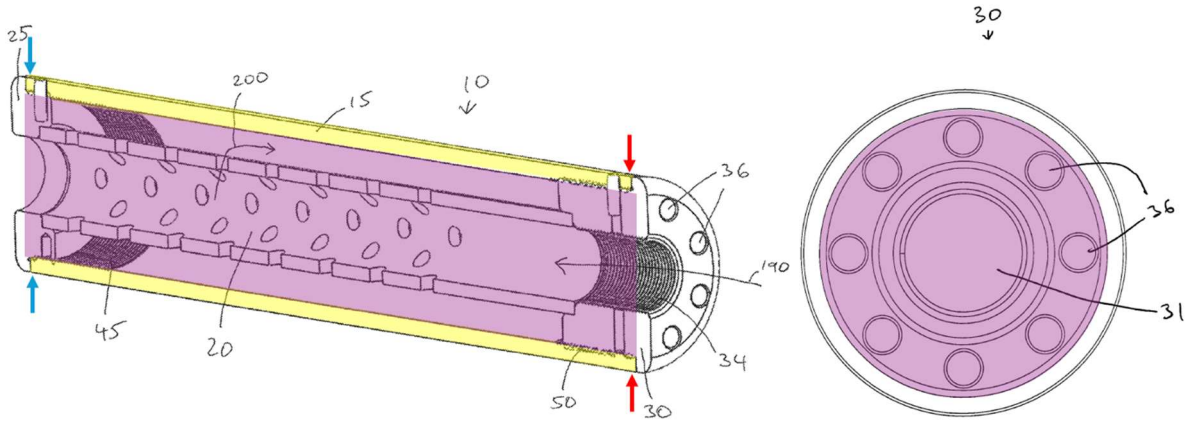
Noonan, Fig. 1b (excerpt, annotated)

213. Thus Noonan discloses a housing comprising a first aperture at the first end and a second aperture at the second end.

> ***Claim 1, Element [1.1b]: [the housing comprising:] 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;***

214. Noonan discloses this limitation. Noonan discloses that the outer tube is a "hollow cylinder" that has "a diameter". Ex. 1004 col. 3, ll. 12-15. Noonan's annotated Fig. 3b, provided below, shows an inner compartment (highlighted in purple) interposed between the first aperture (red arrows) and the second aperture (blue arrows), the inner compartment being substantially the same circumference from the rear end 40 (i.e., first end) to the front end 35 (i.e., second end). Ex. 1004 Fig. 3b. A "tube" that is described as a hollow *cylinder* having *a diameter* along with the corresponding drawings below discloses a tube with an inner compartment that

has a circumference that is the same along its length. For the avoidance of doubt, I measured the original Fig. 9 from the published Noonan patent with a caliper and confirmed that the inner compartment also depicted in Fig. 3b (highlighted in purple in the annotated Fig. 3b) has a rectangular cross section. I also measured the rear cap 30 of original Fig. 5b of the published Noonan patent (area measured is highlighted in purple in the annotated Fig. 5) with a caliper and confirmed that the rear cap 30 is circular. Collectively, this confirms Noonan's description of the outer tube 15 (i.e., housing) being a "hollow cylinder".



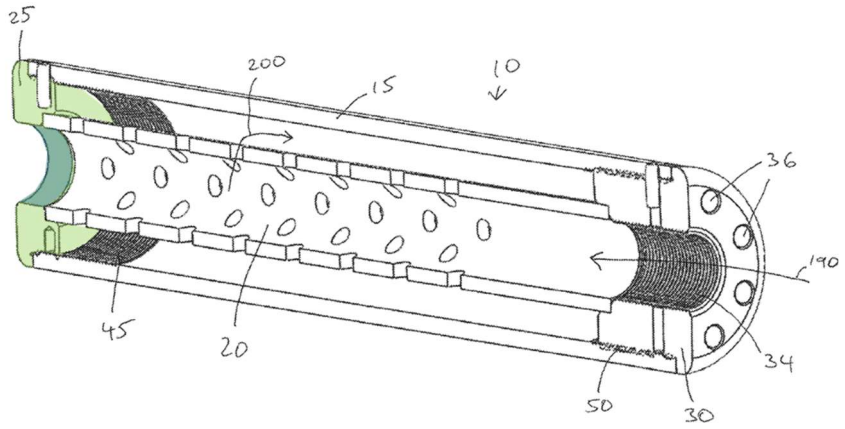
Noonan, Fig. 3b (annotated) **Noonan, Fig. 5b (annotated)**

215. As such, the outer tube 15 (i.e., housing) of Noonan has a hollow cylinder shape and, therefore, the outer tube 15 (i.e., housing) would have an inner compartment that is substantially the same circumference from the first end to the second.

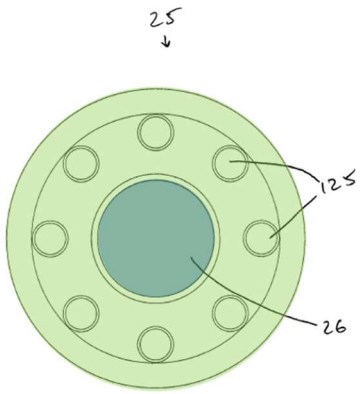
Claim 1, Element [1.2]: an end cap with a projectile aperture; and

216. Noonan discloses this limitation. Noonan discloses that the ***outer tube 15*** (i.e., housing) has inner screw threads 45 at the ***front end 35*** (i.e., second end) that are configured to accommodate and/or engage *outer threads 28* of a front cap 25. Ex. 1004 col. 3, ll. 34-39. Noonan also discloses "… the front cap 25 comprises a through aperture 26" and "… a bullet, fired from a firearm, travels through the firearm's barrel 70, through the aperture 31, through the inner tube 20, and *through the aperture 26 of the expansion chamber assembly 10*." Ex. 1004 col. 3, ll. 29-31; col. 4, ll. 6-13 (emphasis added). Further, Noonan's annotated Figs. 3b and 4b, provided below, show a front cap 25 (i.e., end cap) (highlighted in green) with a through aperture 26 (i.e., projectile aperture) (highlighted in blue). Ex. 1004 Figs 3b, 4b. Thus, Noonan has an end cap with a projectile aperture.

217. Similarly, the '906 patent discloses that the "… end cap 110 may include *threaded fasteners 124* so as to be threadably coupleable to housing 102 . . . ". Ex. 1001 col. 5, ll. 66-col. 6, ll. 9 (emphasis added). The '906 patent also discloses that the end cap has a projectile aperture where the bullet leaves the firearm and system. Ex. 1001 col. 2, ll. 2-4.



Noonan, Fig. 3b (annotated)



Noonan, Fig. 4b (annotated)

218. Accordingly, the front cap 25 of Noonan is an end cap, and the through aperture 26 is a projectile aperture, because the structure and function of the front cap 25 and through aperture 26 correspond in structure and function to those of the end cap 110 and projectile aperture of the '906 patent.

Claim 1, Element [1.3]: a core removably attachable to the housing and positioned therein,

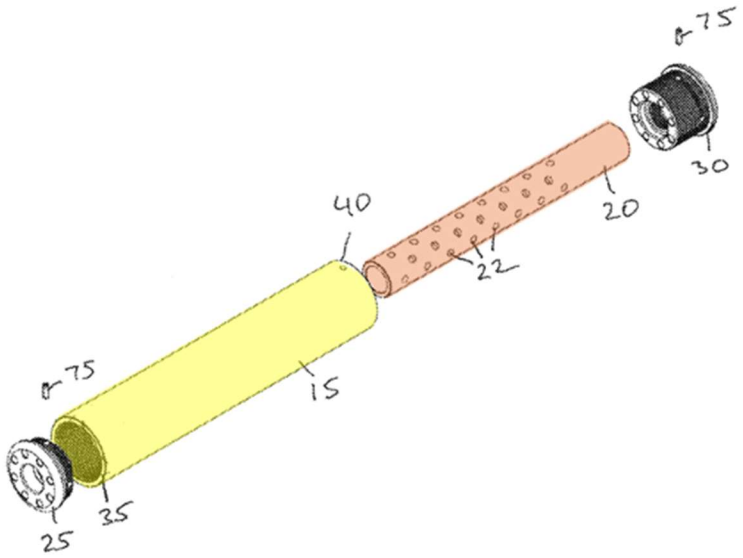
219. Noonan discloses this limitation. First, Noonan discloses a core positioned within the housing. Specifically, Noonan discloses that a bullet, fired

from the firearm travels through an inner tube 20 that is retained inside the outer tube 15 (i.e., housing). Ex. 1004 col. 3, ll. 16-17; col. 4, l. 8. Similarly, the '906 patent discloses that "[t]he core 310 may be . . . positioned *within* the inner compartment 316 of the housing 302." It also disclosed that the core has a projectile passage 154 that is at the center of the core and extends from one end to the other. Ex. 1001 col. 7, ll. 64-57; col. 9, ll. 23-30 (emphasis added). As such, Noonan discloses a core and the function and positioning of Noonan's inner tube 20 (i.e., core) corresponds to the function and positioning of the '906 patent's core 310. Accordingly, Noonan's inner tube 20 is a core.

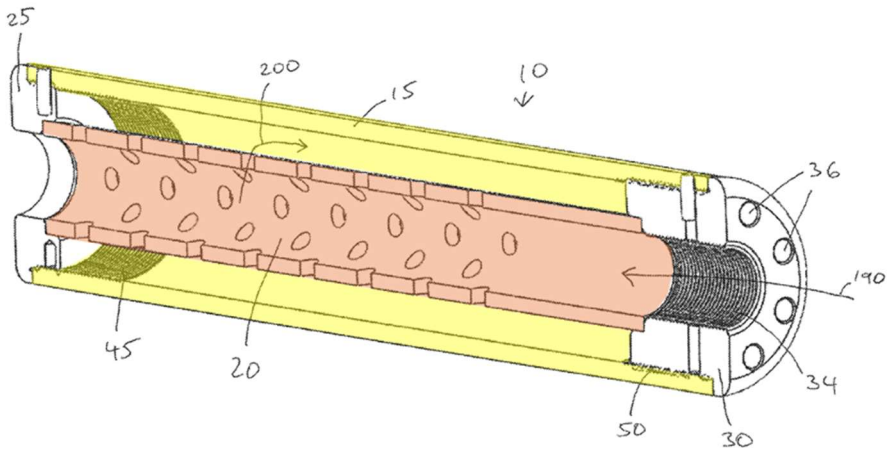
220. Second, Noonan discloses that the inner tube 20 (i.e., core) is removably attachable to the outer tube 15 (i.e., housing). Specifically, in addition to the threaded front cap 25 (i.e., end cap) discussed above, Noonan discloses that the rear end 40 (i.e., first end) of the outer tube 15 (i.e., housing) may have inner screw threads 50 configured to accommodate and/or engage outer threads 32 of a rear cap 30. Ex. 1004 col. 3, ll. 39-42. The inner tube 20 (i.e., core) is retained inside the outer tube 15 (i.e., housing) by screwing the front cap 25 (i.e., end cap) in the front end 35 (i.e., second end) and screwing the rear cap 30 in the rear end 40 (i.e., first end). Ex. 1004 col. 3, ll. 42-45. The inner tube 20 (i.e., core) is sandwiched inside the outer tube 15 (i.e., housing) between the front cap 25 (i.e., end cap) and the rear cap 30. Ex. 1004 col. 3, ll. 45-47. Thus, the inner tube 20 (i.e., core) is held between the

front cap 25 (i.e., end cap) and the rear cap 30, which are engaged with inner surfaces of the outer tube 15 (i.e., housing). Noonan then confirms that "[a]ccording to some embodiments, the front cap 25 and/or the rear cap 30 are removably coupled with the outer tube 15." Ex. 1004 col. 3, ll. 20-22. Thus, the inner tube 20 (i.e., core) is removably attachable to the outer tube 15 (i.e., housing).

221. Noonan's annotated Fig. 1b shows a core 20 (highlighted in orange) removably attachable to the housing 15 (highlighted in yellow) and Noonan's annotated Fig. 3b shows the core 20 positioned entirely within the housing 15. Ex. 1004 Figs. 1b, 3b.



Noonan, Fig. 1b (annotated)



Noonan, Fig. 3b (annotated)

222. Similarly, the ’906 patent describes each of its embodiments as having a core that is “removably attachable” to the housing and “positioned within the inner compartment 122 of the housing 102.” Ex. 1001 col. 6, ll. 53-55; *see also* col. 8, ll. 48-50 (“The core 210 may be removably attachable to the housing 202 and positioned within the inner compartment 220 of the housing 202”), *and see* col. 9, ll. 23-25 (“The core 310 may be removably attachable to the housing 302 and positioned within the inner compartment 316 of the housing 302.”).

223. In the embodiment of Figs. 1-4, the device of the ’906 patent includes a threaded fastener 124 connecting the core 112 to the housing 102 at the first end 104 and includes a sidewall 138 that “may be threaded” to the inner surface 114 of the housing 102. Ex. 1001 col. 6, ll. 39-42, Fig. 2. In the embodiment of Figs. 9-10 of the ’906 patent, the core 310 is “removably attachable” to the housing 302 through a combination of structural features and a rear cap 308 rather than a direct threaded

interface between the core 310 and the housing 302. Ex. 1001 col. 9, ll. 23-43. Specifically, and as depicted in Figs. 9 and 10, the housing 302 would be sandwiched between a flange-like structure of the core 310 and the rear cap 308, which the specification describes as the "… core 310 may be threadably coupled to the housing 302 via the rear cap 308.", and the rear cap 308 is threadably coupled to the core 310. Ex. 1001 col. 9, ll. 18-26, Figs. 9, 10. At the opposite end, "…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." Ex. 1001 col. 9, ll. 26-30.

224. Based on this context from the '906 patent, when a first component is described as being "threadably coupled" to a second component, which includes attachments "via" a third component, the term "coupled" encompasses both direct coupling and indirect coupling through one or more intermediate components. This is consistent with the ordinary usage of "coupled" in mechanical firearm arts as understood by a person of ordinary skill.

225. Two components that are "screwed" to each other, as disclosed in Noonan, are removably attached unless permanent methods of attachment are present. The Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) provides examples of permanent methods of attachment in reference to a muzzle device that is permanently attached to a barrel of a firearm. These permanent methods of

attachment include "… full-fusion gas or electric steel-seam welding, high-temperature (1100°F) silver soldering, or blind pinning with the pin head welded over." Ex. 1010 p. 17. While the ATF definition refers to attachment between a firearm barrel and a muzzle device (e.g., suppressor) and the present analysis relates to a core being removably attachable to the housing, the ATF definition both confirms my understanding and evidences what a POSITA would have understood "removable" to mean in the suppressor arts. The larger threaded attachments of Noonan between the caps 25, 30 and the outer tube 15 (i.e., housing) do not meet the ATF definition of permanently attached. Moreover, Noonan discloses that "[a]ccording to some embodiments, the front cap 25 and/or the rear cap 30 are coupled with the outer tube 15 by one or more fasteners 75 … the fasteners 75 are a pin, a screw, a set screw, a full dog point set screw, or a dogleg set screw." This indicates that Noonan contemplates removable means of further fastening the caps 25, 30 to the outer tube 15 (e.g., via set screws). *See* Ex. 1004 col. 3, ll. 24-28. As such, the components of Noonan that are "screwed" to each other are removably attached.

226. To emphasize, while the claims of the '906 patent are not so limited, the '906 patent specification's disclosure of removably attaching (e.g., threadably coupling) the core 310 to the housing 302 *via* the rear cap *at the first end* corresponds to Noonan's disclosure of attaching the inner tube 20 (i.e., core) to the outer tube 15

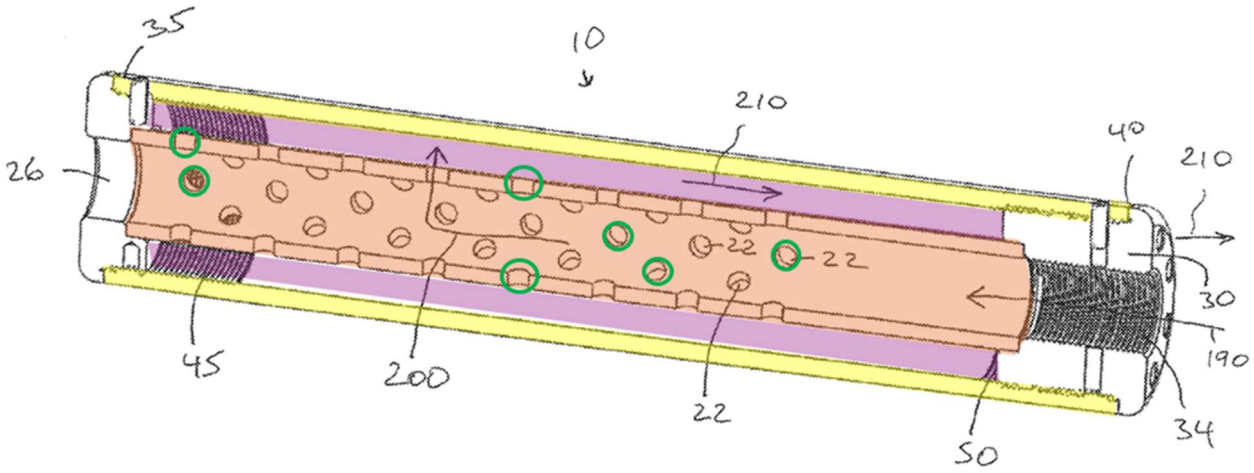
(i.e., housing) via screwing the inner tube 20 (i.e., core) to the rear cap 30 at the rear end 40 (i.e., first end), such that both use the same underlying attachment and both are thus removably attached under the terminology used by the '906 patent. As such, Noonan's inner tube 20 (i.e., core) is removably attachable to the outer tube 15 (i.e., housing) and positioned therein.

Claim 1, Element [1.4]: 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,

227. Noonan discloses this limitation. Noonan discloses that the inner tube 20 (i.e., core) comprises one or more through apertures 22 to allow a portion of the expanding gasses to enter the outer tube 15 (i.e., housing), as shown by the arrow 200 in Fig. 3a. Ex. 1004 col. 4, ll. 17-20; Fig. 3a. The expanding gases located between the outer tube 15 (i.e., housing) and the inner tube 20 (i.e., core) exit the expansion chamber assembly 10 through one or more exit through apertures 36 in the rear cap 30 as shown by arrow 210 in Fig. 3a or through one or more exit apertures (not shown in the figures) in the front cap 25 (i.e., end cap). Ex. 1004 col. 4, ll. 27-35, Fig. 3a.

228. Noonan's annotated Fig. 3a, provided below, shows the inner tube 20 (i.e., core) (highlighted in orange) comprising apertures 22 (i.e., a plurality of core apertures) (examples shown with green circles) on an outer surface that allow gas passing from a projectile and cartridge to pass to a space (i.e., channel) (highlighted

in purple) between the inner surface of the outer tube 15 (i.e., housing) (highlighted in yellow) and an outer surface of the inner tube 20 (i.e., core). Ex. 1004 Fig. 3a, col. 4, ll. 23-37. Thus, Noonan's inner tube 20 (i.e., core) has a plurality of core apertures 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.



Noonan, Fig. 3a (annotated)

229. Similarly, the '906 patent discloses a plurality of core apertures 144 that allow gas passing from the projectile and operating system to pass to a channel 142 that is between the core 112 and the housing 104, and out through vent apertures 126 that are on the end cap 110. Ex. 1001 col. 6, ll. 17-20, col. 7, ll. 22-25. Due to the apertures 22 and the area between the outer tube 15 (i.e., housing) and inner tube 20 (i.e., core) of Noonan having a corresponding structure and function as the plurality of core apertures 144 and channel 142 of the '906 patent, the apertures 22 of Noonan

are a plurality of core apertures on an outer surface of the core and the area between Noonan's outer tube 15 (i.e., housing) and inner tube 20 (i.e., core) is a channel.

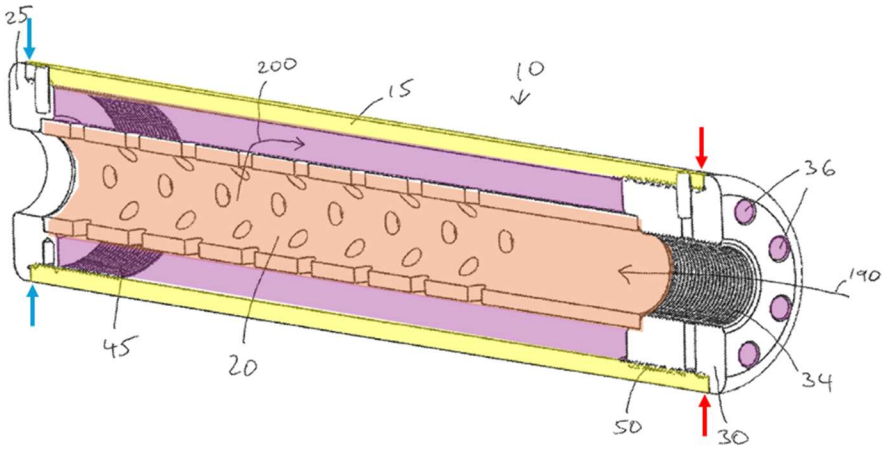
230. While the gas itself (and thus the source) does not appear to be positively recited in the claim, a POSITA would have recognized that the "expanding gasses" referred to in Noonan are the claimed "gas passing from a projectile and cartridge". For example, Noonan states that the "expanding gasses" are formed by the firing of a bullet. Ex. 1004 col. 4, ll. 9-13. As such, the "gas passing from a projectile and cartridge" refers to expanding gas as disclosed by Noonan passing from a bullet and its cartridge.

231. As such, Noonan discloses an inner tube 20 (i.e., core) that comprises apertures 22 (i.e., 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.

Claim 1, Element [1.5]: 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.

232. Noonan discloses this limitation. Specifically, Noonan discloses that the outer tube 15 (i.e., housing) and the inner tube 20 (i.e., core) are hollow cylinders and that the outer tube 15 (i.e., housing) has a diameter sufficient to accommodate the inner tube 20 (i.e., core). Ex. 1004 col. 3, ll. 7-12. Further, as depicted in annotated Fig. 3b, provided below, Noonan shows that the channel (highlighted in

purple) circumscribes the outer surface of the inner tube 20 (i.e., core). Ex. 1004 Fig. 3b. The depicted outer tube 15 (i.e., housing) accommodates the inner tube 20 (i.e., core) and the inner tube 20 (i.e., core) concentrically in the center of the outer tube 15 (i.e., housing), as further confirmed by the circumferential arrangement of the depicted through apertures 36, such that the channel that is defined between the outer tube 15 (i.e., housing) and the inner tube 20 (i.e., core) circumscribes the outer surface of the inner tube 20 (i.e., core). Ex. 1004 Fig. 3b.



Noonan, Fig. 3b (annotated)

233. Noonan also discloses that the channel equalizes pressure that begins at the first end of the housing and terminates at the second end of the housing. In particular, Noonan discloses that expanding gases (i.e., gas passing from a projectile and cartridge) entering the channel may escape through the front cap 25 (i.e., end cap) at exit apertures of the front cap 25 (i.e., end cap), which is past the second end of the outer tube 15 (i.e., housing). Ex. 1004 col. 4, ll. 31-35. These expanding gases

originate in the firearm, which is proximal (i.e., upstream) of the outer tube 15 (i.e., housing), and enter the housing via the rear cap 30. For example, Noonan states that "… expanding gasses formed by the firing of the bullet also travel through the firearm's barrel 70 and into the expansion chamber assembly 10 as shown by arrow 190 in FIGS. 3a -b." Ex. 1004 col. 4, ll. 9-13. Thus, the channel between the outer tube 15 (i.e., housing) and the inner tube 20 (i.e., core) of Noonan equalizes pressure that begins at the first end of the housing and terminates at the second end of the housing, because the vent path allows continuous fluid communication between the high-pressure region near the barrel interface and the low-pressure region at the exit.

234. It is also my opinion that the quantity and locations of the apertures 22 (i.e., a plurality of core apertures) described above and the flow paths from those apertures 22 through the channel between the outer tube 15 (i.e., housing) and the inner tube 20 (i.e., core) of Noonan evidence that Noonan would equalize pressure that begins at the first end of the outer tube and terminate at the second end of the outer tube.

235. For example, Noonan discloses that the expansion chamber assembly 10 (i.e., firearm suppression system) is configured to decelerate and cool at least a portion of the expanding gases, thereby reducing the noise created when the bullet is fired from the firearm. Ex. 1004 col. 5, ll. 9-13. The structure that facilitates the exit, and thus equalization, of these expanding gases is at least the space between the

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inner tube 20 and outer tube 15 and the corresponding apertures at the front and/or rear. *See* Ex. 1004 col. 4, ll. 23-37. Specifically, Noonan discloses that "[s]imilar to the bullet, the expanding gasses formed by the firing of the bullet also travel through the firearm's barrel 70 and into the expansion chamber assembly 10 as shown by arrow 190 in Figs. 3a-b." Ex. 1004 col. 4, ll. 9-13. The expanding gases may exit the expansion chamber assembly 10 through one or more exit through apertures in the front cap 25 or the rear cap 30. Gases flow from areas of higher pressure to areas of lower pressure and equalize in pressure. As such, to "equalize" pressure would require the areas of higher pressure to be fluidically connected to the areas of lower pressure. The exit through apertures in the front cap 25 or the rear cap 30 (i.e., areas of lower pressure immediately after a bullet is fired) are fluidly connected to the expanding gases that are expelled from the firearm's barrel 70 (i.e., area of higher pressure immediately after a bullet is fired), depict a wide flow path, and are described as being used for allowing gas to vent from the expansion chamber assembly 10 (i.e., firearm suppression system). Thus, gas flows from the high-pressure region proximate the firearm's barrel toward the exit and redistributes through the central bore and peripheral apertures of the end cap. This bidirectional communication necessarily equalizes pressure between those regions and throughout the intervening volume.

236. Thus, it is my opinion that the device of Noonan discloses, by virtue of its structure and flow paths, that it equalizes pressure that begins at the first end of the outer tube (i.e., housing) and terminates at the second end of the outer tube (i.e., housing).

237. For the avoidance of doubt, and to the extent it is argued that the space between the outer tube 15 (i.e., housing) and inner tube 20 (i.e., core) of Noonan does not equalize pressure that begins at the first end of the housing and terminates at the second end of the housing, the structure and purpose of the channel of Noonan corresponds to the structure and purpose of the channel 142 of the ’906 patent, which the ’906 patent describes as performing the claimed equalization function, such that the channel of Noonan also equalizes pressure that begins at the first end of the housing and terminates at the second end of the housing.

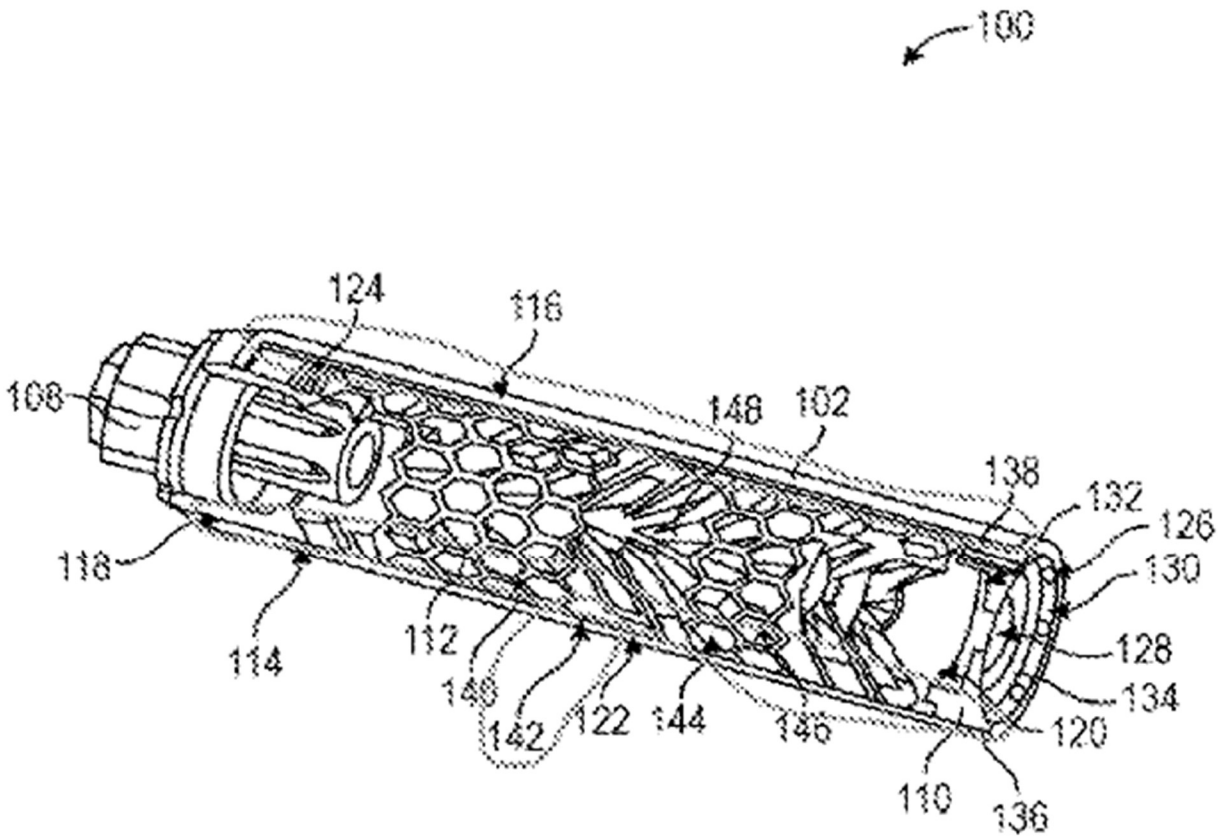
238. For example, in Noonan, the channel is between the outside of the inner tube 20 (i.e., core) and the inside of the outer tube 15 (i.e., housing), and Noonan discloses through apertures 22 (i.e., a plurality of core apertures) that are dispersed along a substantial length of the inner tube 20 (i.e., core) and dispersed circumferentially around the inner tube 20 (i.e., core) that allow expanding gas (i.e., gas passing from a projectile and cartridge) to “enter the outer tube 15” from the inner tube 20 (i.e., core). Ex. 1004 col. 4, ll. 17-20; Figs. 1b, 3a. Similarly, the ’906 patent’s channel is between the core 112 and the housing 102, and the core apertures

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144 of the ’906 patent are dispersed along a substantial length of the core 112 “that allow gas passing from the projectile and operating system to pass to the channel 142.” Ex. 1001 col. 6, ll. 62-34, col. 7, ll. 22-25; Fig. 5.

239. Moreover, the ’906 patent states that “[b]etween 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.” Ex. 1001 col. 6, ll. 62-67. In the Response to the Office Action dated February 16, 2024, Patent Owner cited to the preceding passage from its specification for support for the amendment that included Element [1.5] and asserted that “[t]he following screenshot of Fig. 2 illustrates the channel 142 that is positioned between the housing and the core and that circumscribes the core, running the entire length of the core.” Ex. 1002 p. 104.

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Annotated Fig. 2 of the '906 patent (annotated by Patent Owner in the Response to the Office Action dated February 16, 2024)

240. As can be seen in annotated Fig. 2, above, and annotated Fig. 3, below, the device of the '906 patent includes a threaded fastener 124 (highlighted in red) connecting the core 112 (highlighted in orange) to the housing 102 (highlighted in yellow) at the first end 104 and includes a sidewall 138 that "may be threaded" to the inner surface 114 of the housing 102. Ex. 1001 col. 6, ll. 39-42, Fig. 2.

241. The '906 patent discloses that gas from the fired cartridge enters the firearm suppression system 100 and escapes through the end cap 110 at vent

apertures 126 on the end cap 110. Ex. 1001 col. 6, ll. 13-20. Therefore, the structure and purpose of the channel of Noonan corresponds to the structure and purpose of the channel 142 of the ’906 patent and both would have the same gas equalization properties. Further still, Noonan appears to contemplate at least one embodiment in which there is an open passage from the front cap 25 to the rear cap 30 via the channel between the outer tube 15 and the inner tube 20 (Ex. 1004 col. 4 ll. 27-35 (describing the possibility of exit apertures in the front cap and rear cap)), such that the pressure may also be equalized from the front vents to the rear vents, which also equalizes pressure that begins at the first end of the housing and terminates at the second end of the housing.

242. Assuming, for purposes of argument, that the channel 142 of the ’906 patent performs the claimed function of equalizing pressure that begins at the first end of the housing and terminates at the second end of the housing, the channel of Noonan would also perform the claimed function of equalizing pressure due to the corresponding structures and purposes of the channel of Noonan and the channel 142 of the ’906 patent.

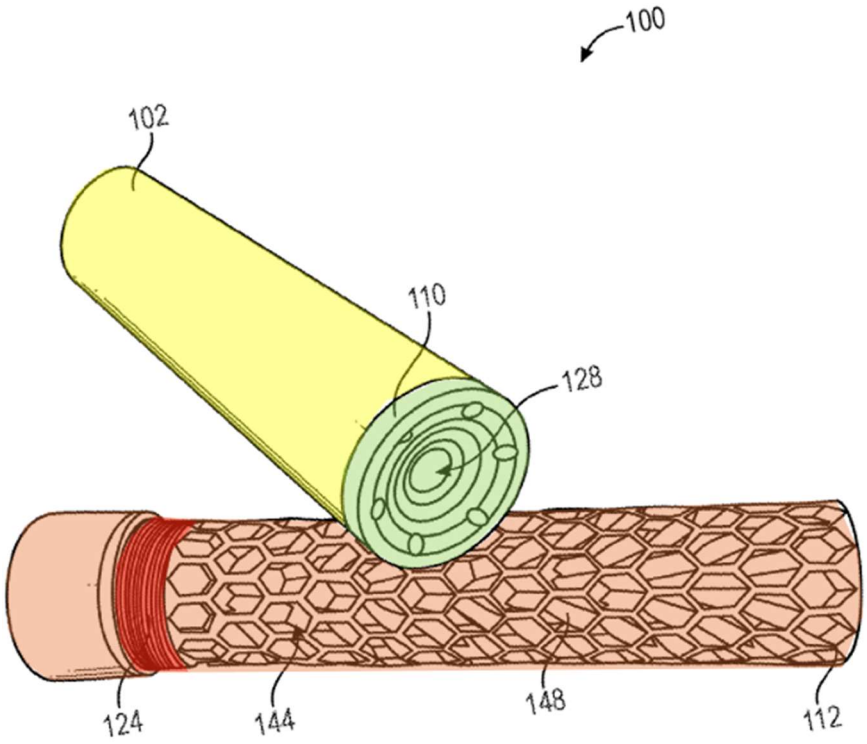
243. To the extent it is argued that the channel equalizing pressure that begins at the first end of the housing and terminates at the second end of the housing requires the pressure within the channel itself to extend from the first end of the housing to the second end of the housing, this is contrary to the plain and

ordinary meaning of the claim and contrary to the disclosure of the ’906 patent and representations made by the Applicant of the ’906 patent during prosecution.

244. The ’906 patent states that “[t]he 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”, which “equalizes the high pressures *[sic]* gas through the entire system 100 rapidly…”. Ex. 1001 col. 6, line 67 to col. 7 line 5. As such, the suppressor disclosed by the ’906 patent does not include “immediate” gas transfer to the channel at the first end of its housing despite disclosing and arguing during prosecution that the channel 142 performs the claimed function. As can be seen in annotated Fig. 3 of the ’906 patent below, the earliest instance that gas would be permitted to flow from the interior of the core 112 to the channel adjacent the housing 102 would be downstream of the threads 124 and downstream of the first end of the housing since the core apertures 144 do not begin until after the threads 124 while the housing 102 extends to the proximal (i.e., to the left in Fig. 3 below) end of the threads.

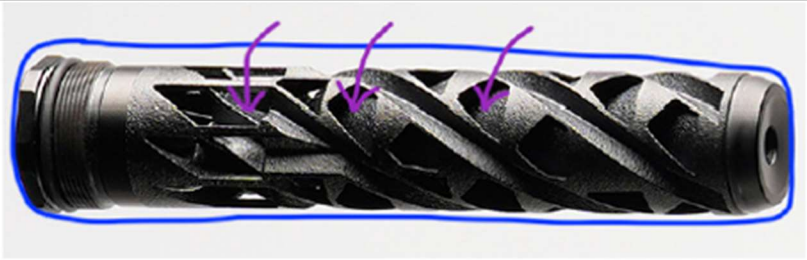
245. Moreover, in the Office Action response discussed above, and with reference to the Applicant’s annotated Fig. 2 above, the claimed “channel” includes the region that is threaded, which would not, in my opinion, allow pressure to escape through the threads. Thus, it is clear from the Patent Owner’s

statements and the corresponding disclosure that the "pressure" which begins at the first end of the housing and terminates at the second end of the housing does not "begin" within the channel at the first end of the housing and the claims do not require it. Further, the structure of the core of the '906 patent does not include core apertures at a first extremity of the core, and the claim language does not require a specific radial location for the pressure. Instead, for the pressure of the '906 patent to begin "at the first end of the housing", the pressure may begin within the core (e.g., along the projectile path into the suppressor) and may enter the channel through core apertures that are not at a first extreme end of the core.



'906 Patent, Annotated Fig. 3

246. For further avoidance of doubt, it is also my understanding that Patent Owner believes and has asserted in a claim chart (excerpt provided below) that a suppressor design that allows a "core to slide into the housing" would inherently include a channel meeting the limitations as recited in claim 1. Ex. 1011 p. 32.

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.	 Company's Suppressor includes a core (blue), a plurality of core apertures (purple arrows), and a channel. While the channel is not shown, it is inherent in the design so as to allow Company's core to slide into the housing. As such, a channel surrounds the core and is positioned between an outer surface of the core and an inner surface of the housing/shell.

core apertures (purple arrows), and a channel. While the channel is not shown, it is inherent in the design so as to allow Company's core to slide into the housing. As such, a channel

Patent Owner's Claim Chart (excerpt, annotated)

247. The Noonan expansion chamber assembly 10 features an inner tube 20 (i.e., core) that slides into an outer tube 20 (i.e., housing). Ex. 1004 Fig. 1b. As such, according to Patent Owner's definition, the Noonan device would have a channel

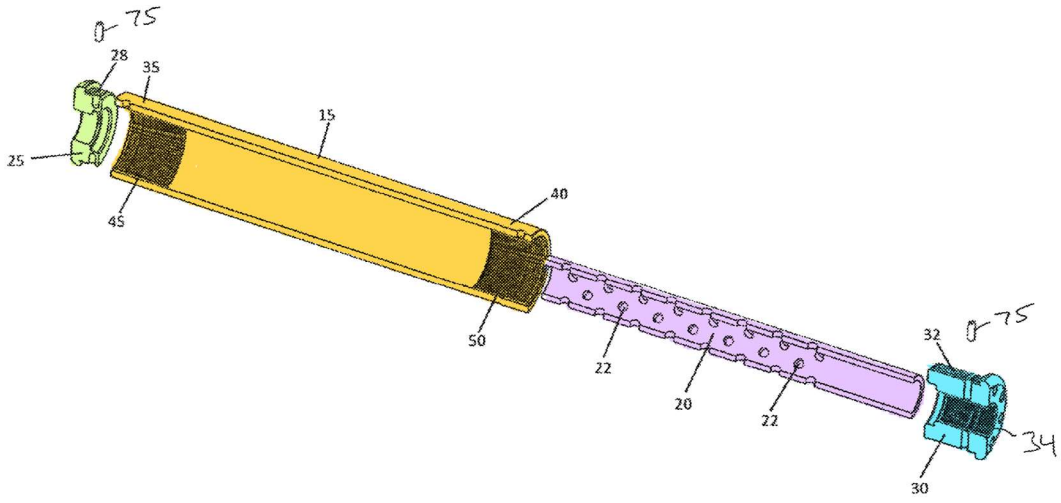
that surrounds (i.e., circumscribes) the core, is positioned between the outer surface of the core and the inner surface of the housing/shell, and equalizes pressure that begins at the first end of the housing and terminates at the second end of the housing. Ex. 1004 Fig. 1b; Ex. 1011 p. 32.

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

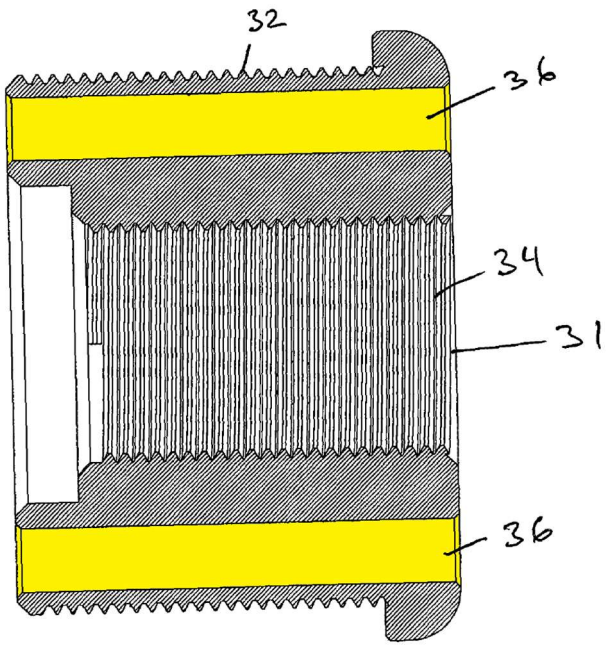
248. Noonan discloses the limitations added in dependent claim 3. With reference to annotated Fig. 3c below, Noonan includes a front cap 25 (i.e., end cap) (highlighted in green) defining the through aperture 26 (i.e., projectile aperture) and a rear cap 30, with the outer tube 15 (i.e., housing) (highlighted in orange) and inner tube 20 (i.e., core) (highlighted in purple) held therebetween. With reference to annotated Fig. 5c below, Noonan contemplates that the rear cap 30 include multiple apertures that vent the space (i.e., channel) between the outer tube 15 (i.e., housing) and inner tube 20 (i.e., core). In particular, Noonan notes that "the expanding gasses located between the outer tube 15 and the inner tube 20 may exit the expansion chamber assembly 10 through one or more exit through apertures 36 in the rear cap 30" and "[a]ccording to some embodiments, one or more exit through apertures 36 are in communication with the space between the outer tube 15 and the inner tube 20." Ex. 1004 col. 4, ll. 27-37. In Fig. 5c below, the apertures 36 (highlighted in

yellow) are shown extending entirely through the rear cap 30, such that the channel would be vented by the apertures.

249. Noonan additionally describes that "[a]ccording to some embodiments, the expanding gasses located between the outer tube 15 and the inner tube 20 may exit the expansion chamber assembly 10 through one or more exit apertures (not shown) in the front cap 25." Ex. 1004 col. 4, 31-35. Thus, while not illustrated, Noonan uses the same terminology to describe the apertures in the front cap 25 (i.e., end cap) as the rear cap 30. These apertures vent the space located between the outer tube 15 (i.e., housing) and the inner tube 20 (i.e., core) in the same manner as the depicted and described apertures 36 in the rear cap 30. Thus, Noonan discloses that the front cap 25 (i.e., end cap) comprises a plurality of vent apertures.



Noonan, Fig. 3c (annotated)

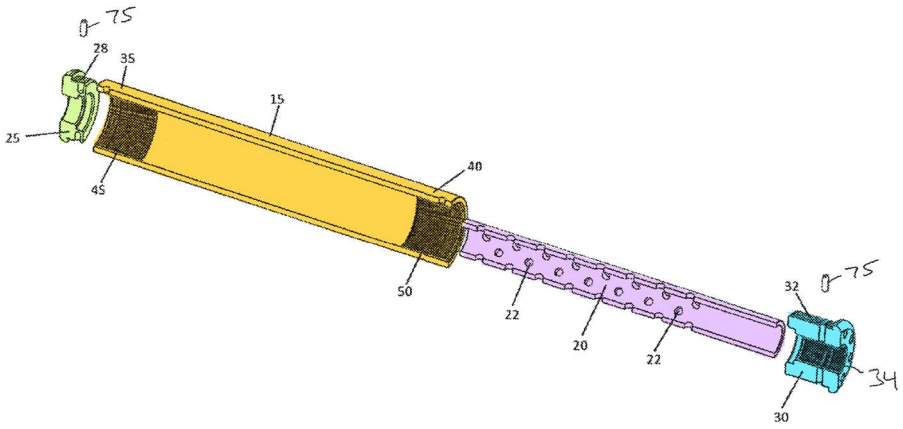


Noonan, Fig. 5c (annotated)

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

250. Noonan discloses the additional limitation of dependent claim 4. As shown in annotated Fig. 3c below, the expansion chamber assembly 10 (i.e., firearm suppression system) includes a rear cap 30 (i.e., muzzle adapter). Noonan explains that "… the entire through aperture 31 of the *rear cap 30 comprises an inner thread 34* (shown in Figs. 3a and 3c) *configured to accommodate at least a portion of an outer thread 71 (shown in Fig. 12a) on the exit end of the barrel 70*." Ex. 1004 col. 4, ll. 1-5 (emphasis added). This structure establishes that rear cap 30 (i.e., muzzle adapter) is a discrete component that threadably connects the suppressor assembly 10 to the muzzle end of the firearm barrel 70. The plain and ordinary meaning of a

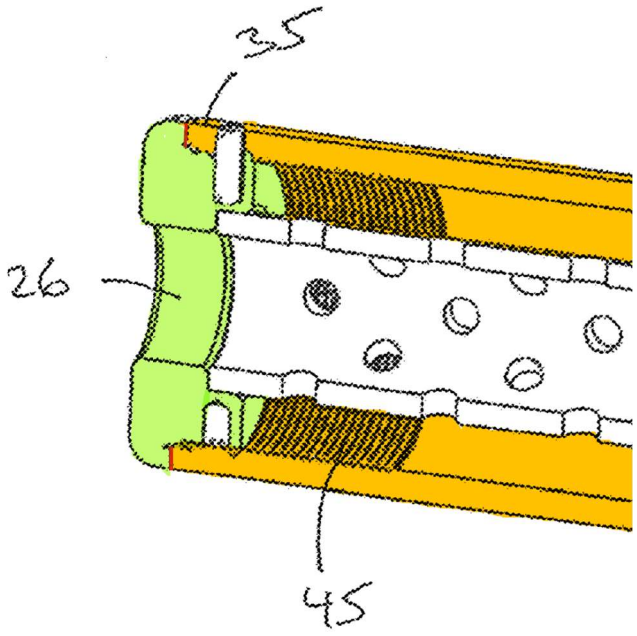
"muzzle adapter" is any component that mechanically couples or interfaces a suppressor to the firearm's nuzzle, including by threading, clamping, or fast-attach mechanisms. Because the '906 patent provides no special definition of "muzzle adapter," its ordinary meaning encompasses any such connecting component. The rear cap 30 of Noonan therefore corresponds to the claimed muzzle adapter, for example, because it is located at the muzzle end of the suppressor, provides the mechanical interface to the barrel, and is removable and replaceable to accommodate different muzzle thread patterns. The exploded view of Fig. 3c confirms its separability from the outer tube 15 and inner tube 20, and the threaded connection further indicates that different rear caps could be substituted to mate with various firearm thread sizes—precisely the purpose of a muzzle adapter. Accordingly, Noonan teaches the structure and function required by dependent claim 4.



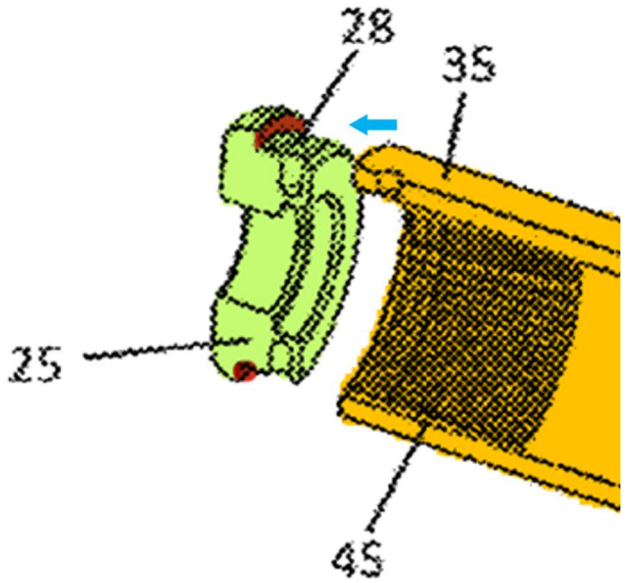
Noonan, Fig. 3c (annotated)

Dependent Claim 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.

251. Noonan discloses the limitations added in dependent claim 5. Referring to the annotated excerpts of Figs. 3a and 3c below, the front cap 25 (i.e., end cap) (highlighted in green) at the front end 35 (i.e., second end) of the assembly 10 of Noonan includes a side (i.e., second side, blue arrow in Fig. 3c) opposite its front face (the left side in Figs. 3a, 3c) that includes a ledge (highlighted in red and red lines) that rests upon and is flush with the front end 35 (i.e., second end) of the outer tube 15 (i.e., housing) (highlighted in orange). Ex. 1004 Figs. 3a, 3c.



Noonan, Fig. 3a (excerpt, annotated)



Noonan, Fig. 3c (excerpt, annotated)

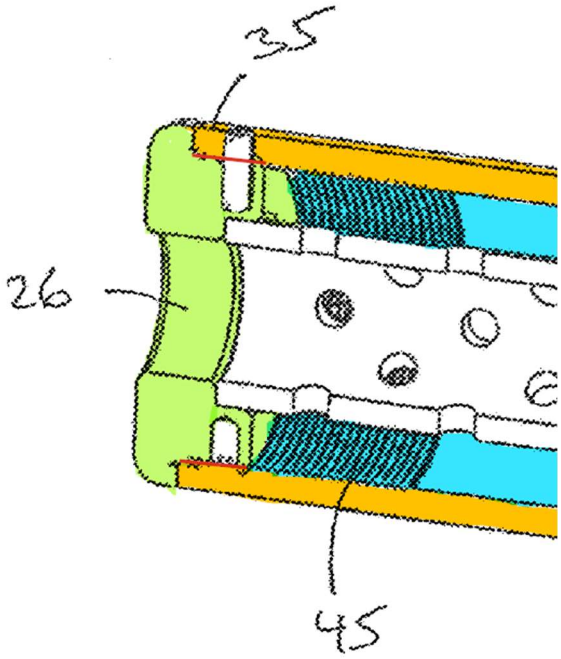
252. Noonan discloses that "[t]he front end 35 [i.e., second end] may comprise an inner screw threads 45 [sic] (shown in cutaway Figs. 3a-c) configured to accommodate and/or engage the outer thread 28 of the front cap 25 [i.e., end cap]", and the front cap is described as "coupled with the outer tube [i.e., housing] at the front end". Ex. 1004 col. 3, ll. 36-39, claim 1, Fig. 3a. It can be seen in Fig. 3a that the front cap 25 (i.e., end cap) (highlighted in green) is attached via the threaded connection until there is contact between the ledge (red lines) of the front cap 25 (i.e., end cap) and the front end 35 (i.e., second end) of the outer tube 15 (i.e., housing) (highlighted in orange). Additionally, the fastener holes illustrated between the front cap 25 (i.e., end cap) and the outer tube 15 (i.e., housing) suggest to me that the front cap 25 threading would be designed and toleranced to stop when the ledge is fully engaged with the outer tube 15 (i.e., housing). For example, this may be

optionally accomplished by adding a thread relief between the ledge and the end of the thread to allow full contact at that mating surface, or can be accomplished – though less often implemented this way – by removing some of the threads from the end of the housing. The point of contact between the ledge (red lines) and the outer tube 15 (i.e., housing) is the distalmost point (i.e., the left most point in Fig. 3a above) on the second end of the outer tube 15 (i.e., housing), and the ledge (highlighted in red and red lines) thus rests upon and is flush with the front end 35 (i.e., second end).

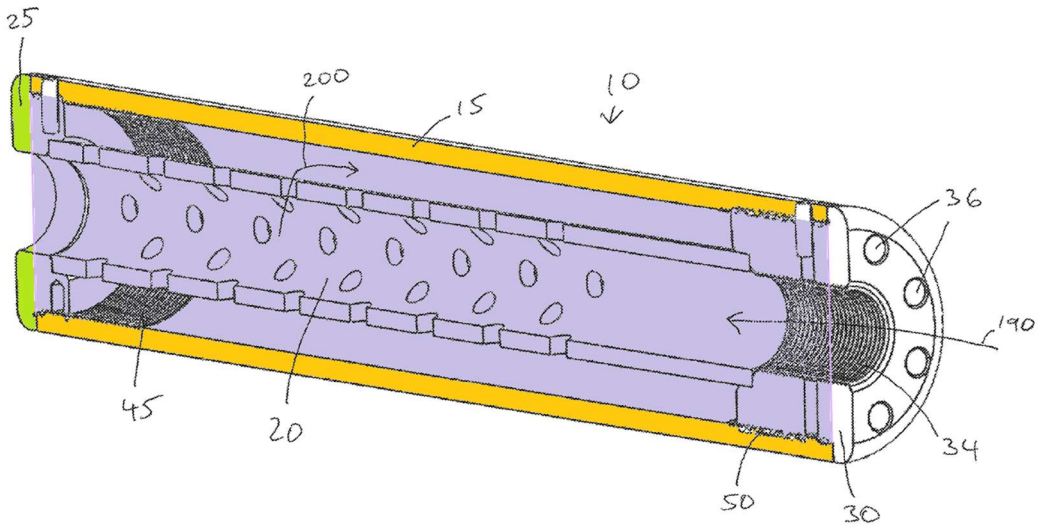
Dependent Claim 6: The firearm suppression system of claim 1, wherein the end cap comprises a sidewall that is positioned in the inner compartment and rests against an inner surface of the housing.

253. Noonan discloses the limitations added in dependent claim 6. Referring to the annotated excerpts of Figs. 3a and 3c below, the front cap 25 (i.e., end cap) (highlighted in green) at the front end 35 (i.e., second end) of the assembly 10 of Noonan includes an outer thread 28 (i.e., the sidewall being the wall defining the thread) (highlighted in red and red lines in annotated excerpts of Figs. 3a, 3c) that rests against the inner surface (highlighted in blue in annotated excerpts of Figs. 3a, 3c) of the outer tube 15 (i.e., housing) (highlighted in orange). Ex. 1004 Figs. 3a, 3c. Comparing annotated Fig. 3b below with annotated Figs. 3a and 3c, it is also clear that the outer thread 28 (i.e., the sidewall being the wall defining the thread)

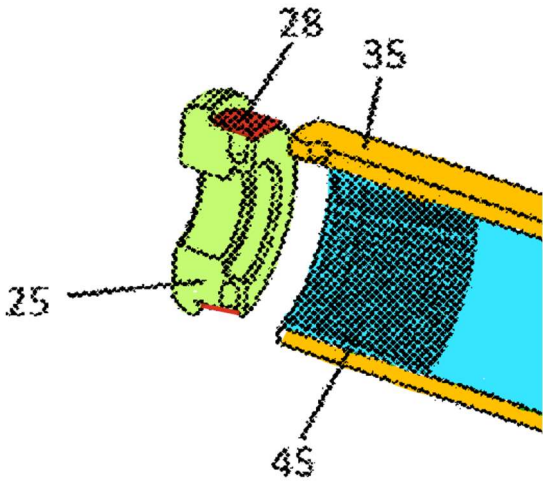
(highlighted in red and red lines in annotated excerpts of Figs. 3a and 3c) is positioned in the inner compartment (highlighted in purple in annotated Fig. 3b) of the housing. Ex. 1004 Figs. 3a-3c. The inner compartment can also be visualized as the extent of the inner surface (highlighted in blue in annotated excerpts of Figs. 3a, 3c) of the outer tube 15 (i.e., housing) (highlighted in orange) shown in annotated excerpts of Fig. 3c below. Ex. 1004 Fig. 3c.



Noonan, Fig. 3a (excerpt, annotated)



Noonan, Fig. 3b (annotated)



Noonan, Fig. 3c (excerpt, annotated)

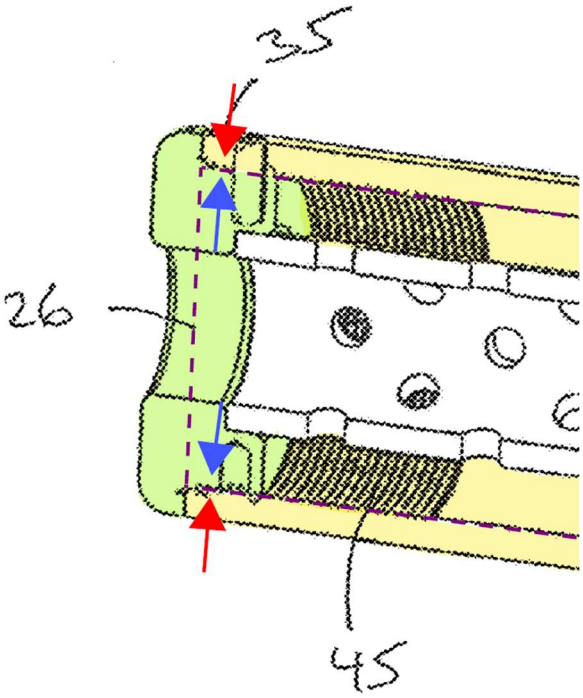
254. As described by Noonan, "[t]he front end 35 may comprise an inner screw threads 45 (shown in cutaway FIGS. 3a-c) configured to accommodate and/or engage the outer thread 28 of the front cap 25." Ex. 1004 col. 3, ll. 36-39. The inner screw threads 45 of Noonan are on the interior surface (highlighted in blue in annotated excerpts of Figs. 3a, 3c) of the outer tube 15 (i.e., housing) (highlighted

in orange), and the interior surface is within the inner compartment (highlighted in purple in annotated Fig. 3b). Moreover, Fig. 3a illustrates the front cap 25 (i.e., end cap) (highlighted in green) threaded into the inner compartment until the threads are entirely engaged and the ledge (discussed above with respect to Claim 5) abuts the outer tube 15 (i.e., housing) (highlighted in orange). Ex. 1004 Fig. 3a. Thus, the outer thread 28 (i.e., the sidewall being the wall defining the thread) (highlighted in red and red lines in annotated excerpts of Figs. 3a and 3c) of the front cap 25 (i.e., end cap) (highlighted in green) is positioned in the inner compartment (highlighted in purple) and rests against the inner surface (blue highlighting) of the outer tube 15 (i.e., housing) (highlighted in orange).

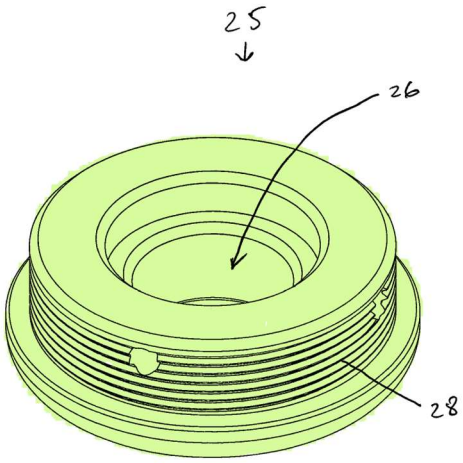
Dependent Claim 7: The firearm suppression system of claim 6, wherein the sidewall comprises threads that couple to the housing.

255. Noonan discloses the limitations added in dependent claim 7. In particular, with reference to annotated excerpts of Figs. 3a and 4a of Noonan below, Noonan includes a front cap 25 (i.e., end cap) (highlighted in green) with a sidewall (blue arrows) that is positioned in the inner compartment (bounded by the purple dashed lines) and rests against an inner surface (red arrows) of the outer tube 15 (i.e., housing) (highlighted in yellow). As depicted in annotated Figs. 3a and 4a, the resulting sidewall (blue arrows) may further include threading 28 for engaging the

corresponding threading 45 on the inner surface of the outer tube 15 (i.e., housing). *See* Ex. 1004 Figs. 3a, 4a, col. 3, ll. 36-39.



Noonan, Fig. 3a (excerpt, annotated)



Noonan, Fig. 4a (annotated)

D. Ground 4: Claim 2 is rendered obvious by Noonan in view of Slack and Sclafani.

256. For at least the reasons below, claim 2 of the '906 patent are unpatentable as rendered obvious by Noonan in view of Slack and Sclafani.

Motivation to Combine Noonan, Slack, and Sclafani

257. It is my opinion that a POSITA would have been motivated to combine Noonan with each and either of Slack and Sclafani, and would have had a reasonable

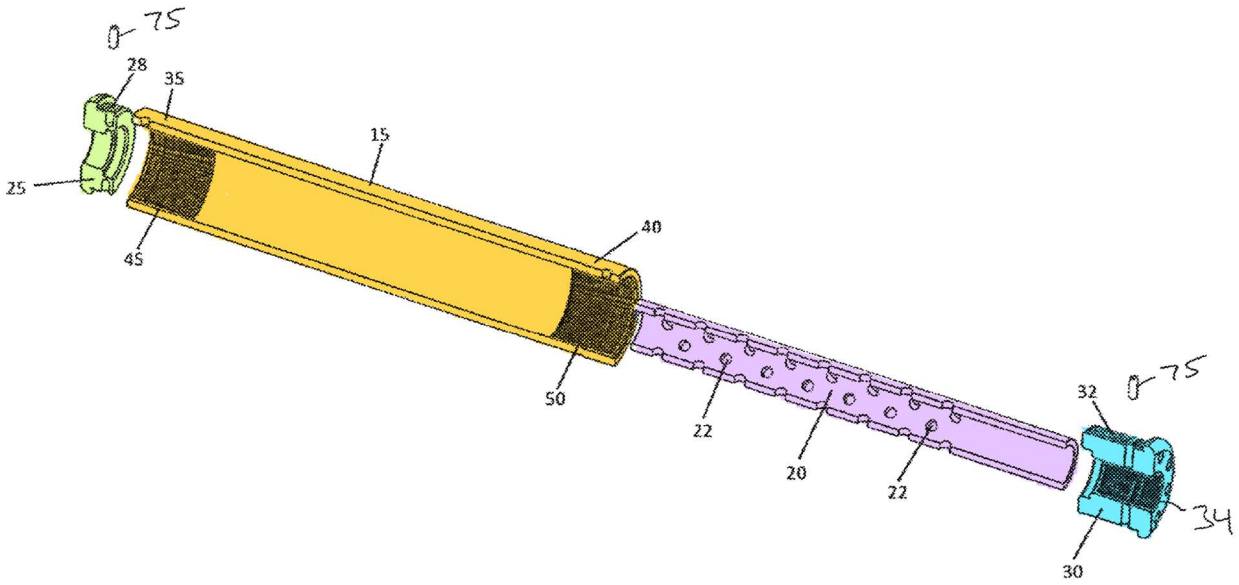
expectation of success. Noonan, Slack, and Sclafani are analogous art because they are from the same field of endeavor and address the same problem—improving firearm suppressors. Even if it were argued that Noonan, Slack, and Sclafani were somehow not from the same field of endeavor, Slack and Sclafani would still be reasonably pertinent to the problems addressed by Noonan, and vice versa.

258. There are numerous reasons why a POSITA would have been motivated to combine Noonan with Slack and Sclafani. Each reference is directed towards improvements in firearm suppressors and thus is in the same field of endeavor. For example, Noonan discloses that its expansion chamber assembly 10 (i.e., firearm suppression system) is designed to solve a need for "a way to reduce noise levels, flash and/or recoil when firing a firearm". Ex. 1004 col. 1, ll. 29-30. Slack discloses that suppressors "absorb, dissipate and/or reduce the audible frequencies and muzzle flash from firing a firearm", and there is "a continuing need to develop additional firearm suppressors" because "such configurations are not always as effective as desired". Ex. 1006 ¶ 4. Further, Sclafani discloses that silencers (i.e., firearm suppression system) "attenuated the noise level associated with the firing of a round in the rifle" and that its silencers (i.e., firearm suppression system) solve a need for "… a silencer that is less costly to manufacture and that can be reused without incurring an additional tax." This, Sclafani explains, is due to the easy replacement of the interior components of the silencer. Ex. 1007 ¶¶2-6.

259. A POSITA in possession of Noonan would have recognized that teachings for improving one suppressor can be used to improve other suppressors and would have been motivated to use the teachings of Slack and Sclafani to improve the expansion chamber assembly (i.e., firearm suppression system) of Noonan using such techniques. In particular, the POSITA would have looked to Slack, among many reasons, for its improved performance in their shared goals of reduced audible frequencies (e.g., reduced noise levels) and muzzle flash. For example, Slack discloses an interchangeable list of manufacturing techniques and materials that may be used to form the "suppressor 20 and/or 120, or the components thereof". Ex. 1006 ¶ 67. In particular, regarding the manufacturing technique, Slack states that the "suppressor or components thereof may be made by machining, such as CNC machining, lathing, molding, such as injection molding, casting, milling, stamping, die cutting, *3D printing*, laser cutting, bending, cold working, drilling, or other desired processes." Ex. 1006 ¶ 67 (emphasis added).

260. Moreover, the structure of the expansion chamber assembly 10 (i.e., firearm suppression system) of Noonan is the same as Slack in all material respects related to the choice of *3D printing* (i.e., printing from a three-dimensional printer) as a manufacturing process for the inner tube 20 (i.e., core). For example, comparing annotated Fig. 3c of Noonan with annotated Fig. 9 of Slack below shows that each has corresponding structures defining the basic components of their respective

devices. In particular, Noonan includes a front cap 25 (i.e., end cap) (highlighted in green), outer tube 15 (i.e., housing) (highlighted in orange), inner tube 20 (i.e., core) (highlighted in purple), and a rear cap 30 (not claimed in the '906 patent) (highlighted in blue) configured to engage the barrel of a firearm (not shown) and the outer tube 15. Ex. 1004 Fig. 3c, col. 3, ll. 16-28, col. 4, ll.1-5. Similarly, Slack discloses an end cap 160 (i.e., end cap) (highlighted in green), an external component 22 (i.e., housing) (highlighted in orange), an internal component 124 (i.e., core) (highlighted in purple), and the internal component 124 includes an integral end (highlighted in blue) with flanges 150 that engage the external components and internal threads to engage a firearm barrel 12. Ex. 1006 Fig. 9, ¶ 42-44, 63, 64, 67.



Noonan, Fig. 3c (annotated)

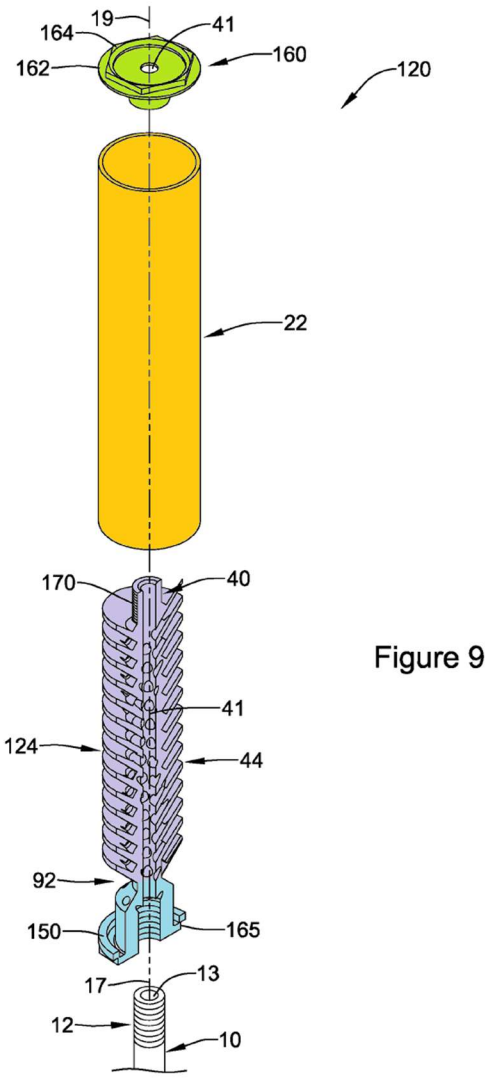


Figure 9

Slack, Fig. 9 (annotated)

261. Noonan and Slack differ, in part, because the internal component 124 (i.e., core) (highlighted in purple) of Slack threads to the end cap 160 (i.e., end cap) (highlighted in green) and firearm barrel 10 and the combination of the integral end (highlighted in blue) and the end cap 160 (i.e., end cap) (highlighted in green) of Slack captures the external component 22 (i.e., housing). Ex. 1006 Fig. 9, ¶ 63. In Noonan, the inner tube 20 (i.e., core) (highlighted in purple) of Noonan is captured

between the front cap 25 (i.e., end cap) (highlighted in green) and rear cap 30 (highlighted in blue), while the outer tube 15 (i.e., housing) (highlighted in orange) threads into engagement with both caps 25, 30 and the rear cap 30 engages the barrel. Ex. 1004 Fig. 3c, claims 7-10, col. 3, ll. 29-47. Slack includes a broad disclosure of both a variety of manufacturing techniques and explicitly states that its suppressors or components thereof may be made by the various techniques. *See* Ex. 1006 ¶ 67. This broad teaching suggests that the various manufacturing processes were considered interchangeable to Slack, and both Noonan and Slack include various combinations of threaded, clearance, and interference fits that would lend themselves to the same manufacturing techniques, including 3D printing.

262. Thus, it is my opinion that a POSITA would have been motivated to use the 3D printing techniques taught by Slack to manufacture at least the inner tube 20 (i.e., core) of Noonan. In particular, additive manufacturing (i.e., 3D printing)—including metal additive manufacturing such as DMLS or SLM—optionally enables fabrication of suppressor cores with complex internal geometries that cannot be produced through conventional subtractive methods (e.g., as discussed with respect to Muceus below), while also allowing immediate iteration of design variables such as baffle shape, aperture placement, and wall thickness each of which would benefit the combination of Noonan, Slack, and Sclafani. A POSITA engaged in suppressor development would have recognized that 3D printing allows the rapid evaluation of

successive prototypes and the ability to evolve designs through direct firing tests without the lead time and cost of tooling. Additionally, 3D printing reduces material waste, allows direct integration of lattice or cellular structures to optimize weight and heat dissipation, and permits targeted strengthening in regions subject to high gas erosion. Suppressor cores are also the components most prone to thermal and erosive wear, and 3D printing would facilitate their low-cost replacement and continuous refinement. For these reasons, a POSITA would have been motivated to fabricate at least the inner tube 20 (i.e., core) of Noonan by 3D printing using a metal additive manufacturing process.

263. Moreover, the POSITA would have had a reasonable expectation of success in combining Noonan with 3D printing as taught by Slack because both references concern suppressors that are similarly structured, operate under the same gas-dynamic principles, and share the same environmental and performance constraints. The POSITA would have understood that applying Slack's additive manufacturing technique to Noonan's inner tube 20 (i.e., core) would produce a functionally equivalent suppressor component—one that maintains the same gas flow and sound-reduction characteristics, but benefits from simplified manufacture, reduced cost, and improved part interchangeability. The use of 3D printing to produce a comparable cylindrical baffle or core geometry would present no technical uncertainty, and success would be reasonably expected given the maturity of metal

additive processes available at the time of the earliest priority of the ’906 patent. Accordingly, a POSITA would have been motivated to combine, and would have had a reasonable expectation of success in combining, Noonan and Slack.

264. It is my opinion that a POSITA would have recognized that manufacturing at least the inner tube 20 (i.e., core) of Noonan using 3D printing as disclosed by Slack constitutes a straightforward use of a known technique to improve a similar device in the same way. Noonan provides the base expansion-chamber assembly, while Slack teaches an equivalent suppressor made by additive methods. Substituting 3D printing for traditional machining would predictably yield the same structure and performance, with the added benefits of weight reduction, consolidation of parts, and internal features that would otherwise require multi-piece assemblies. Such substitution represents a classic case of applying a known process to a known device to obtain predictable, incremental improvement, providing motivation to use 3D printing. The POSITA would further have understood that manufacturing at least the ***inner tube 20*** (i.e., core) of Noonan using 3D printing as disclosed by Slack would have been a simple use of known technique to improve a similar device in the same way. Noonan discloses a “base” expansion chamber assembly (i.e., firearm suppression system), which includes all of the limitations of the firearm suppression system of claim 2 of the ’906 patent, for the reasons discussed with respect to claim 1, except for the disclosure of being printed using a

three dimensional printer. Slack discloses that components of a suppressor, which includes the suppressor core (e.g., the inner tube 20 of Noonan) may be manufactured using 3D printing. Ex. 1006 ¶ 67. To the extent that claim 2 of the '906 patent is seen as an improvement over the device of Noonan because of the use of printing with a three dimensional printer, Slack discloses a comparable device (e.g., suppressor 20, 120) that has been improved in the same way (i.e., by using 3D printing). Under the same logic, Slack discloses a known technique (i.e., 3D printing) that may be applied to a known device (i.e., Noonan's expansion chamber assembly), which is ready for improvement to yield predictable results (i.e., ready and needing to be manufactured, and not requiring any further modification of its structure or functions to implement 3D printing).

265. The POSITA would have also understood that 3D printing offers significant functional and economic advantages—faster prototype turnaround, easier parameter optimization, and reduced waste—that make it an attractive alternative to CNC machining or casting. The ability to modify baffle shapes and flow paths directly from CAD files allows rapid evolutionary design cycles informed by live-fire testing, enabling optimization for tone, recoil, and gas flow behavior. These capabilities would have strongly motivated a POSITA engaged in suppressor development to implement 3D printing for Noonan's inner tube 20 (i.e., core) and, optionally, other components.

266. A POSITA would have applied the known 3D printing improvement from Slack in the same way to the "base" expansion chamber assembly of Noonan and the results would have been predictable to one of ordinary skill in the art. In particular, both suppressor structures of Slack and Noonan are analogous and share the same performance objectives, each having a core (i.e., inner tube 20 and internal component 24/124, respectively) through which the projectile passes and through which gas is allowed to flow both out an axial end of the suppressor and radially into a space between the core (i.e., inner tube 20 and internal component 24/124, respectively). *See* Ex. 1004 Figs 3a-3b, col. 4, ll. 14-37; Ex. 1006 Fig. 2, ¶¶ 44-45. Given the similarity in the structure and functions of the cores (i.e., inner tube 20 and internal component 24/124 respectively) of Noon and Slack, and Slack's clear teaching of 3D printing as an optional manufacturing process, the results of printing the inner tube 20 of Noonan using 3D printing as disclosed by Slack would have yielded predictable results. Indeed, applying Slack's identified 3D-printing technique (see, e.g., Ex. 1006 ¶ 67; Fig. 2) to Noonan's core (see, e.g., Ex. 1004 Figs. 3a–3b) would be expected to yield a suppressor that functions identically but is lighter, simpler to manufacture, and more adaptable to design iteration and repair.

267. Thus, the scope and content of the prior art include Noonan's expansion chamber assembly 10, which meets the structural requirements of claims 1 and 2 of the '906 patent except for being printed with a three-dimensional printer (3D

printer), and Sclafani's and Slack's disclosure of a removable core suitable for 3D printing. A POSITA, given the similarity of structure and purpose among these references, would have been motivated to combine Noonan with Sclafani and Slack with a reasonable expectation of success.

268. In addition, a POSITA would have viewed Slack's disclosure of 3D printing among a finite list of manufacturing options—including machining, casting, and molding, and thus the POSITA would have understood that fabricating Noonan's inner tube 20 (i.e., core) using 3D printing as disclosed by Slack would have been "obvious to try," representing one of a finite number of predictable manufacturing solutions with a reasonable expectation of success. MPEP § 2143(I)(E). Noonan identifies the need for lighter, less costly suppressors, stating that "These silencers are heavy, use lots of different types of parts and/or are difficult to assemble thereby making them expensive to manufacture and quite costly for ultimate consumers." Ex. 1004 col. 1, ll. 23–26. In particular, Noonan recognizes a need for improved suppressor performance (e.g., "a need exists for a way to reduce noise levels, flash and/or recoil when firing a firearm") and that traditional suppressors are too heavy, too complex, and too costly (e.g., "[t]hese silencers are heavy, use lots of different types of parts and/or are difficult to assemble thereby making them expensive to manufacture and quite costly for ultimate consumers"). Ex. 1004 col. 1, ll. 19-30. Similarly, Slack recognizes "… a continuing need to

develop additional firearm suppressors," and Slack's inventive solutions relate to "… firearm suppressors, and *design, material, manufacturing method, and use alternatives for such firearm suppressors.*" Ex. 1006 ¶¶ 4–5 (emphasis added). Thus, the known performance and cost benefits of 3D printing would have resolved a clear design need in references such as Noonan and motivated the POSITA to apply Slack's method to Noonan's core. In addition, the POSITA would be motivated to seek out manufacturing processes that achieve the benefits of 3D printing discussed herein. Slack presents a list of options which would have been obvious to try, and the known benefits of 3D printing would have lead to a reasonable expectation of success and predictable results when applying 3D printing to solve the aforementioned problems.

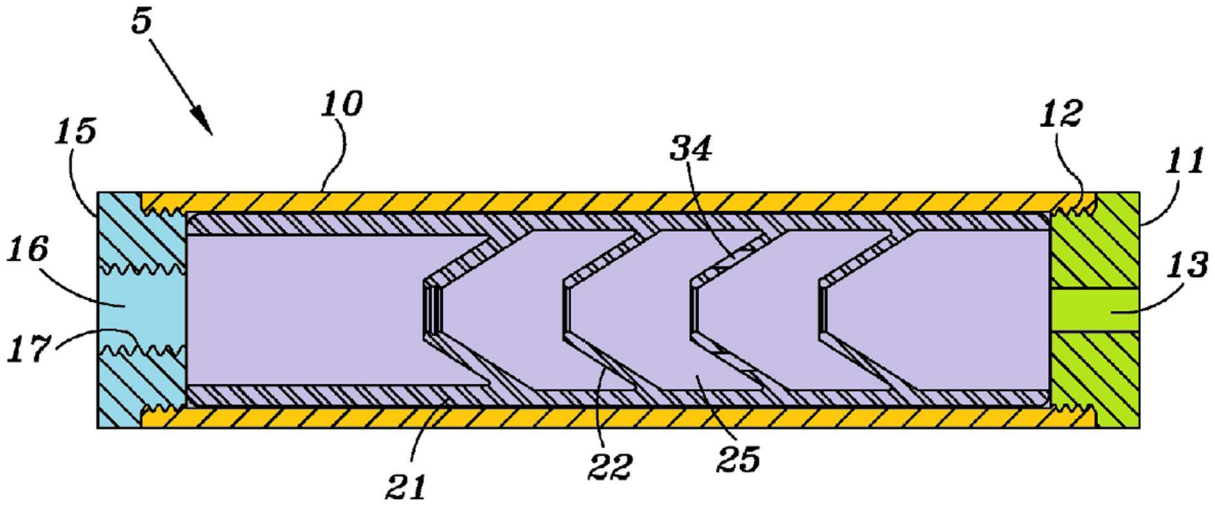
269. Slack further identifies a finite set of predictable fabrication options—machining, molding, casting, milling, stamping, die-cutting, 3D printing, and related processes (Ex. 1006 ¶ 67)—from which a POSITA would have selected 3D printing as an obvious and practical method to meet Noonan's goals of reduced weight, simplicity, and cost. The POSITA would have reasonably expected success because Slack explicitly applies those techniques to suppressors of analogous structure and function. The POSITA would have recognized, that there are a finite number of identified, predictable potential solutions to the recognized need or problem. Said differently, Slack presents a small list of easily traversed options that include 3D

printing, namely "the suppressor or components thereof may be made by machining, such as CNC machining, lathing, molding, such as injection molding, casting, milling, stamping, die cutting, 3D printing, laser cutting, bending, cold working, drilling, or other desired processes." Ex. 1006 ¶ 67. While the list is open ended (i.e., "or other desired processes") the POSITA would recognize that the specifically listed options may be tried as predictable potential solutions to the aforementioned problems. Moreover, the POSITA would have had a reasonable expectation of success in pursuing the use of the techniques identified by Slack when manufacturing the expansion chamber assembly 10 of Noonan, including particularly in using the 3D printing option to achieve the benefits of 3D printing discussed herein.

270. Thus, the prior art teaches every element of claims 1 and 2 of the '906 patent except the printing step, and Slack supplies that step explicitly. Three-dimensional printing was a routine engineering tool known to provide faster prototyping, lower cost, and improved modularity and repairability. Based on the similarity of structure and function between the suppressors of Slack and Noonan, a POSITA would have combined their teachings with a reasonable expectation of success.

271. In addition and in the alternative, a POSITA in possession of Noonan would have been motivated to use the techniques of Sclafani, among many reasons,

for improved manufacturing of the suppressor core which reduces manufacturing cost. For example, Sclafani discloses that it may be "necessary to replace the core member after prolonged use", and discloses that "core member can be formed by using a three dimensional printer unit that will create a solid, one piece structure formed of a high strength plastic or metallic material". Ex. 1007 ¶¶ 7-8. Referring to annotated Fig. 3 of Sclafani, reproduced below, Sclafani includes a core member 30 (i.e., core) (highlighted in purple) that is held within the tubular housing 10 (i.e., housing) by the respectively threaded end caps 11, 15 (i.e., the "second cap member 11" being an end cap). This matches the assembly of Noonan's expansion chamber assembly 10 (i.e., firearm suppression system) and retention of the inner tube 20 (i.e., core) between the respective front cap 25 (i.e., end cap) and rear cap 30. See Ex. 1004 Fig. 3a-3c. To replace the core member 30 (i.e., core) (highlighted in purple), either "cap 11 or 15 can be removed and core member 30 withdrawn from tubular housing 10. A new core member may then be placed within the tubular housing 10 and the cap member can be rethreaded into the tubular housing." Ex. 1007 ¶15, Figs. 1-3.



Sclafani, Fig. 3 (annotated)

272. In light of this disclosure, including the similarly inserted and retained cores of Noonan and Sclafani, it is my opinion that a POSITA would have been motivated to make the inner tube 20 (i.e. core) of Noonan using the three dimensional printer of Sclafani to achieve the benefits described by Sclafani, including a strong and replaceable core that would prolong the overall life of the expansion chamber assembly 10 (i.e., firearm suppression system) of Noonan. Moreover, based on the similarity between Noonan and Slack discussed above, it is further my opinion that the POSITA would have been motivated by both Slack and Sclafani to manufacture the inner tube 20 (i.e. core) of Noonan using a three-dimensional printer to achieve the performance improvements suggested by Slack and the longevity improvements suggested by Sclafani.

273. Because Noonan and Sclafani are structurally analogous and perform the same functions, a POSITA would have had reasonable expectation that printing

Noonan's inner tube 20 using Sclafani's method would succeed and improve manufacturability, modularity, repairability, and performance. Accordingly, a POSITA would have been motivated to combine Noonan and Sclafani with a reasonable expectation of success.

274. In addition, it is my opinion that modifying Noonan to include an inner tube 20 (i.e., core) printed with a three-dimensional printer is obvious as a combination of known elements according to known methods to yield predictable results. The prior art discloses each claimed element, with the only difference being the absence of 3D printing being explicitly taught in Noonan, which otherwise includes all features of claim 2.

275. One of ordinary skill in the art would have combined Noonan's expansion chamber assembly 10 with 3D printing by known methods—either printing the existing inner tube 20 or replacing it with a printed version—where the combined elements perform the same functions and use the same techniques as separately known.

276. Sclafani discloses that three dimensional printing is a known technique for creating a suppressor core (Ex. 1007 ¶ 7, 16) and may use "longer lasting materials such as plastics" or "high strength plastic or metallic material." Ex. 1007 ¶ 7. Noonan does not detail its manufacturing process; thus printing its inner tube 20 with Sclafani's method would produce the same structure using a known technique,

already disclosed by Sclafani as "longer lasting" and materially suitable. See Ex. 1007 ¶¶ 4–8.

277. Further, one of ordinary skill in the art would have recognized that printing Noonan's inner tube 20 using a three-dimensional printer as taught by Sclafani would predictably yield a usable equivalent core. Because Sclafani teaches this process as a suitable and even superior replacement for non-printed cores (Ex. 1007 ¶¶ 4–8), its application to Noonan would predictably succeed.

278. Thus, the scope and content of the prior art, as discussed above, includes Noonan's expansion chamber assembly 10 having the structure required by claim 2 of the '906 patent but for three dimensional printing, and Sclafani's method of improving a silencer by introducing a three dimensionally printed core. The POSITA would have had sufficient experience given the closeness of the references and the explicit nature of their teachings to combine Noonan and Sclafani as discussed herein and would have been motivated to do so with reasonable expectation of success.

279. Likewise, modifying Noonan to include at least an inner tube 20 (i.e., core) that is printed with a three dimensional printer is obvious as merely applying a known technique to a known device ready for improvement to yield predictable results and substitution of one known element for another to obtain predictable results.

280. Noonan discloses a base device (i.e., the expansion chamber assembly 10) having every feature of claim 2 except being 3D-printed. Three-dimensional printing is well known in the firearm-suppressor arts as evidenced by Sclafani, which teaches cores "using longer lasting materials such as plastics" or "high strength plastic of metallic material" (Ex. 1007 ¶ 7) and removability of the core (i.e., "[a]fter prolonged use, the core member may be removed and replaced") to allow the silencer to be "reused without incurring an additional tax … after prolonged use." Ex. 1007 ¶¶ 4–8, Abstract. These techniques would improve Noonan in the same manner. Thus, to the extent the firearm suppression system of the '906 patent is seen as an improvement over the device of Noonan in view of the addition of three dimensional printing, Sclafani discloses these limitations being directly applicable to the equivalent structure (i.e., the core) in Scalfani. And these three dimensional printing techniques would improve Noonan in the same manner.

281. Further, a POSITA would have recognized that combining 3D printing with Noonan's inner tube 20 would yield predictable results. As Sclafani discloses, 3D printing produces equivalent or superior suppressor cores (Ex. 1007 ¶¶ 4–8), so applying it to Noonan would predictably produce a usable core and associated components.

282. Applying the known technique of 3D printing would predictably yield an improved system with greater longevity and easy repair as Sclafani discloses.

Even if Noonan used a different manufacturing method, substituting 3D printing would predictably enhance durability and service life. Because both Noonan and Sclafani describe suppressors with removable cores captured by end caps, a POSITA would have a reasonable expectation of success in manufacturing Noonan's inner tube 20 using Sclafani's method.

283. Thus, the prior art includes Noonan's expansion chamber assembly 10 having the structure of claim 2 but for 3D printing, and Sclafani's method of improving a silencer with a printed core. Given the closeness of the references and their explicit teachings, a POSITA would have been motivated to combine Noonan and Sclafani with a reasonable expectation of success.

284. Moreover, the POSITA would have had a reasonable expectation of success when manufacturing at least the inner tube 20 (i.e., core) of Noonan using the combined three dimensional printing techniques of both Slack and Sclafani because all three references concern suppressors with removable cores and compatible geometries.

285. Accordingly, a POSITA would have been motivated to combine Noonan with Slack and Sclafani, including the combination of Slack and Sclafani together, with a reasonable expectation of success.

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

286. Noonan, Slack, and Sclafani disclose the limitations added in dependent claim 2. As described above in Ground 3, Noonan discloses all of the limitations of independent claim 1. Claim 2 merely recites how the core is made (i.e., printed from a three-dimensional printer). However, the specification of the '906 patent does not describe a structural difference in the core itself created by the three-dimensional printer, and claim 2 does not claim the manufacturing process explicitly. To the extent it is argued that printing the core from a three-dimensional printer further limits the subject matter of claim 2 relative to claim 1, it is my opinion that it would be obvious to make at least the inner tube 20 (i.e., core) of Noonan using a three-dimensional printer based on the teachings of Slack and Sclafani, both alone as pairs with Noonan and with all three references in combination.

287. In particular, Slack discloses that "the suppressor or components thereof may be made by machining, such as CNC machining, lathing, molding, such as injection molding, casting, milling, stamping, die cutting, *3D printing*, laser cutting, bending, cold working, drilling, or other desired processes" Ex. 1006 ¶ 67 (emphasis added). Sclafani also discloses that "[c]ore member may be formed by a three dimensional printer such that the core member consist of a one piece, monolithic and homogeneous body." Ex. 1007 ¶ 14. The core member of Sclafani corresponds to the inner tube 20 (i.e., core) of Noonan as described previously.

288. Each of Slack and Sclafani provide a known technique for manufacturing various components of a suppressor, including explicitly the core in the case of Sclafani. The POSITA would have been motivated to use 3D printing, as disclosed by Sclafani and Slack, to manufacture and improve the expansion chamber assembly of Noonan, and the POSITA would have had a reasonable expectation of success and the result of 3D printing Noonan's expansion chamber assembly would have yielded predictable results for the reasons discussed above. Thus, the combination of Noonan, Slack, and Sclafani (as well as the combinations of (a) Noonan and Slack and (b) Noonan and Sclafani) disclose a suppressor having the features of claim 1 wherein the core is printed from a three-dimensional printer.

E. Ground 5: Claims 4 and 9-11 are rendered obvious by Noonan in view of Belykov.

289. For at least the reasons below, claims 4 and 9-11 of the '906 patent are unpatentable as rendered obvious by Noonan in view of Belykov.

Motivation to Combine Noonan and Belykov

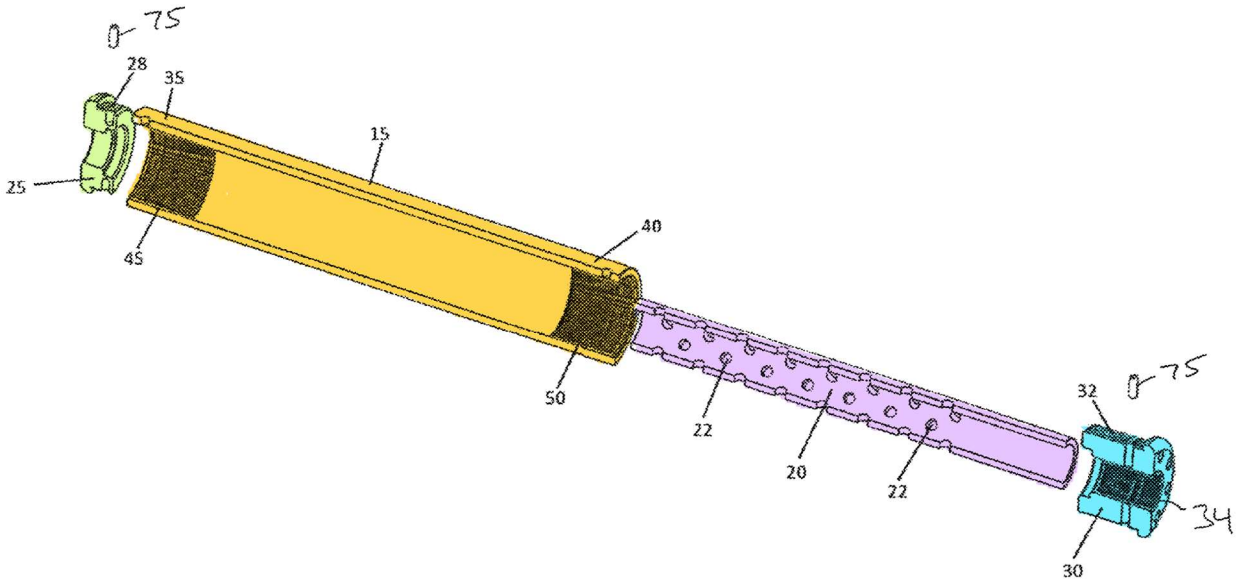
290. It is my opinion that a POSITA would have been motivated to combine Noonan and Belykov, and would have had a reasonable expectation of success. Each are directed to suppressors for firearms that reduce the noise, flash, and other effects of firing the firearm. Ex. 1004 col. 1, ll. 19-30; Ex. 1003 ¶ 6. Noonan, in particular,

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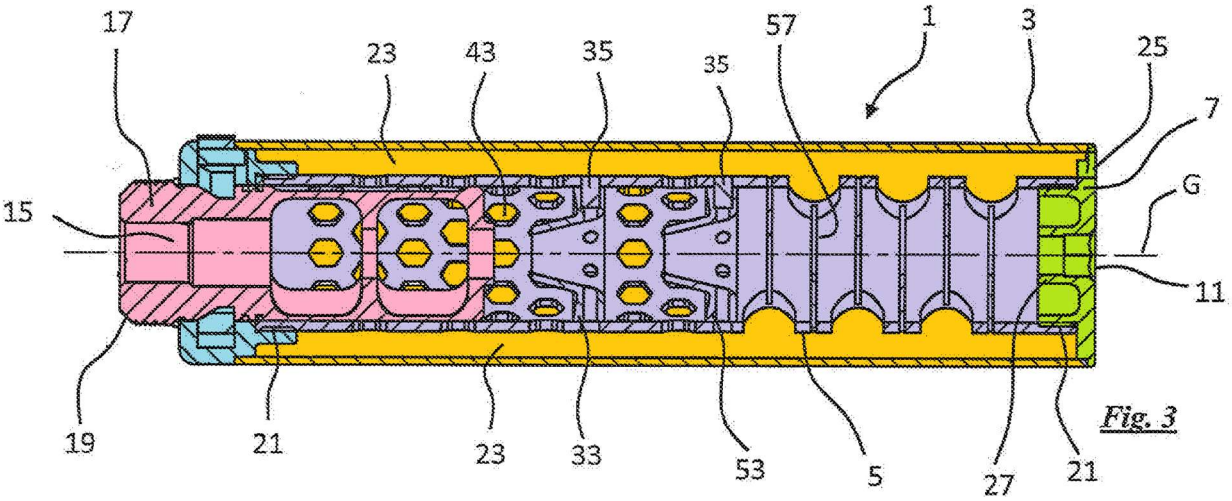
discloses a need for further reducing noise levels, flash and/or recoil when firing a firearm. Ex. 1004 col. 1, ll. 19-30. Belykov, which is in the same field of endeavor of firearm suppressors, discloses several improvements to suppressors that the POSITA would have been motivated to apply to Noonan.

291. Noonan and Belykov are analogous art because they are from the same field of endeavor—firearm suppressors—and address the same problem of improving their performance. Even if it were argued that they were from different subfields, Belykov would still be reasonably pertinent to the problems addressed by Noonan and would still be analogous art.

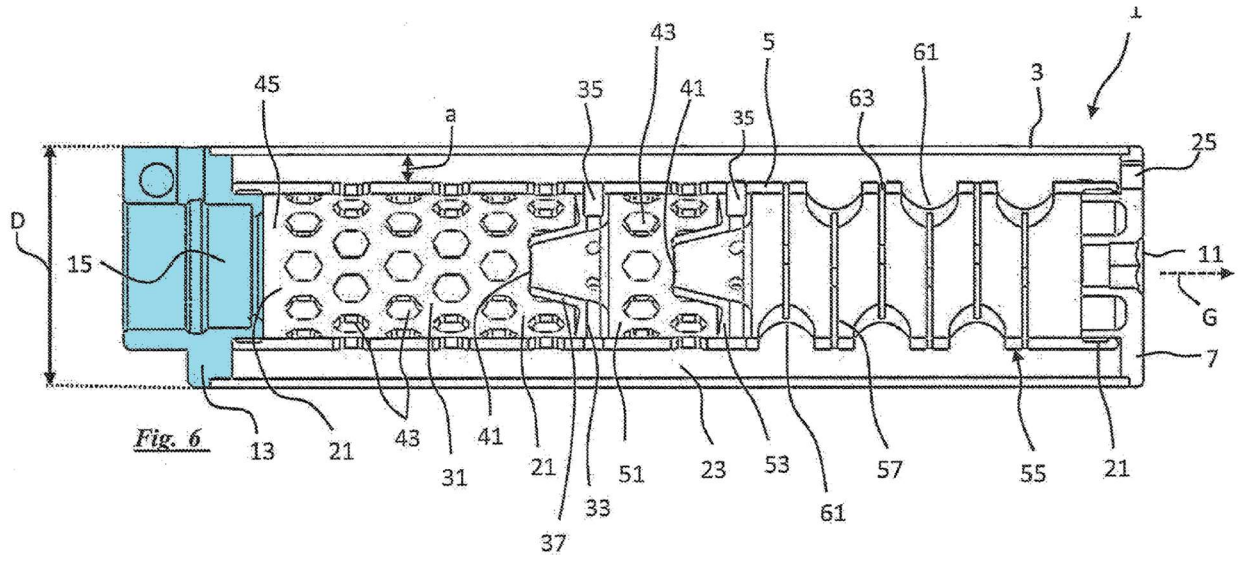
292. Belykov, with reference to annotated Fig. 3 below, *discloses "the face wall 13 on the side* of the firearm *can optionally be replaced by silencer-unrelated components, such as a muzzle brake 17* which can be coupled to the silencer 1 via a detachable fastening device 19." Ex. 1003 ¶ 28 (emphasis added). Comparing annotated Figs. 3 and 6 of Belykov below in light of the foregoing passage, it is clear that the "face wall 13" of Belykov (highlighted in blue) can either directly engage a barrel as a muzzle adapter itself, as shown in Fig. 6, or can be substituted for the unlabeled holding component (highlighted in blue in annotated Fig. 3), which is coupled to a muzzle brake or other "silencer-unrelated components" such as the muzzle brake 17, as shown in Fig. 3.



Noonan, Fig. 3c (annotated)



Belykov, Fig. 3 (annotated)



Belykov, Fig. 6 (annotated)

293. Referring to annotated Fig. 3c of Noonan above and annotated Fig. 3 of Belykov above, each includes a rear component (highlighted in blue) positioned at the rear of their respective housings that engages both their respective core and housing structures - namely, the rear cap 30 (highlighted in blue) in Noonan and the face wall 13 or the substitute therefor (unnamed and unlabeled, highlighted in blue) in Fig. 3 of Belykov. Based on a comparison of the references, including annotated Fig. 3c of Noonan above and annotated Fig. 3 of Belykov above, the POSITA would have been motivated to substitute the component of Belykov at the rear of the outer tube 3 (i.e., the component shown in blue highlighting in Fig. 3) to make the device of Noonan adaptable to receive "silencer-unrelated components", including but not limited to a muzzle brake, between the barrel of the firearm and the rest of the expansion chamber assembly 10 (i.e., firearm suppression system) of Noonan.

294. The POSITA would have known that muzzle brakes reduce the recoil of firing a firearm. They also compliment a silencer by reducing erosion on the silencer baffles. In addition, having multiple options for attaching the suppressor to the firearm as well as having options for additional silencer-unrelated components (e.g., directly to a barrel versus through an intermediate device such as a muzzle brake) would make the suppressor more versatile and would improve the performance of the firearm as well as the ability of the user to choose accessories to add at their discretion. *See* Ex. 1003 ¶28, Figs. 3, 6.

295. The POSITA would have had a reasonable expectation of success with the combination because both describe suppressors with matching design goals of reducing the effects of, among other things, recoil, noise, erosion, and flash, and the muzzle brake or other silencer-unrelated component would be integrated into the device of Noonan according to the known structure shown by Belykov to fulfil its known and conventional design purpose and improve the device of Noonan in the same way as the device of Belykov to resolve a need expressed by Noonan.

296. In addition, it is my opinion that a POSITA would have been motivated to combine Noonan and Belykov by replacing the apertures 22 (i.e., core apertures) of Noonan with the hexagonal openings 43 (i.e., core apertures) of Belykov. Referring back to annotated Fig. 3c of Noonan and annotated Fig. 3 of Belykov shown above, both show core structures having similar structures that would have

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motivated the POSITA to modify one with the teachings of the other. For example, Noonan illustrates an inner tube 20 (i.e., core) (highlighted in purple) held between a front cap 25 (i.e., end cap) (highlighted in green) and a rear cap 30 (highlighted in blue). The inner tube 20 (i.e., core) is designed for "one or more through apertures 22 to allow at least another portion of the expanding gasses to enter the outer 20 tube 15" Ex. 1004 col. 4, ll. 14-20. Noonan further explains that the "through apertures 22 are round, rectangular, oval, circular or any other geometric shape." Ex. 1004 col. 4, ll. 20-22. The gas from the barrel of the firearm passes into the inner tube 25 (i.e., core) and out through a combination of the apertures 22 (i.e., core apertures) in the sidewall of the inner tube 25 in addition to the singular aperture 26 (i.e., projectile aperture) at the front cap 25 (i.e., end cap). Thus, Noonan discloses that numerous geometric shapes may be used for its apertures. This is especially true when one has access to a 3D printer, because non-round shapes, such as hexagonal, suddenly become practical to make without the need for multi-axis CNC machines.

297. Belykov discloses a corresponding structure with improvements for suppressor performance. In particular, referring to annotated Fig. 3 above, Belykov includes an inner tube 5 (i.e., core) (highlighted in purple) that includes "a plurality of honeycomb cell-shaped exchange openings 43 which enable a gas transfer between the projectile channel 45 being margined by the inner tube 5, in particular of the channel expansion chamber 31, and the annular space 23." Ex. 1003 ¶ 34.

Belykov discloses, with respect to the honeycomb shape, that "the special honeycomb hexagonal shape of the exchange openings 43 ensures a high number of relatively large opening cross-sections without substantially destabilizing the inner tube 5." Ex. 1003 ¶ 39.

298. A POSITA would have been motivated to combine Noonan and Belykov to use hexagonal openings for Noonan's apertures 22 (e.g., shaping Noonan's apertures as hexagonal openings and/or replacing the apertures of Noonan with the hexagonal openings of Belykov) both because Noonan states that "any other geometric shape" can be used and because Belykov discloses that "the special honeycomb hexagonal shape of the exchange openings 43 ensures a high number of relatively large opening cross-sections without substantially destabilizing the inner tube 5." Ex. 1003 ¶ 39. A POSITA would have also recognized that hexagonal perforations are readily produced by 3D printing, laser cutting, or other additive processes, allowing easy experimentation with wall geometries without tooling changes. Further, such honeycomb patterns are visually distinctive and often used in modern suppressor design to convey an advanced, high-tech appearance that can increase commercial appeal. These practical and aesthetic motivations would have led a POSITA to adopt the hexagonal openings of Belykov in the structure of Noonan's apertures 22.

299. The POSITA would have had a reasonable expectation of success in combining Noonan and Belykov because both describe suppressors with comparable configurations and objectives—reducing recoil, noise, and flash—and the substitution of one known perforation geometry for another within an analogous structure would be predictable. Given that additive manufacturing readily implements hexagonal perforations and that the geometry maintains strength while increasing perceived sophistication and marketability, a POSITA would a reasonable expectation of success in the combination without undue experimentation. Accordingly, a POSITA would have been motivated to combine, and would have had a reasonable expectation of success in combining, Noonan and Belykov.

300. In addition, it is my opinion that the POSITA would have been motivated to add baffles, as taught by Belykov, to the expansion chamber assembly of Noonan. Belykov describes several sound mitigation elements positioned within the inner tube 5 (i.e., core). For example, Belykov's inner tube 5 (i.e., core) includes a "sound impact plate 33 on the side of the channel expansion chamber" that functions as a "sound reflection element" and is "exchangably attached to the inner tube 5 via a mounting pin 35 and extends from the inside of the inner tube 3 [sic] in a first arm section radially to the inside to which a central section 37 is connected which is designed as a funnel." Ex. 1003 ¶¶ 14-15, 34. Belykov includes a second sound impact wall 53 downstream from and substantially the same structure as the

first sound impact plate 33. Ex. 1003 Fig. 3, ¶41-43, 46. Belykov also includes "second sound reflection elements in the form of a second type of sound impact wall are arranged which are designated in the following as third sound impact walls 57." Ex. 1003 ¶ 44, 46.

301. Thus, similar to Noonan, Belykov includes an inner tube 5 (i.e., core) (highlighted in purple) that extends between a front end wall 7 (i.e., end cap) (highlighted in green) and a rear component (highlighted in blue), which may or may not include a muzzle brake 17 (highlighted in pink), and the inner tube 5 (i.e., core) includes exchange openings 43 (i.e., core apertures) to allow gas into the annular space 23 (i.e., channel) between the outer tube 3 (i.e., housing) and the inner tube 5 (i.e., core). Moreover, Belykov discloses several improvements to this basic design in the form of sound reflection elements, which the POSITA would have understood equate to baffles, the industry-standard term for this structure, for further reducing the sound from the firearm, and hexagonal honeycomb-shaped openings.

302. Noonan discloses that "firearm silencers known in the art have various baffles and intermediate spacers that attempt to decrease the noise level created by the firearm when firing a bullet" and notes that these types of silencers are "heavy, use lots of different types of parts and/or are difficult to assemble thereby making them expensive to manufacture and quite costly for ultimate consumers"; however, in contrast, Noonan notes that "many prior art silencers do not significantly reduce

muzzle flash and/or recoil generated by the firearm when firing the bullet." Ex. 1004 col. 1, ll. 20-30. Thus, while Noonan discusses the undesirable cost and complexity of baffle and spacer based silencers, it also acknowledges that there is a trade-off with suppressor performance and continues to seek a way "to reduce noise levels, flash and/or recoil when firing a firearm". Ex. 1004 col. 1, ll. 29-30. Thus, the POSITA would have appreciated that adding baffles back into the assembly of Noonan, in an instance in which more suppression is desired, would be an acceptable tradeoff to Noonan.

303. A POSITA would have been motivated to apply Belykov's sound reflection elements (i.e., baffles) to the inner tube of Noonan to further improve the sound dampening performance of the expansion by adding one or more sound reflection elements (i.e., baffles). Adding baffles would have been recognized by the POSITA to provide improved the sound and flash suppression in the expansion chamber assembly of Noonan. Moreover, Noonan discloses that there is a tradeoff when using baffles between weight, cost, and complexity, on the one hand, and performance on the other hand (*See* Ex. 1004 col. 1, ll. 19-31), and the POSITA looking for improved performance would have been motivated to balance these considerations further in favor of performance by adding baffles.

304. The POSITA would have had a reasonable expectation of success in applying Belykov's honeycomb-shaped exchange openings 43 (i.e., ports) and

sound reflection elements (i.e., baffles) to Noonan's inner tube 20 (i.e., core) because both describe suppressors with matching design goals—reducing recoil, noise, and flash—using comparable internal flow and venting structures. Belykov discloses that "the special honeycomb hexagonal shape of the exchange openings 43 ensures a high number of relatively large opening cross-sections without substantially destabilizing the inner tube 5" (Ex. 1003 ¶ 39), which directly corresponds to Noonan's plurality of apertures 22 that vent gas from the core to the annular channel. Given these shared purposes and compatible geometries, a POSITA would have recognized that incorporating Belykov's honeycomb openings into Noonan's core would predictably enhance gas flow area while maintaining structural strength. Accordingly, a POSITA would have been motivated to combine, and would have had a reasonable expectation of success in combining, Noonan and Belykov.

305. To the extent it is argued that Noonan does not comprise a muzzle adapter, modifying Noonan to include one as taught by Belykov would be obvious as an "obvious to try" improvement under MPEP § 2143(I)(E), which chooses from a finite number of identified, predictable solutions, with a reasonable expectation of success. At the relevant time, firearms and suppressors commonly used differing thread sizes or pitches, creating a recognized need for adapters to allow interchangeability and attachment of accessories such as muzzle brakes, compensators, and flash hiders. Existing thread adapters provided a finite,

predictable set of solutions—e.g., adapting a 1/2×28 threaded barrel to a 5/8×24 suppressor interface—each well understood in the art. A POSITA, knowing the respective thread geometries of a firearm barrel and suppressor, would have readily designed or selected a compatible adapter to couple the suppressor directly to the barrel or to an intermediate muzzle device, with a reasonable expectation of success.

306. Modifying Noonan to include a muzzle adapter, to the extent it is argued that Noonan does not already, would also be obvious as a combination of prior art elements according to known methods yielding predictable results. MPEP § 2143(I)(A). The prior art collectively discloses each element claimed, with the only distinction being their presence in separate references. For example, Belykov's face wall 13 or its unlabeled coupling component ("detachable fastening device 19") for attaching to "silencer-unrelated components" (e.g., muzzle brake 17) could be incorporated into Noonan's expansion chamber assembly 10 to provide the same attachment function with predictable results. *See* Ex. 1003 ¶28. In such a combination, each element performs the same role as separately in its respective original context, and a POSITA would have recognized that the resulting suppressor would predictably be capable of direct or indirect attachment to a firearm or muzzle device.

307. It is also my opinion that modifying Noonan to have the plurality of core apertures being substantially hexagonal shaped would be obvious. It would be

obvious because there is a teaching, suggestion, or motivation in Belykov that would have led one of ordinary skill to modify Noonan to arrive at the claimed invention. MPEP § 2143(I)(G). For example, Belykov teaches that "the special honeycomb hexagonal shape of the exchange openings 43 ensures a high number of relatively large opening cross-sections without substantially destabilizing the inner tube 5" while also "ensuring a high exchange opening density." Ex. 1003 ¶ 39, 40. There is a reasonable expectation of success that hexagonal shaped exchange openings 43 (i.e. substantially hexagonal shaped plurality of core apertures) could be incorporated into Noonan's inner tube 20 (i.e., core), which would result in increasing the stability of Noonan's inner tube 20 (i.e., core) while also ensuring a high exchange opening density.

308. Modifying Noonan to have the plurality of core apertures being substantially hexagonal shaped would also be obvious because the modification is applying a known technique to a known device ready for improvement to yield predictable results. MPEP § 2143(I)(D). Specifically, Noonan discloses a "base" device upon which the claimed invention can be seen as an "improvement". For example, Noonan's inner tube 20 (i.e., core) comprises through apertures 22 (i.e., a plurality of core apertures) that "are round, rectangular, oval, circular or any other geometric shape." Ex. 1004 col. 5, ll. 1-2. Belykov discloses a known technique that is applicable to the base device of Noonan. For example, Belykov discloses that the

exchange openings 43 (i.e., plurality of core apertures) could be hexagonal shaped, which is applicable to the through apertures 22 (i.e., plurality of core apertures) of Noonan. Ex. 1003 ¶ 39. Applying Belykov's hexagonal aperture configuration to Noonan would have predictably improved flow capacity and maintained core strength. For example, applying the hexagonal shaped core apertures of Belykov to the Noonan device would have "ensure[d] a high number of relatively large opening cross-sections without substantially destabilizing the inner tube 5" while also "ensuring a high exchange opening density." Ex. 1003 ¶ 39, 40.

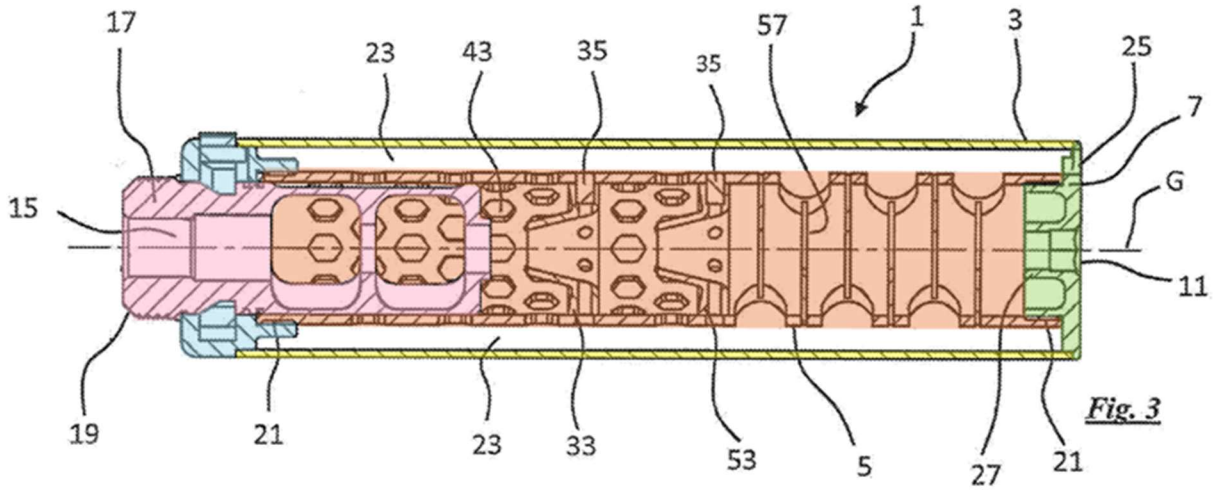
309. It is also my opinion that modifying Noonan to incorporate a core that comprises an inner surface that includes baffles that interact with the plurality of core apertures and are extruded inward would be obvious. It would be obvious because there is a teaching, suggestion, or motivation in Belykov that would have led one of ordinary skill to modify Noonan to arrive at the claimed invention. MPEP § 2143(I)(G). For example, a teaching, suggestion, or motivation, can be found in Belykov, which is also knowledge generally available to one of ordinary skill in the art, to modify Noonan to incorporate baffles on an inner surface of a core that interact with the plurality of core apertures and are extruded inward. For example, Belykov discloses sound impact walls 33, 53, 57 that are described as "sound-reflecting and or -absorbing element[s]". Ex. 1003 abstract. Also, Belykov discloses that the sound impact walls 57 interact with the plurality of core apertures by redirecting muzzle

gas from the channel end chamber 55 radially outward, through the openings 61, 67 (i.e., a plurality of core apertures), and to the annular space 23 (i.e., channel). Ex. 1003 ¶ 43. The term "baffles" refers to an internal component of a firearm suppression system, which improve the suppression effect of the suppression system by disrupting and/or slowing down high-pressure gases that follow a projectile out of a barrel of the firearm suppression system. See e.g., Ex. 1005 ¶ 2 ("Baffles inside the silencer decrease the speed and pressure of propellant gases produced from firing a projectile by trapping gases in chambers formed by the baffles."). As such, having a core comprising an inner surface that includes baffles that interact with the plurality of core apertures and are extruded inward within a suppressor has the known benefit of sound absorption. There is a reasonable expectation of success that incorporating baffles within the core to redirect and slow gas flow would result in additional sound reduction.

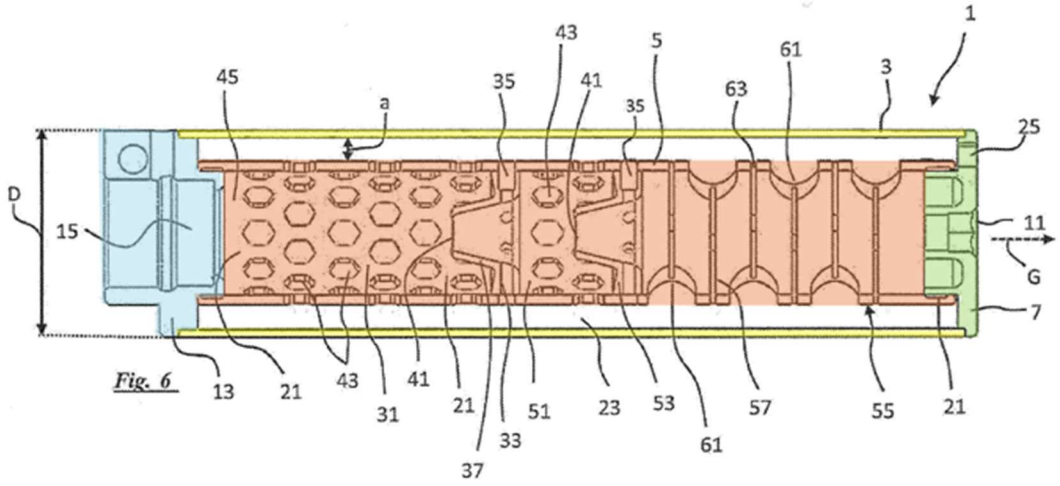
Dependent Claim 4: The firearm suppression system of claim 1, further comprising a muzzle adapter.

310. Noonan and Belykov disclose the limitations added in dependent claim 4. As described above in Ground 3, Noonan discloses a muzzle adapter – specifically one with a threaded interface for attachment to the firearm. To the extent it is argued that Noonan's rear cap 30 does not correspond to a muzzle adapter, Belykov further discloses that its face wall 13, which is similar in structure and purpose to the rear

cap 30 of Noonan, "… the face wall 13 on the side of the firearm *can optionally be replaced by silencer-unrelated components, such as a muzzle brake 17 which can be coupled to the silencer 1 via a detachable fastening device 19*." Ex. 1003 ¶ 28 (emphasis added).



Belykov, Fig. 3 (annotated)



Belykov, Fig. 6 (annotated)

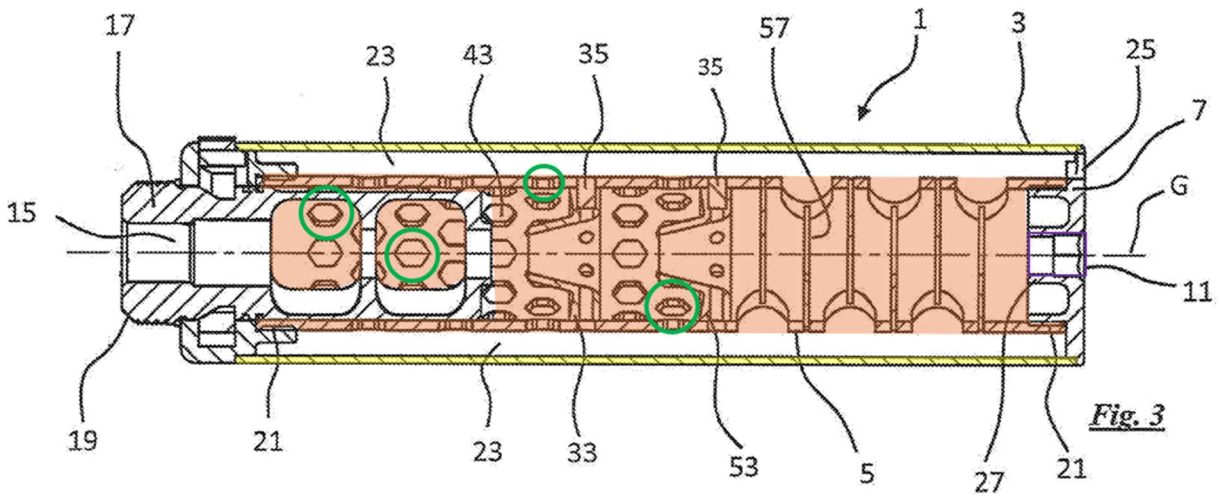
311. A muzzle adapter is a silencer component that allows for a mating to, for example, a threaded barrel on a firearm, a flash suppressor, or muzzle brake that

is already installed onto the barrel of a firearm. They are generally removable so as to allow them to be swapped to adapt to other types of firearms – for example to one with a different thread pitch or made for another type of muzzle device. Belykov discloses that the front face 13 (i.e., muzzle adapter) (highlighted in blue) can be coupled with the firing arm [sic]. Ex. 1003 ¶ 28. Because the front face 13 (i.e., muzzle adapter) can be coupled to a muzzle of a firearm barrel, the front face 13 (i.e., muzzle adapter) corresponds to the claimed muzzle adapter. Further, the front face 13 could be replaced by the muzzle brake 17 (highlighted in pink), and the muzzle brake 17 is held onto the suppressor 1 by the unlabeled component shown above in annotated Fig. 3 (highlighted in blue), and as such, this holding component also equates to at least a portion of the claimed muzzle adapter. The modularity and removability of the components being able to be swapped to adapt the silencer 1 (e.g., firearm suppressor assembly) to engage multiple structures further supports the conclusion that the depicted components (both highlighted in blue) are each muzzle adapters. Moreover, in the embodiment depicted in Belykov's Fig. 3 above, the muzzle brake 17 (highlighted in pink) mates with the muzzle adapter, which therefore is engaged with and adapts and attaches the silencer to the muzzle of the firearm. The component (highlighted in blue in Fig. 3) that replaces the front face 13 (highlighted in blue in Fig. 6) may equate to the claimed muzzle adapter as each

is part of the assembly of components that adapt and affix the silencer to the firearm muzzle.

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

312. Belykov discloses the limitations added in dependent claim 9. As discussed, and as shown in annotated Fig. 3, Belykov discloses an inner tube 5 (i.e., core) (highlighted in orange) that comprises a plurality of bypass and exchange openings 43, 61, 67 (i.e., plurality of core apertures). Ex. 1003 Fig. 3.



Belykov, Fig. 3 (annotated)

313. Belykov discloses that "the special honeycomb *hexagonal shape* of the exchange openings 43 ensures a high number of relatively large opening cross-sections without substantially destabilizing the inner tube 5." Ex. 1003 ¶ 39 (emphasis added). As such, the exchange openings 43 (i.e., plurality of core

apertures) that are "the special honeycomb hexagonal shape" are the plurality of core apertures that are substantially hexagonal shaped.

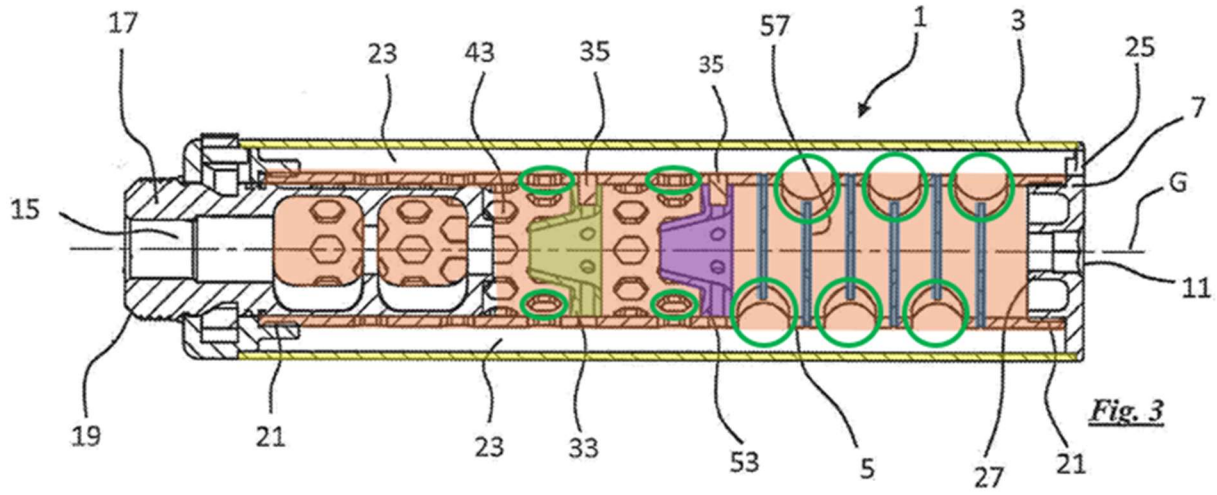
314. Moreover, Noonan discloses that its apertures 22 (i.e., core apertures) can be "round, rectangular, oval, circular or any other geometric shape." Thus, it would be obvious to make the apertures 22 of Noonan a hexagonal shape as disclosed by Belykov and it would similarly be obvious to replace the apertures 22 of Noonan with the exchange openings 43 of Belykov based on their similar purpose and the benefits of a honeycomb shape disclosed by Belykov.

Dependent Claim 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.

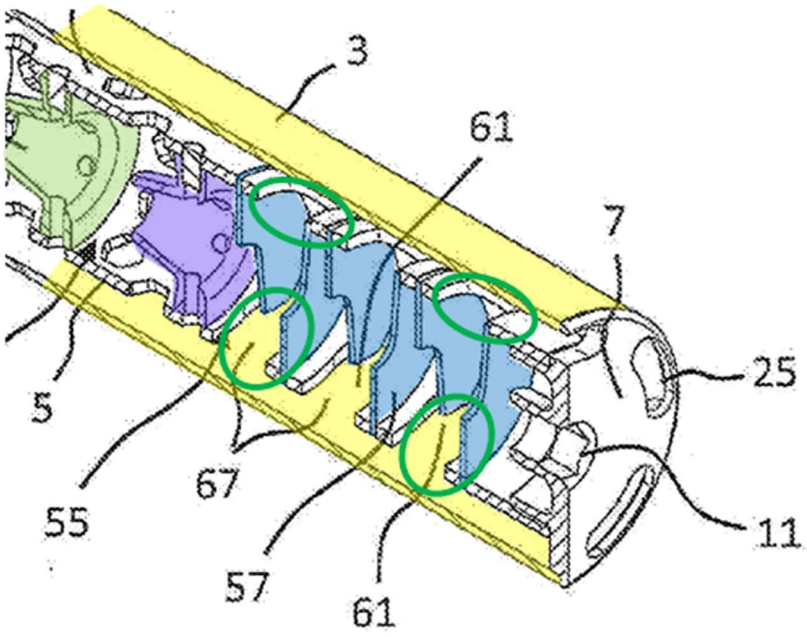
315. Belykov discloses this limitation added in dependent claim 10. As discussed, and as shown in annotated Fig. 3 and the annotated excerpt of Fig. 5, below, Belykov discloses a core that comprises openings 43, 61, 67 (i.e., a plurality of core apertures) (green circles on an exemplary subset of the openings shown below). Ex. 1003 Figs. 3, 5.

316. Belykov also discloses baffles. Specifically, and as shown below in the annotated Fig. 3 and the annotated excerpt of Fig. 5, Belykov discloses a first sound impact wall 33 (highlighted in green), a second sound impact wall 53 (highlighted in purple), and third sound impact walls 57 (highlighted in blue). Ex. 1003 ¶¶ 41,

43, 44; Figs. 3, 5. The sound impact walls are described as "sound-reflecting and or -absorbing element[s]" that each have a "projectile passage opening" that is "coaxial to the projectile entry opening 15 and the projectile exit opening 11." Ex. 1003 abstract, ¶ 46. As shown in the annotated Fig. 3 and the annotated excerpt of Fig. 5, each of the sound impact walls 33, 53, 57 are within the inner tube 5 (i.e., core) (highlighted in orange) at the inner surface of the inner tube 5.



Belykov, Fig. 3 (annotated)



Belykov, Fig. 5 (excerpt, annotated)

317. The term "baffles" refers to an internal component of a firearm suppression system, which improve the suppression effect of the suppression system by, for example, disrupting and/or slowing down high-pressure gases that follow a projectile out of a barrel of the firearm suppression system. See e.g., Ex. 1005 ¶ 2 ("Baffles inside the silencer decrease the speed and pressure of propellant gases produced from firing a projectile by trapping gases in chambers formed by the baffles."). Thus, the sound impact walls 33, 53, 57 are baffles in the plain and ordinary meaning of the term, and the inner surface of the inner tube 5 (i.e. core) includes the baffles.

318. Belykov also discloses that the baffles interact with the plurality of core apertures. For example, Belykov discloses that the third sound impact walls 57 (i.e.,

baffles) (highlighted in blue) interact with the openings 61, 67 (i.e., a plurality of core apertures). Specifically, Belykov explains that:

> [f]rom the slit mounting, the *third sound impact wall 57* extends almost completely to the opposite end and forms there an axial bypass opening 61 which *radially* ends in the projectile passage opening 41. In combination with the axial bypass opening 61, an additional type of exchange opening 67 is formed opposite it in the inner tube 5 which is *radially opposite the bypass opening 61* of the sound impact wall 57, wherein the additional exchange opening is designated as second exchange opening 67. The second exchange opening 67 has a long form *extending in circumferential direction* which ends are rounded off.
>
> The muzzle gas reaching the channel end chamber 55 which enters over the projectile passage opening 41 from the channel intermediate chamber 51 into the channel end chamber 55 is at least partially *redirected by the third sound impact wall 57 radially to the outside and reaches the second exchange opening 67 in the annular space 23*. This muzzle gas can also reach via the annular space 23 and the respective venting openings 25 the outside of the silencer 1.

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Ex. 1003 ¶¶ 47-48 (emphasis added). The third sound impact walls 57 (i.e., baffles) redirect muzzle gas from the channel end chamber 55, which is "margined by the second sound impact wall 53 and in circumferential direction by the inner tube 5," radially outward, through the openings 61, 67 (i.e., a plurality of core apertures), and to the annular space 23 (i.e., channel). Accordingly, the third sound impact walls 57 (i.e., baffles) interact with the openings 61, 67 (i.e., a plurality of core apertures). Ex. 1003 ¶ 43.

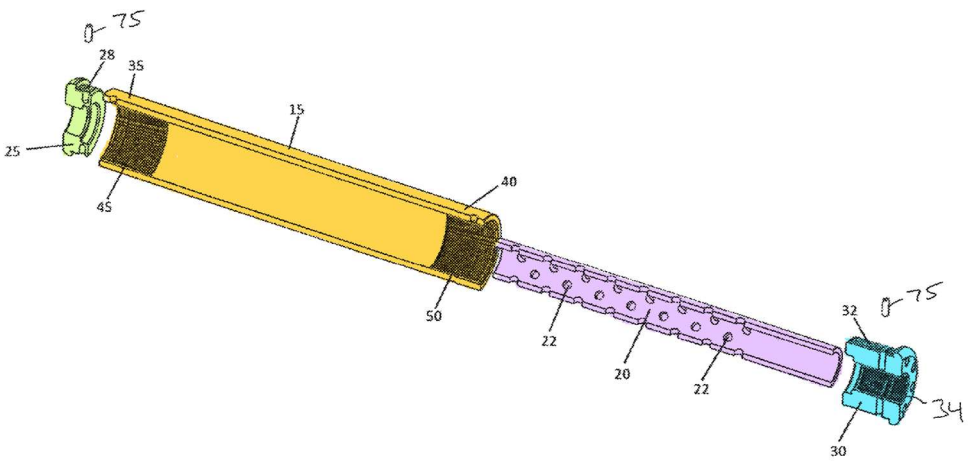
319. Also, the first and second sound impact walls 33, 53 (highlighted in green and purple, respectively) interact with the openings 43 (i.e., a plurality of core apertures). For example, Belykov discloses that:

> [t]he first sound impact plate 33 on the side of the channel expansion chamber is exchangably attached to the inner tube 5 via a mounting pin 35 and *extends from the inside of the inner tube 3* in a first arm section radially to the inside to which a central section 37 is connected which is *designed as a funnel*. The funnel-formed central section 37 *extends in a tapering manner contrary to the projectile flight direction G* to the front wall 13 and defines coaxially a first passage opening 41.

Ex. 1003 ¶ 34 (emphasis added). Belykov also discloses that "second sound impact wall 53 […] is designed identical to the first sound impact wall 33 in form and mounting." Ex. 1003 ¶ 41.

320. As shown in the annotated Figs. 3 and 5, at least a portion of the muzzle gas would move forward (left-to-right in Fig. 3), impact the first and second sound-impact walls 33 and 53, and then be redirected by those walls toward and through the openings 43 (i.e., the plurality of core apertures). Openings 43 are adjacent both the first sound impact wall 33 and the second sound impact wall 53 for receiving diverted gas therethrough. Because of this redirection of the muzzle gas by the sound impact walls 33, 53 the first and second sound impact walls 33, 53 (highlighted in green and purple, respectively) interact with the openings 43 (i.e., a plurality of core apertures).

321. Moreover, referring to annotated Fig. 3c below, Noonan depicts an inner surface of its inner tube 20 (i.e., core) (highlighted in purple). Ex. 1004 Fig. 3c. The inner surface is generally smooth and cylindrical, matching the same general shape as Belykov's inner tube 5 (i.e., core) without the above-described baffles. Ex. 1004 Fig. 3c; Ex. 1003 Figs. 3, 5. It would therefore be obvious to add baffles to Noonan as taught by Belykov, such that Noonan comprises an inner surface that includes baffles that interact with the plurality of core apertures.



Noonan, Fig. 3c (annotated)

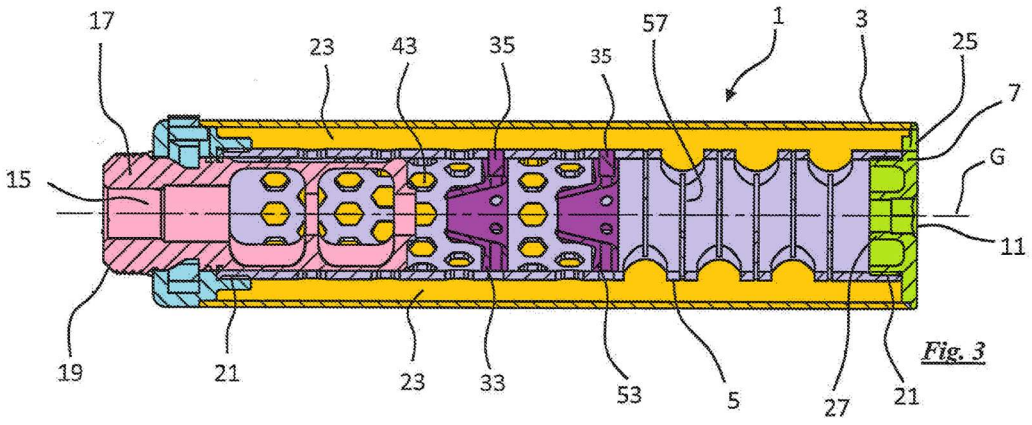
Dependent Claim 11: The firearm suppression system of claim 10, wherein the baffles are extruded inward.

322. Belykov discloses this limitation with the illustrations of the sound impact walls 33, 53, 57 (i.e., baffles). The '906 patent uses the term in the description as follows: "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." Ex. 1001 col. 3, ll. 14-17. We can see that the '906 patent means that the shapes protrude inward at an angle. In computer-aided design ("CAD"), extrusion is a tool for generating or expanding a three dimensional part from a two dimensional profile by displacing the profile along an axis perpendicular to the profile, or sometimes along a path. For example, Solidworks - probably the most commonly used CAD tool for silencer design - calls this tool "Extrude Boss/Base." Fusion (formerly known as Fusion 360), simply calls it "Extrude."

Alternatively, in the manufacturing context, "extrusion" may refer to a high-pressure die-based forming process (i.e., not 3D printing).

323. In either of the foregoing instances, "extrusion" refers to the method by which the shape of the component is formed or designed to achieve a resulting shape, and not a manufacturing method for the final product. Given that the '906 patent discloses three dimensional printing but not a high-pressure die-based manufacturing process, the baffles being "extruded" inward refers to the baffles "extending" inwardly, such as might be created by using the extrude function for the CAD model of the part. The plain and ordinary meaning of "inwardly" in the firearm suppressor arts could either refer to the direction toward the shooter (e.g., aft towards the firearm muzzle), or radially inward. For example, the '906 patent describes, with respect to the end cap 110, that the "end cap 100 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." Ex. 1001 col. 6, ll. 26-29. With respect to the baffles, the '906 patent states that "[t]hese baffles 608 may be extruded inward, toward a muzzle when coupled to a firearm, at various prescribed angles" thus confirming my understanding of the term "inward" as used in the '906 patent. Ex. 1001 col. 10, ll. 51-53. Belykov's baffles are extruded both inward toward the shooter and also inward radially.

324. Belykov discloses that at least the third sound impact walls 57 are extruded radially inward. Belykov discloses that at least the first set of sound impact walls 33, 53 (i.e., baffles) are extruded inward towards the shooter and radially inward. Specifically, Belykov discloses that "[t]he first sound impact plate 33 on the side of the channel expansion chamber is exchangably attached to the inner tube 5 via a mounting pin 35 and extends from the inside of the inner tube 3 in a first arm section radially to the inside to which a central section 37 is connected which is designed as a funnel." Ex. 1003 ¶ 34. Belykov then explains that the "funnel-formed central section 37 extends in a tapering manner contrary to the projectile flight direction G to the front wall 13 and defines coaxially a first passage opening 41." Ex. 1003 ¶ 34. Said differently, the funnel extends inwardly towards the front wall 13, the muzzle of the firearm, and the shooter. Referring to annotated Fig. 3 of Belykov below, the funnel shape of the sound impact plates 33, 53 (i.e., baffles) (highlighted in dark purple) extends both radially towards the center axis of the silencer 1 (e.g., firearm suppression system) and rearward (i.e., inwardly) towards the muzzle end of the suppressor.



Belykov, Fig. 3 (annotated)

F. Ground 6: Claims 1, 2, 4, 10, and 11 are rendered obvious by Muceus in view of Slack.

325. For at least the reasons below, claims 1, 2, 4, 10, and 11 of the '906 patent are unpatentable as rendered obvious by Muceus in view of Slack.

Motivation to Combine Muceus and Slack

326. Muceus and Slack are analogous art because they are from the same field of endeavor and address the same problem—improving firearm suppressors. Even if one were to argue that Muceus and Slack were not from the same field of endeavor, Slack would still be reasonably pertinent to the problems addressed by Muceus, and vice versa.

327. A POSITA would have been motivated to combine the teachings of Muceus and Slack because both references are directed to the same field of endeavor,

firearm suppressors, and address similar problems related to noise and gas management in firearm suppression systems. Ex. 1005 ¶ 2; Ex. 1006 ¶ 2, 4. Indeed, both disclose firearm suppressors having at least cores manufactured by three dimensional (i.e., 3D) printing. Ex. 1005 ¶ 29; Ex. 1006 ¶ 67. Both Muceus and Slack disclose suppressors comprising a cylindrical housing, a core positioned within the housing, and an end cap that attaches to the distal end of the suppressor. Ex. 1005 ¶¶ 25, 59; Ex. 1006 ¶¶ 42, 63, 64, Figs. 9, 10. Muceus discloses an endcap attached to the exit end (i.e., distal end) of the suppressor in substantially the same location as Slack's end cap, but does not explicitly describe a projectile aperture even though one is implied due to the nature of it being a firearm sound suppressor. Ex. 1005 ¶ 59, Fig. 13; Ex. 1006 Fig. 9.

328. Slack also teaches that its end cap 160 includes a bore 41, which allows the projectile to exit the suppressor. Ex. 1006 ¶¶ 63, 64, Figs. 9-10. Specifically, referring to the embodiment of Fig. 2 showing a unified core (i.e., internal component 24) and end cap (i.e., "distal flange 60" labeled in Fig. 5), Slack states that "[t]he distal bore segment 21 has an open distal end, through which firearm projectiles may exit the bore 41 of the suppressor 20." Ex. 1006 ¶ 44. In the embodiment of Figs. 9-10, referenced above, the same bore 41 is again shown in the end cap 160 and otherwise is not modified, with Slack noting "other than the noted differences, all information regarding the suppressor 20 [shown in Fig. 2] applies to

the suppressor 120 [shown in Fig. 9], and vice versa." Ex. 1005 ¶ 65, Figs. 2, 5, 9-10. Thus, the bore 41 of the end cap 160 of Slack is used to allow projectiles to exit.

329. A POSITA would have recognized that an endcap with a projectile aperture or adding such a projectile aperture to an end cap are well-known features of a firearm suppressor, as the projectile aperture allows the projectile to pass out of the suppressor without damage to the silencer, while reducing the visible flash, and without deflecting the projectile. To the extent one is not described in Muceus (though one would inherently be present as discussed herein), Slack would provide the motivation and suggestion for improving the device of Muceus by including such an aperture in the end cap of Muceus or alternatively replacing the end cap of Muceus with an end cap having a projectile aperture because Slack discloses that its end cap includes a bore (i.e., projectile aperture) for projectiles to exit and Muceus needs an exit path for projectiles that enter its suppressors. There actually are historical firearm sound suppressors that do not have a pre-formed aperture. For example, some pistol silencers, such as the WWII-era Welrod, had "wipes" that were rubber or urethane discs that the projectile would form a hole on the first shot – the advantage being that they were very well sealed and that made them quieter. The main disadvantage is that they would wear out after 10-15 shots and lose their ability to suppress sound effectively. There has also been controversy on if is legal to replace such parts. In 1999, the ATF issued the "Bardwell" opinion letter, saying it

was ok to replace such wipes, but in March of 2017 (prior to the '906 patent), they changed their mind and decided that replacement of such a part would require a $200 NFA tax each time. As such, forming an aperture prior to firing, as all sound suppressor do in modern times with the exception of a few reproductions of historical designs such as Welrod re-creations, is a given because there is no costly NFA tax to deal with to replace the rubber end caps after each use and the durability issues associated with designs such as the Welrod are avoided. There is one other example of a "shoot through" design without a pre-formed aperture: Some have been known to improvise firearms sound suppressors by adapting automobile engine oil filters to thread onto the muzzle of the firearm. Upon the first shot, the projectile would penetrate the thin steel shell of the filter. Of course this was a destructive process, and there is no market to sell such a device other than as a $15 thread adapter of questionable legality. Therefore, a POSITA would have been motivated to incorporate an aperture to allow for the projectile to exit the sound suppressor without impacting the end cap when the first round is fired, which both improves accuracy and saves from having to exchange incredibly expensive (via taxation) parts after each few shots.

330. Combining the endcap with a projectile aperture from Slack with the suppressor assembly of Muceus would have been straightforward for a POSITA, as both references describe corresponding suppressor architectures and components.

See Ex. 1005 ¶¶ 25, 59, Fig. 13; *and see* Ex. 1006 ¶¶ 42, 63, 64, Figs. 9-10. Modifying Muceus' end cap to include a projectile aperture would merely involve incorporating a bore 41 (i.e., projectile aperture) in the endcap of Muceus to allow passage of the projectile, as taught by Slack, which is a typically essential design choice in the art of firearm suppressors.

331. A POSITA would have had a reasonable expectation of success in making this combination because both references provide descriptions of suppressor components and both already include end caps at the distal ends of the core, and the addition of a projectile aperture to the endcap would not require undue experimentation or inventive skill, in addition to being inherently present in Muceus as discussed herein. The inclusion of a projectile exit aperture in the end cap of Muceus is an inherent and fundamental feature of the end cap and would have been recognized as such by a POSITA. The lack of explicit discussion of the projectile aperture in Muceus likely reflects the fundamentality of this feature in its suppressor design rather than any substantive distinction, as the suppressor of Muceus without a projectile exit in its end cap would be inoperable for its intended purpose.

332. Additionally, Slack discloses that the end cap 160 includes the bore 41 (i.e., projectile aperture) and a threaded bore 172 that is configured to threadingly engage with a threaded portion 170 disposed on a distal end of the body portion 40 (i.e., core). Ex. 1006 ¶ 63. The external component 22 (i.e., housing) can be captured

between a flange 162 of the end cap 160 and a flange 150 of the internal component 124 (i.e., core). Ex. 1006 ¶ 63. As such, a POSITA would have been motivated to modify Muceus to have the endcap of Slack —with a threaded component comprising a bore engaging the distal end of Muceus' core 1330—to retain the main body (i.e., housing) within the assembly by replacing the end cap 1360 (i.e., end cap) of Muceus with the end cap 160 (i.e., end cap) of Slack. Notably, the core 1108 (i.e., core) depicted in Fig. 11 of Muceus includes a protrusion at a distal end that could be modified to threadingly engage with a threaded bore on an end cap, as disclosed in Slack. Ex. 1005 Fig. 11; Ex. 1006 Fig. 10. Thus, modifying Muceus to include an end cap and bore as disclosed in Slack would have been straightforward for a POSITA. The motivation would arise from standard suppressor practice—providing a projectile aperture to allow bullet passage and minimize flash and pressure damage—an inherently required feature in the end cap design. The modification would also have a reasonable expectation of success without undue experimentation because both references already disclose end caps at the distal ends of their cores and show compatible structures for threaded attachment.

333. Furthermore, both Muceus and Slack are analogous art because they are directed to the same problem—reducing noise and managing gas flow in firearm suppressors—and they both already include end caps that allow projectiles to exit their respective suppressors, such that a POSITA seeking to improve or modify a

suppressor design would have naturally looked to references such as Slack for solutions to common design requirements, such as providing a projectile aperture in the endcap. Ex. 1005 ¶¶ 2, 25, 59; Ex. 1006 ¶¶ 2, 4, 42, 63, 64. The combination of Muceus and Slack would have been obvious to a POSITA because of the shared field of endeavor, the analogous nature of the references, and the routine nature of the proposed modification, and the POSITA would have both been motivated to make the combination and had a reasonable expectation of success based on the foregoing considerations and the predictable nature of the combination.

334. Slack's exploded view (Fig. 9) shows an external component 22 (i.e., housing) with an open distal end and an internal component 124 (i.e., core) inserted from the proximal end, demonstrating a housing having apertures at both ends (i.e., a first aperture at a first end and a second aperture at a second end). Ex. 1006 Fig. 9. Thus, Slack provides direct motivation to configure Muceus' main body with a first aperture at the first end and a second aperture at the second end so that Muceus' core can be inserted from one end and the housing receives a cylindrical internal component consistent with Slack's construction.

335. Because Muceus and Slack both employ cylindrical housings and internal cores for managing expanding gases, the combination would have a reasonable expectation of success and predictable results without undue experimentation. A POSITA would have therefore reasonably expected that

modifying Muceus' housing to include end apertures as in Slack would be structurally compatible and would improve manufacturability and functional integration. Accordingly, a POSITA would have been motivated to combine, and would have had a reasonable expectation of success in combining, Muceus and Slack..

336. Slack and Muceus both use cylindrical housings, a shape long favored in suppressor design for its mechanical and manufacturing advantages. Cylinders are simple to machine using standard lathe and milling processes, provide rotational symmetry for ease of mounting, and resist deformation under internal pressure because the load is evenly distributed across the wall. The uniform circular cross-section also promotes consistent gas expansion and flow, reducing turbulence and improving sound attenuation. A POSITA would have therefore recognized that combining the cylindrical housing teachings of Slack with Muceus would naturally yield a structure having an inner compartment of substantially constant circumference from the first end to the second end, improving both manufacturability and pressure handling.

337. Because both references show substantially the same cylindrical housing shape and employ internal convoluted flow paths for gas suppression, a POSITA would have had a reasonable expectation that providing Muceus with an inner compartment of constant circumference (between its end apertures) would

predictably improve performance. Accordingly, a POSITA would have been motivated to combine, and would have had a reasonable expectation of success in combining, Muceus and Slack without undue experimentation, and the resulting combination would include a housing having an the inner compartment being substantially the same circumference from the first end to the second end.

338. Cores are high-precision elements subject to wear, fouling, and damage, and a non-removable core renders a suppressor difficult or impossible to service. Slack's teaching that cores can be made removable and separately manufactured (including by 3D printing) provides clear motivation to make Muceus' core removably attachable so it can be cleaned, replaced, or optimized independently. This modularity also simplifies manufacturing and reduces lifecycle cost, giving a POSITA practical reasons to adopt Slack's approach.

339. Given that both Muceus and Slack depict separate cylindrical housings and removable internal components (see Ex. 1005 Fig. 13; Ex. 1006 Fig. 9) and share the same functional objective of suppressing propellant gases, a POSITA would have a reasonable expectation of success in combining Muceus and Slack based on these teachings, and the POSITA would have reasonably expected that making Muceus' core removable would be predictable and advantageous. A removable core allows direct access for cleaning carbon buildup, inspection for erosion or cracking, and replacement of worn internal parts without discarding the entire suppressor. It also

simplifies experimentation and modularity—different core geometries can be swapped for tuning back pressure or sound characteristics without redesigning the housing. From a manufacturing standpoint, separable cores enable independent production and inspection of the precision inner component and the outer housing, reducing cost and scrap rates. Thus, a POSITA would have been motivated to combine, and would have had a reasonable expectation of success in combining, Muceus and Slack.

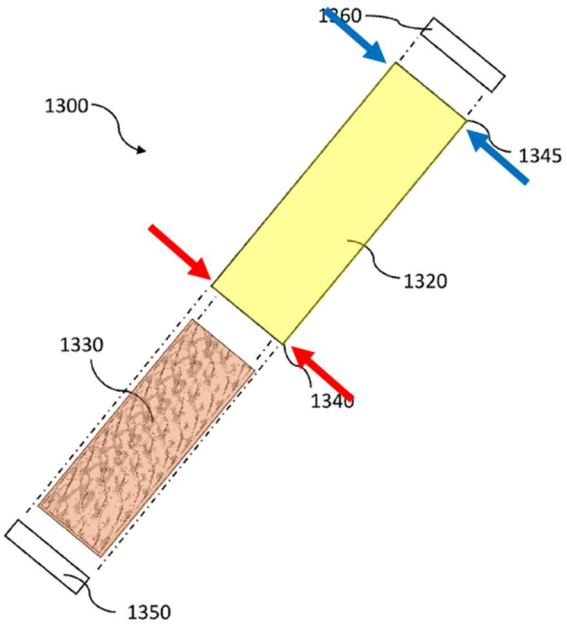
Independent Claim 1

Claim 1, Element [1.pre]: A firearm suppression system comprising:

340. To the extent the [1.PRE] is limiting, Muceus discloses this limitation. Muceus discloses "[s]uppressors for firearms". Ex. 1005 abstract. Muceus states that the suppressors "achieve superior noise reduction." Ex. 1005 ¶ 34. Similarly, the '906 patent discloses that the firearm suppression system results in "reduced sound." Ex. 1001 col. 3, ll. 23. The suppressors for firearms of Muceus is a claimed firearm suppression system, for example, because the functions of the suppressors of Muceus correspond to the function of the firearm suppression system of the '906 patent.

Claim 1, Element [1.1]: a housing comprising a first end and a second end,

341. Muceus discloses this limitation. Muceus discloses that the suppressors (i.e., firearm suppression system) comprise a "*cylindrical*" body that is an "*outer tube*", which a suppressor core is positioned within. Ex. 1005 ¶ 51, 59 (emphasis added). The suppressors have an entry end 1340 and an exit end 1345 that is opposite of the entry end 1340. Ex. 1005 ¶ 59, Fig. 13. Similarly, the '906 patent discloses that "[t]he housing 102 may be *cylindrical-shaped*" and that "[t]he core 112 may be removably attachable to the housing 102 and *positioned within the inner compartment 122 of the housing 102*." Ex. 1001 col. 5, ll. 27-28; col. 6, ll. 53-55 (emphasis added). The housing 102 has a first end that is near a muzzle adapter and a second end that is opposite the first end. Ex. 1001 col. 5, ll. 60-64.

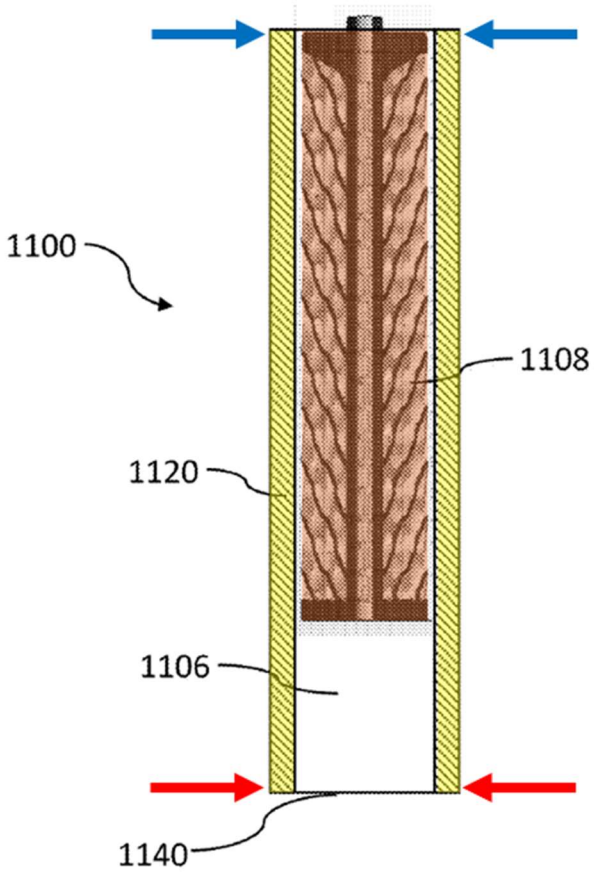


Muceus, Fig. 13 (annotated)

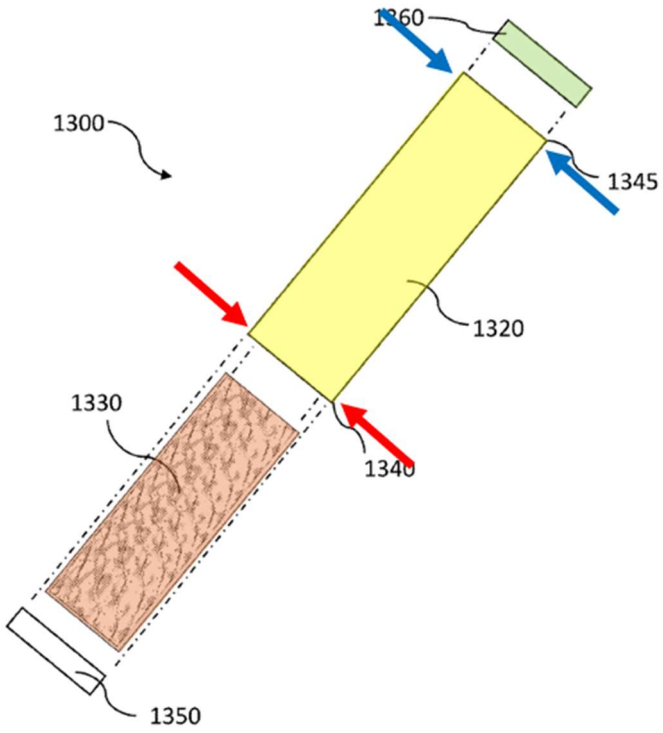
342. The structure and function of the main bodies of the suppressors (i.e., firearm suppression system) of Muceus corresponds to the structure and function of the housing 102 of the ’906 patent. Thus, Muceus discloses a main body (i.e., housing) (highlighted in yellow) comprising an entry end (i.e., first end) (red arrows) and an exit end (i.e., second end) (blue arrows), as depicted in the annotated Fig. 13. Ex. 1005 Fig 13.

Claim 1, Element [1.1a]: the housing comprising: a first aperture at the first end, a second aperture at the second end;

343. Muceus discloses this limitation. Muceus discloses that the main bodies (i.e., housing) of the suppressors (i.e., firearm suppression system) are *cylindrical bodies* and an “*outer tube*”. Ex. 1005 ¶ 51, 59 (emphasis added). Annotated Fig. 11 below depicts a main body 1120 (i.e., housing) having an entry end 1140 (i.e., first end) (red arrows) and an exit end (i.e., second end) (blue arrows) that are each open. Ex. 1005 Fig. 11. Fig. 13 of Muceus, as annotated and shown below, similarly shows main body 1320, also described as an “outer tube”, and a ”suppressor core 1330 that is inserted into the body 1320”. Ex. 1005 ¶ 59, Fig. 13.



Muceus, Fig. 11 (annotated)



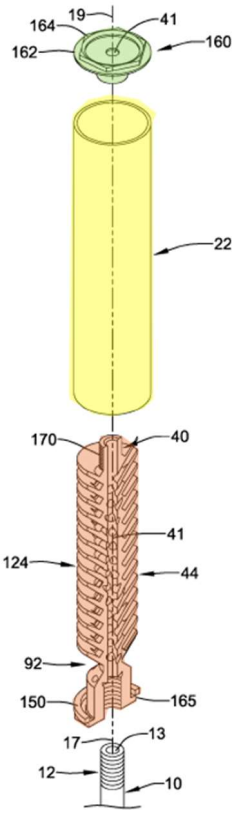
Muceus, Fig. 13 (annotated)

344. Describing the main body as a tube or as cylindrical in shape and showing the core being insertable into the main body with a baseplate 1350 and end cap 1360 at either end means that the main body has apertures at the entry end (i.e., first end) (red arrows) and the exit end (i.e., second end) (blue arrows), which is confirmed by the cross-sectional view of Fig. 11. Ex. 1005 Fig. 11.

345. Thus, the main body 1120 as illustrated in Fig. 11 shows the first aperture and a second aperture. Fig. 5 of Muceus shows the same apertures at each end of the housing, and the embodiment of Fig. 13 similarly discloses that the "suppressor core 1330 is inserted into the body 1320" and has corresponding entry and exit ends 1340, 1345, which includes apertures through which the core is

inserted. Each of the embodiments of Fig. 1, 4, 5, 11, and 13 of Muceus use the same corresponding terminology (e.g., main body 120 of Fig. 1, main body 420 of Fig. 4, main body 520 of Fig. 5, main body 1120 of Fig. 11, and main body 1320 of Fig. 13) to describe their main bodies and, as such, each would have corresponding openings and thus a corresponding aperture. Ex. 1005 Figs. 1, 4, 5, 11, and 13. Alternatively, it would be obvious to make the main body 1320 of Fig. 13 of Muceus with a first aperture at the first end, a second aperture at the second end to accommodate the core therein.

346. For the avoidance of doubt, Slack also discloses a first aperture at the first end, a second aperture at the second end. For example, and as shown in Slack's annotated Figs. 9, 3, and 4, below, Slack discloses an external component 22 (i.e., housing) (highlighted in yellow) that "may include or be made of a generally cylindrical member including an outer surface 30, an inner surface 28, and defining an inner lumen 26" that is designed to house at least a portion of an internal component 124 (i.e., core) (highlighted in orange). Ex. 1006 ¶ 42; Fig. 3, 4, 9.



Slack, Fig. 9 (excerpt, annotated)

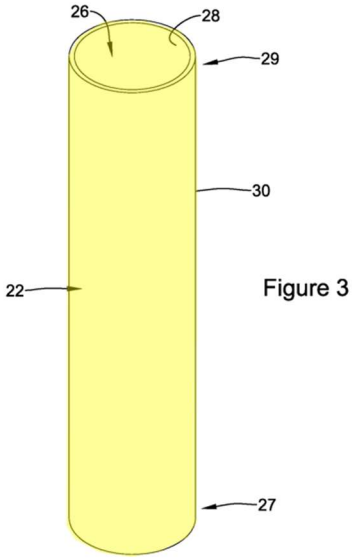


Figure 3

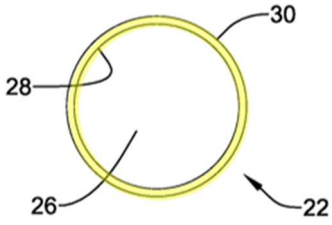


Figure 4

Slack, Fig. 3 (annotated) **Slack, Fig. 4 (annotated)**

347. Slack also discloses in the exploded view of Fig. 9 that the internal component 124 (i.e., core) would be inserted into a proximal end of the external component 22 (i.e., housing), and that the distal end of the external component 22 (i.e., housing) is open. Ex. 1006 Fig. 9. As such, Slack discloses an external component 22 (i.e., housing) that comprises a first aperture at the first end and a second aperture at the second end. Thus, the main body 1320 in Muceus includes a first aperture at the first end and a second aperture at the second end as a structure configured to facilitate assembly of the core with the main body, and for the avoidance of doubt, Slack would have motivated the POSITA to include apertures in either end of a main body in the cylindrical configuration disclosed by Slack. Moreover, given that both Muceus and Slack use cylindrical outer structures (i.e., the main body and external component, respectively) and internal components for suppressing the high pressure gas from a firearm, the combination would have had predictable results without undue experimentation. Thus, Muceus discloses a housing having a first aperture and a second aperture, and it would further be obvious to make any housing of Muceus (e.g., main body 1320) such that it comprises a first aperture at the first end, a second aperture at the second end, as disclosed by Slack.

Claim 1, Element [1.1b]: [the housing comprising:] 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;

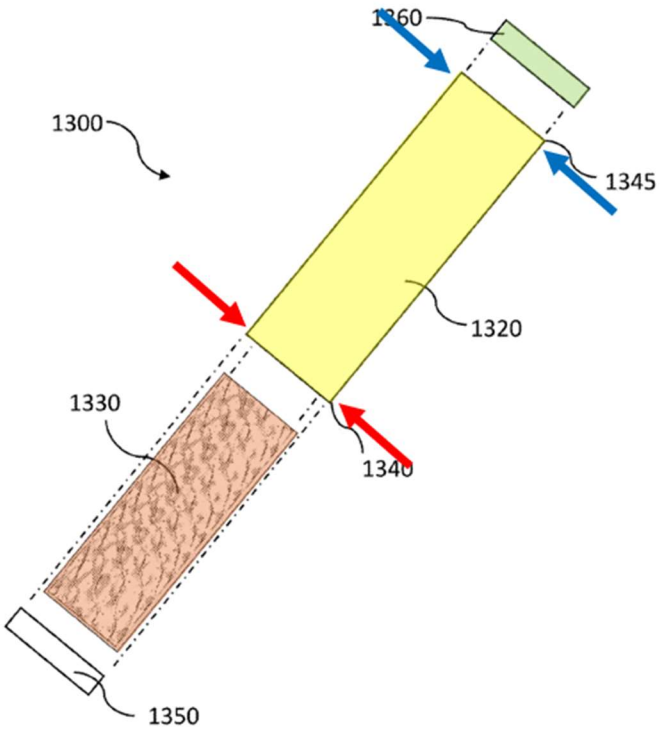
348. Muceus discloses this limitation. Muceus discloses that "[in] some embodiments, a noise suppressor for a firearm includes a *cylindrical body extending along a longitudinal direction*", the inner portions 570 and 670a-c and outer portions 580 are "*annular cylinders*", the TPMS structures of suppressor cores 300a-c and 400 are "*cylindrical*", and the TPMS structure of Figs. 7A-7C are "positioned around a central axis of the cylindrical suppressor and arranged circumferentially, fanning out around the center bore" . Ex. 1005 ¶¶ 4-6, 31-32, 40, 51-53 (emphasis added). Further, *the main body* 1320 (i.e., housing) of Fig. 13 is described as an "*outer tube*", which, in combination with the foregoing teachings and the teachings described with respect to claim 1, element [1.1a], means that the main body has a uniform inner circumference along its length. Ex. 1005 ¶ 59 (emphasis added).

349. Also, the cores that are housed within the main bodies (i.e., housing) of the suppressors (i.e., firearm suppression system) are depicted as having a circumference that is substantially the same along the lengths of the cores. Ex. 1005 Figs. 3, 12. As such, and as depicted in annotated Fig. 13, below, the main bodies (i.e., housing) (highlighted in yellow), which house cores with circumferences that are substantially the same along their lengths, would have an inner wall that has a circumference that is substantially the same along its length based on the

descriptions of the main bodies (e.g., "cylinder", "tube", etc.), their depiction in the figures, and their ability to accommodate the cylindrical cores. *See* Ex. 1005 Figs. 11, 13.

350. As additional confirmation, I measured original Figs. 11 and 13 from the published Muceus patent application publication with a caliper and confirmed that the exterior of main body 1320 of the exploded view of Fig. 13 is rectangular via verifying that each pair of opposing sides have equal lengths and the lengths of the respective diagonals are equal, and I confirmed that the exterior and interior of main body 1120 of the cross-sectional side view of Fig. 11 has a rectangular cross-sectional shape (i.e., that each vertical side has the same length, each end has the same vertical height, and each corner is ninety degrees). Ex. 1005 ¶¶ 20, 22; Figs. 11, 13. This confirms Muceus' description of the main body 1320 (i.e., housing) of Fig. 13 as an "outer tube". This was possible to do because I could see that the drawing views were orthographic rather than perspective projections.

351. Indeed, every depiction and description of a "main body" in the various embodiments of Muceus describes a tube or cylinder or shows a cylindrical structure. Ex. 1005 Figs. 1, 4, 5, 11, 13. For example, Fig. 13 of Muceus, as annotated and shown below, similarly shows main body 1320, described as an "outer tube", and a "suppressor core 1330 that is inserted into the body 1320". Ex. 1005 ¶ 59, Fig. 13.

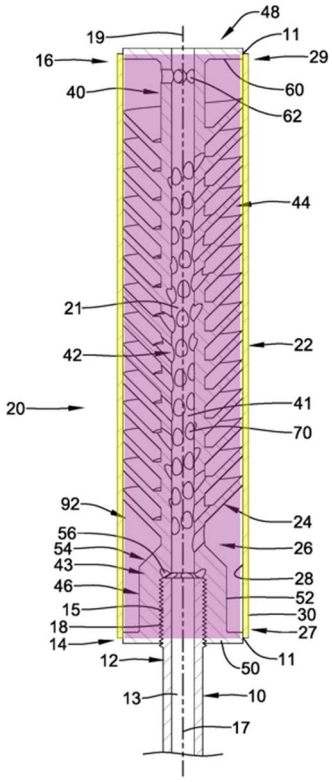


Muceus, Fig. 13 (annotated)

352. The main bodies (i.e., housing) have inner walls that have circumferences that are substantially the same along their lengths for the reasons discussed above, and as such, an inner compartment is interposed between the first aperture at the entry end (i.e., first end) (red arrows) and the second aperture at the exit end (i.e., second end) (blue arrows), the inner compartment being substantially the same circumference from the entry end (i.e., first end) to the exit end (i.e., second end). *See* Ex. 1005 Fig. 11, 13.

353. For the avoidance of doubt, Slack also discloses 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. For example, and as depicted in the annotated Fig. 2, below, Slack discloses an external component 22 (i.e., housing) (highlighted in yellow) that is a "generally cylindrical member" that defines an inner lumen 26 designed to house at least a portion of an internal component 24/124 (i.e., core). Ex. 1006 ¶ 42; Fig. 3, 4, 9.



Slack, Fig. 2 (annotated)

354. Slack discloses in at least the cross-sectional view of Fig. 2 that the inner diameter of the external component 22 (i.e., housing) is constant along a length of the external component 22 (i.e., housing), which I confirmed by measuring with caliper using the same process described above. As such, Slack discloses an inner compartment (highlighted in purple) interposed between the first aperture and the

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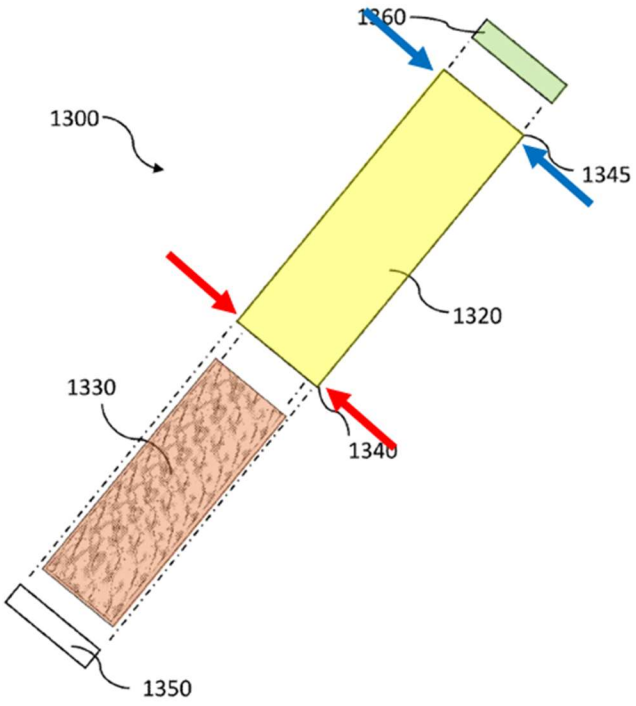
second aperture, the inner compartment being substantially the same circumference from the first end to the second end.

355. Thus Muceus discloses a main body (i.e., housing) having 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. Moreover, assuming solely for purposes of this analysis that Muceus did not disclose the foregoing features, it would additionally be obvious to make the housing of Muceus such that an inner compartment is 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, based on the teachings of Slack, which would correspond to Muceus' already disclosed cylindrical body configuration.

Claim 1, Element [1.2]: an end cap with a projectile aperture; and

356. Muceus discloses this limitation, and Muceus and Slack render obvious this limitation. Specifically, Muceus discloses an end cap. Muceus discloses that an endcap 1360 (highlighted in green) "attaches to the exit end 1345" (i.e., second end) (blue arrows), and the "components may be screwed and/or welded to contain the TPMS structure inside the body 1320", as depicted in annotated Fig. 13. Ex. 1005 ¶ 59, Fig. 13. Moreover, Muceus discloses that the "[e]xit end 145 of the suppressor

100, *where the projectile leaves the suppressor 100*, is opposite the entry end 140." Ex. 1005 ¶ 25; Fig. 1 (emphasis added). The embodiments of Fig. 1 and 13 use the same corresponding terminology (e.g., entry end 140 and exit end 145 of Fig. 1 and entry end 1340 and exit end 1345 of Fig. 13). Ex. 1005 ¶¶ 25, 59; Figs. 1, 13. As such, it necessarily follows that the projectile leaves the suppressor 100 of Fig. 13 from the exit end 1345, which is in the end to which the end cap 1360 is attached. With end cap 1360 covering the end of core 1330, the only non-destructive path for the projectile is via an aperture in end cap 1360. Therefore, the conclusion that a projectile aperture is inherently present in Muceus' end cap 1360 necessarily flows from Muceus' description of suppressor operation, the projectile path, and the end cap's location. Similarly, the firearm suppression system of the '906 patent discloses that "[t]he end cap 110 may be threadably coupled to the second end 106 of the housing 102", and "[t]he end cap may comprise a projectile aperture, where the projectile may exit the suppression system" Ex. 1001 col. 2, ll. 63-65, col. 6, ll. 6-8.

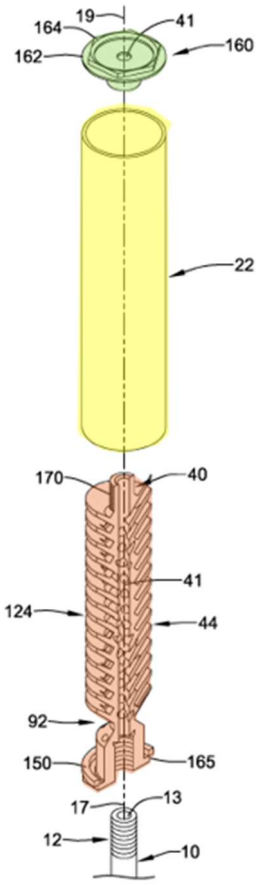


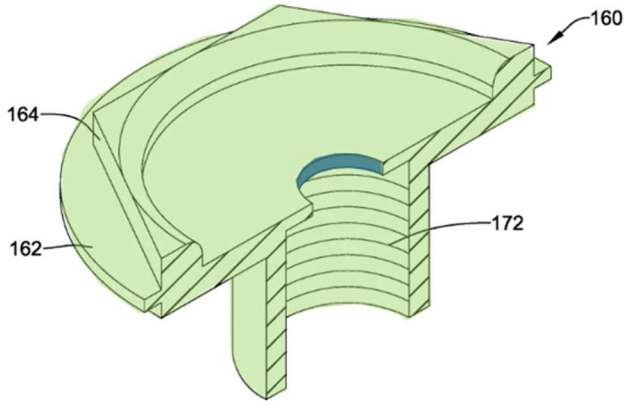
Muceus, Fig. 13 (annotated)

357. Because Muceus' endcap 1360 is attached at the second end of the main body 1320 and the projectile exits through the exit end 1345, the end cap 1360 necessarily includes a projectile aperture. A projectile aperture must be present; otherwise, the projectile could not exit the suppressor without destroying the end cap. Accordingly, Muceus' end cap 1360 corresponds to the claimed end cap having a projectile aperture.

358. To the extent it is argued that Muceus does not disclose that the endcap (i.e., end cap) has a projectile aperture, Slack discloses an end cap with a projectile aperture, and it would be obvious to add the projectile aperture of Slack to the end cap of Muceus. Specifically, as depicted in the annotated excerpt of Fig. 9 and the

annotated Fig. 10, both below, the suppressor 120 of Slack has an end cap 160 (highlighted in green) with a bore 41 (highlighted in blue), the end cap 160 being positioned at a distal end of an external component 22 (i.e., housing) (highlighted in yellow) of a suppressor 120. Ex. 1006 ¶ 42, 55, Figs. 9, 10. Slack's end cap 160, Muceus' end cap 1360, and the '906 end cap are caps positioned at a distal end (i.e., second end) of their corresponding housings, and as such, Slack's end cap 160 also corresponds to the claimed end cap and the components and uses thereof are analogous to the end cap of the '906 patent and the endcap 1360 of Muceus.





Slack, Fig. 9 (excerpt, annotated) **Slack, Fig. 10 (annotated)**

359. Slack's end cap 160 (i.e., end cap) has a projectile aperture. Specifically, Slack discloses that its end cap has a bore 41 (labeled in Fig. 9, highlighted in blue in annotated Fig. 10 above) that is axially aligned with a bore 41 of the internal component 124 through which a projectile travels. Ex. 1006 ¶ 44, 45; Fig. 2, Fig. 9. As depicted in Fig. 9, the bore 41 of the end cap 160 (i.e., end cap) is axially aligned with the bore 41 of the internal component and a bore 13 of the barrel of the firearm barrel. Ex. 1006 ¶ 44; Fig. 9. Muceus similarly has an "[e]xit end 145 of the suppressor 100, where the projectile leaves the suppressor 100, is opposite the entry end 140" and the embodiment of Fig. 13 of Muceus places an end cap 1360 at this exit end 1345, similarly needing to allow the projectile to leave the suppressor through the location of the end cap 1360. Ex. 1006 ¶ 25; Fig. 13. It would thus be obvious to modify Muceus (assuming solely for purposes of this analysis that Muceus does not include a projectile aperture, which it does) to include the bore 41 of Slack in Muceus' end cap, and for the avoidance of doubt, it would similarly be obvious to replace Muceus' end cap with the end cap of Slack.

360. Moreover, with reference to the embodiment of Figs. 2 and 5 of Slack, for which the embodiment of Fig. 9 is merely a two-part alternative as noted above, the bore 41 of the internal component 24 (i.e., core) is described as having a diameter "that is at least as large, and in most cases larger than, the diameter of the bore 13 of the firearm to which it is intended to be attached". Ex. 1006 ¶ 44; Figs. 2, 5, 9. Since

a firearm bore is the path from which the projectile exits the muzzle of the firearm and the bore 41 of Slack's internal component 24 (i.e., core) is at least as large as the firearm bore and configured to allow projectiles to exit the suppressor, and indeed the projectile passes immediately adjacent to the bore 41, the bore 41 of the end cap 160 of Slack is a projectile aperture.

361. Moreover, the end cap 160 restricts the aperture at the end of the external component 22 of Slack's suppressor 120 and, for example, the bore 41 diameter is less than the diameter of the aperture at the end of the external component. *See* Ex. 1006 Figs. 2, 9. Similarly, the '906 patent discloses a projectile aperture that a projectile may exit the suppression system, and various embodiments are directed towards restricting the diameter of the projectile aperture to a smaller diameter to "reduce gas flow exiting the system." Ex. 1001 col. 3, ll. 2-9; col. 10, ll. 10-12; col. 9, ll. 49-62; col. 10, ll. 1-29; Figs. 11-15. Slack's bore 41 and end cap 160 (i.e., end cap) similarly reduce gas flow exiting the system due to the restriction on the gas flow relative to the larger diameter upstream sections of the suppressor. Ex. 1006 Fig. 9. Thus, the bore of Slack also operates similarly to the described functionality of the projectile aperture in the specification of the '906 patent, and the combination of Muceus and Slack would accomplish a corresponding functionality.

362. Accordingly, Muceus includes an end cap inherently having a projectile aperture, and it would be obvious to modify Muceus with the bore of Slack and the combination of Muceus and Slack discloses an end cap with a projectile aperture.

Claim 1, Element [1.3]: a core removably attachable to the housing and positioned therein,

363. Muceus discloses this limitation. Specifically, Muceus discloses that "[t]he suppressor core 1330 is inserted into the body 1320". Ex. 1005 ¶ 59. Muceus further discloses that the "suppressor core may be made separate from or integral with other components of the suppressor" and then "screwed" together with the other components (e.g., the main body (i.e., housing), baseplate, and/or endcap (i.e., end cap)). Ex. 1005 ¶¶ 59, 63, Fig. 13. Muceus explains that "the suppressor device is assembled by placing the suppressor core inside the outer body/casing, with a baseplate on the entry end and an endcap on the exit end." Ex. 1005 ¶ 63. As such, the suppressor core is within the main body (i.e., housing) and bounded by the baseplate on the entry end and the endcap on the exit end. Therefore, the core 1330 of Muceus is both removably attachable to the main body (i.e., housing) and positioned therein.

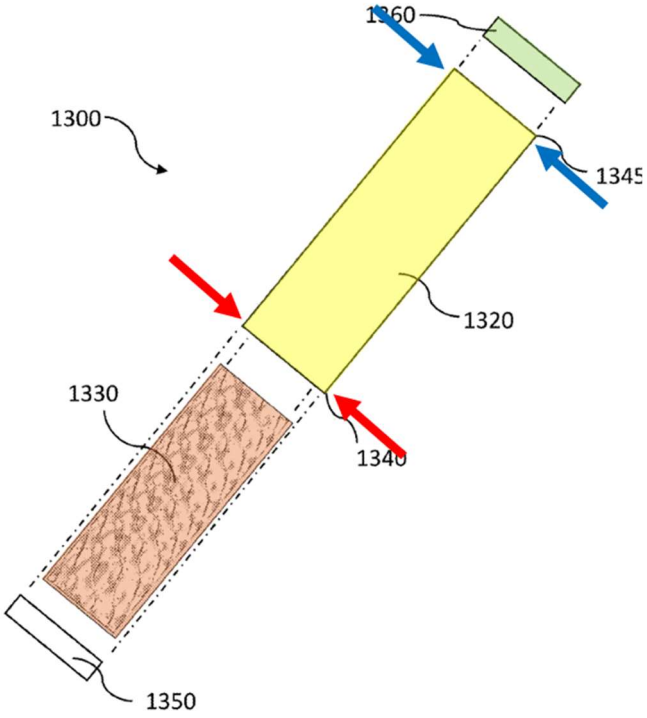
364. Further, two components that are "screwed" to each other, as disclosed in Muceus, are removably attached unless permanent methods of attachment are present. Not only is this the common understanding of threaded fasteners in the field

of engineering, but the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) provides examples of methods of attachment in reference to a muzzle device that is permanently attached to a barrel of a firearm. These permanent methods of attachment include "full-fusion gas or electric steel-seam welding, high-temperature (1100°F) silver soldering, or blind pinning with the pin head welded over." Ex. 1010 p. 17. While the ATF definition refers to attachment between a firearm barrel and a muzzle device (e.g., suppressor) and the present analysis relates to a core being removably attachable to the housing, the ATF definition both confirms my understanding and evidences what a POSITA would have understood "removable" to mean in the suppressor arts. The "screwed" attachments of Muceus do not meet the ATF definition of permanently attached. As such, the components of Muceus that are "screwed" to each other are removably attached.

365. The suppression core of Muceus "provides greatly improved sound suppression performance compared to conventional devices." Ex. 1005 ¶ 36. Similarly, the '906 patent discloses that "[b]ecause of the design of the core 112, the system 100 can be optimized to get the desired relationship between sound, recoil, and back gassing." Ex. 1001 col. 7, ll. 58-62. Muceus discloses a suppression core (highlighted in orange) that is positioned within and screwed together with the main body (i.e., housing) (highlighted in yellow) of the suppressor, as depicted in annotated Fig. 13, which is similar to the structure of the '908 patent, and improves

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sound suppression performance, which is similar to the function of the core of the '906 patent. Accordingly, the suppression core 1330 of Muceus is the claimed core removably attachable to the housing and positioned therein.



Muceus, Fig. 13 (annotated)

366. For the avoidance of doubt, Slack discloses an inner component 124 (i.e., core) removably attachable to the housing and positioned therein. For example, Slack discloses that "[t]he end cap includes a flange 162, and the internal component 124 includes a flange 150[,]" and that a threaded bore 172 of the end cap 160 is configured to "threadingly engage a threaded portion 170 disposed on the distal end of the cylindrical body portion 40" of the internal component 124 (i.e., core). Ex. 1006 ¶ 63. Slack further discloses that when the external component 22 (i.e.,

housing) is disposed over the internal component (i.e., core), the end cap 160 can be threaded onto the threaded portion 170 of the internal component (i.e., core), thereby capturing the external component 22 (i.e., housing) "between the flanges 162 and 150, to thereby couple the external component 22 to the internal component 124." Ex. 1006 ¶ 63. As such, the internal component 124 (i.e., core) is removably attachable to the external component 22 (i.e., housing).

367. Further, as discussed, the ATF provides examples of permanent methods of attachment. The means of capturing the external component 22 (i.e., housing) between the flange 162 of the end cap and the flange 150 of the internal component 124 (i.e., core), and threadingly engaging the internal component 124 (i.e., core) with the end cap 160 do not meet the definition of permanently attached, and while the ATF definition refers to attachment between a firearm barrel and a muzzle device (e.g., suppressor) and the present analysis relates to a core being removably attachable to the housing, the ATF definition both confirms my understanding and evidences what a POSITA would have understood "removable" to mean in the suppressor arts. As such, the components of Slack that are threadingly engaged or captured between other components are removably attached. In fact, one would have to take additional costly steps to make it non-removable, such as the already mentioned, welding, pinning, or high temperature soldering – otherwise known as brazing.

368. Thus, in addition to Muceus' disclosure of a removable core, it would be obvious to keep the core of Muceus removable rather than take extra steps to prevent removal. This would follow from Slack's teachings, which include threaded connections between respective components corresponding to Muceus' already disclosed "screw" configuration. The '906 patent likewise describes the core as being positioned within the inner compartment of the housing and threadably coupled to the housing, allowing for removal for cleaning or maintenance. Ex. 1001 col. 5, ll. 60-col. 6, ll. 9; col. 6, ll. 53-58; col. 9, ll. 23-25.

Claim 1, Element [1.4]: 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,

369. Muceus discloses this limitation. Regarding the core apertures, Muceus discloses a core that comprises a plurality of channels terminating at the outer surface of the cores (i.e., plurality of core apertures) that allow gas passing from a projectile and cartridge to exit out of the core. Specifically, Muceus discloses that "[s]ound suppressors of the present disclosure utilize triply periodic minimal surfaces (TPMS) structures to provide improved noise reduction characteristics compared to conventional devices". Ex. 1005 ¶ 26. Muceus discloses that the suppressor cores of the suppressor assemblies of Figs. 3-14 have or are configured with a TPMS structure. Ex. 1005 ¶¶ 14, 18, 19, 31, 32, 37, 38, 40, 42, 46, 54, 57, 59, 62; Figs. 3-

14. Muceus also notes that "features illustrated or described as part of one embodiment may be used with another embodiment to yield a still further embodiment. Thus, it is intended that the present subject matter covers all such modifications and variations within the scope of the appended claims and their equivalents." Ex. 1005 ¶ 65.

370. It is disclosed that the suppressor assemblies of Figs. 5, 11, and 13 can comprise any of the disclosed TPMS structures throughout the disclosure, and said differently, any of the depicted TPMS core structures may have the various other surrounding suppressor components (e.g., main body, endcap, baseplate) added. For example, in several instances, Muceus does not show, but explicitly contemplates including, a "main body" with the various versions of the suppressor cores. See Ex. 1005 ¶ 31 ("The outer main body of the suppressors is not shown in this illustration, to enable the TPMS structures to be viewed."), and see ¶ 38 ("The main body of the suppressors are not shown in these figures, for clarity."). In addition to being explicitly disclosed, it is my opinion that the various TPMS structures are interchangeable based on their corresponding exterior shapes, the utility of the main body to encircle the core, which benefits each embodiment of suppressor core, and the interchangeability of parts shown and described in Muceus.

371. Muceus discloses that the suppression core (i.e., core) may include an inner portion that surrounds a center bore, and an outer portion that has a baffle

structure that surrounds the inner portion. Ex. 1005 claim 1; ¶¶ 6, 31-32, 36-37. Muceus further describes that "[t]he TPMS structure is formed of walls 402 with wall thickness "T", where open spaces between the walls 402 form channels 404 within the TPMS structure." Ex. 1005 ¶ 32. Referring to the annotated Fig. 4 below, Muceus explains that "[g]ases in the center bore 410, from firing a projectile, can enter the suppressor core 400 through a plurality of openings 412 at the inner diameter of the suppressor core 400, where the openings 412 are also connected to the channels 404." Ex. 1005 ¶ 32. Muceus also discloses that "[t]he channels 404 provide flow pathways for gases to travel from the entry end 440 of the suppressor core 400, along the center bore 410, radially outward and along the length of the suppressor core 400 as shown by the arrows 460." Ex. 1005 ¶ 32.

372. With reference to annotated Fig. 4, below, the inlet openings (examples shown with pink circles) of the channels 404 are spaced along the length of the center bore 410 of the suppression core (i.e., core) and would therefore allow gas transfer from the center bore 410 and out of the channels 404 at outlet openings of the channels 404 (examples shown with green circles) at numerous locations along the length of the suppression core (i.e., core). Ex. 1005 Fig. 4, ¶ 32-33. Each of the respective TPMS cores of Muceus includes channels with similar structures. Ex. 1005 ¶¶ 33, 37, 41, 47, 49, 57. Thus, at least the channels of Muceus correspond to the plurality of apertures of the '906 patent. Similar to a sponge, the channels of

Muceus are intertwined and include numerous openings throughout the structure, including openings on the outer surfaces. To the extent it is argued that the plurality of apertures of claim 1 of the ’906 patent being “on an outer surface” requires merely a flat (relative to the curvature of the outer surface) opening on the core rather than a three dimensional channel, the outermost extent of the channels of Muceus would still equate to the claimed apertures. Each of the respective cores of Muceus includes similar apertures that would likewise equate to core apertures. *See* Ex. 1005 Figs. 3, 4, 6A-13.

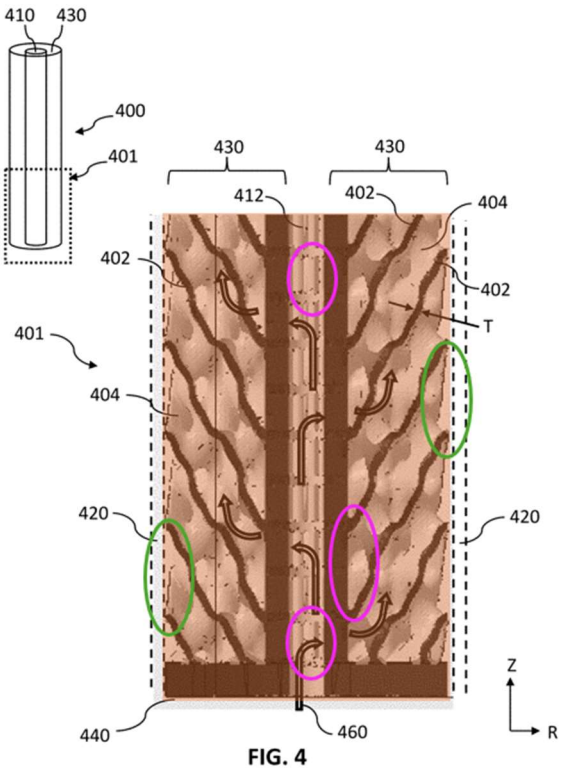


FIG. 4

Muceus, Fig. 4 (annotated)

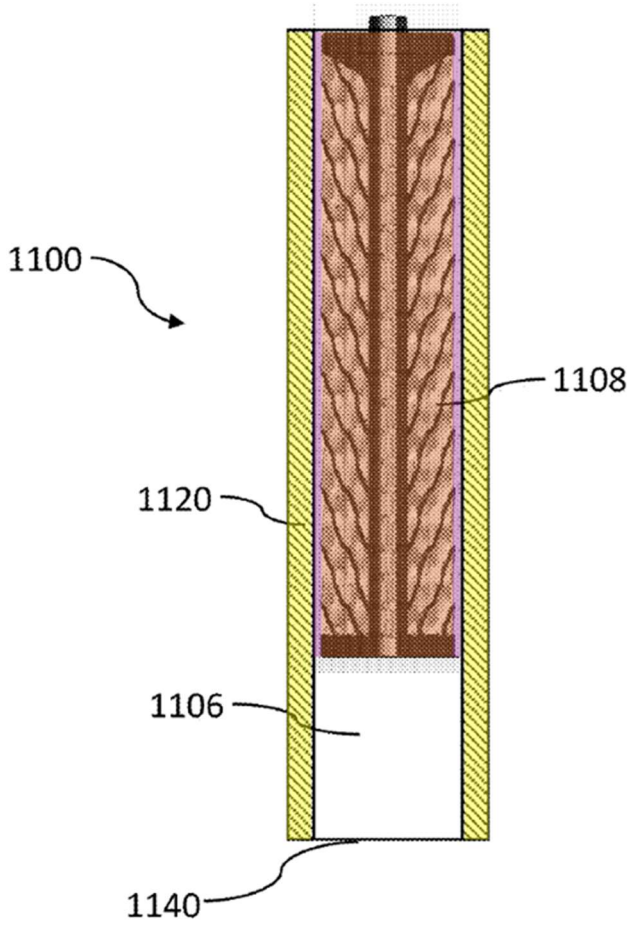
373. While the gas itself (and thus the source) does not appear to be positively recited in the claim, Muceus refers in numerous instances to "gas" (e.g., "propellant gas" or "projectile gas"), which the POSITA would have understood is the claimed "gas passing from a projectile and cartridge", which is the source of propellant gas in modern cartridge-based firearms such as that of the '906 patent and Muceus. Ex. 1005 ¶ 30, 33, 36. Muceus also mentions a "cartridge" in combination with gases in its background. Ex. 1005 ¶ 2.

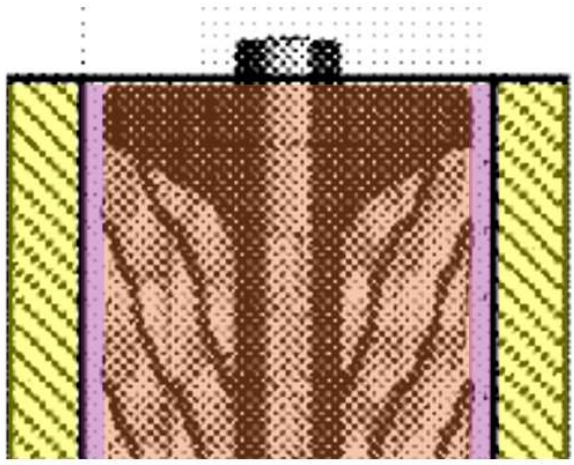
374. Similarly, the '906 patent discloses that the core includes an inner surface that comprises baffles that interact with a plurality of core apertures, and that a channel may surround the core. Ex. 1001 col. 6, ll. 63-67; col. 7, ll. 29-31. The core apertures allow incoming high pressure to enter into the core and subsequently exit the core into the channel. Ex. 1001 col. 6, ll. 63-col. 7, ll. 8; col. 7, ll. 22-25.

375. The channels (e.g., channels 404 shown with annotated gas flow arrows in Fig. 4 above) of the suppression core (i.e., core) of Muceus allow gas to flow from the central bore and outward to openings at the outer surface of the core (i.e., apertures).

376. Regarding the "channel" of independent claim 1, Muceus discloses several types of voids downstream of the channels (i.e., core apertures) within the main body of the suppressor, each corresponding to the "channel" claimed in claim 1 of the '906 patent. For example, Muceus further discloses that the *outlet openings*

of the channels 404 (i.e., plurality of core apertures) allow gas passing from a projectile and cartridge to pass to an empty region between the inner surface of the housing and an outer surface of the core. Specifically, Muceus describes that the suppressor core can extend only partly along the length of the suppressor assembly and/or into the radial volume of the chamber. This indicates that the suppression core does not occupy the entire internal radial volume of the main body (i.e., housing) in some embodiments, but instead leaves a circumferential space or gap between the outer surface of the suppression core (i.e., core) and the inner surface of the main body (i.e., housing). Ex. 1005 ¶ 54. This structural arrangement is illustrated in annotated Fig. 11 and the annotated excerpts of Fig. 11, both below, showing a gap (highlighted in purple) between the outer surface of the suppression core (i.e., core) (highlighted in orange) and the inner surface of the main body (i.e., housing) (highlighted in yellow) through which gas could flow from the outlet of the channels 404 (i.e., plurality of core apertures). Ex. 1005 Fig. 11; ¶ 54. This teaching of a suppressor core that only partly extends into the radial volume of the chamber of the main body is not limited to a specific embodiment and likewise applies to at least the embodiments of Fig. 13 discussed herein. For example, Muceus discloses that "features illustrated or described as part of one embodiment may be used with another embodiment to yield a still further embodiment." Ex. 1005 ¶ 65.



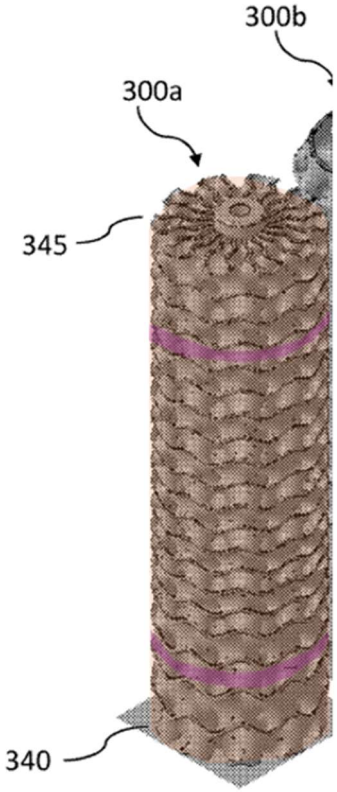


Muceus, Fig. 11 (annotated) **Muceus, Fig. 11 (excerpt, annotated)**

377. Similarly, the ’906 patent discloses a channel that allows incoming high pressure to enter into the core and subsequently exit the core into a channel between the housing and the core. Ex. 1001 col. 6, ll. 63-col. 7, ll. 8; col. 7, ll. 22-25.

378. The gap and reduced radial volume of the core between the outer surface of the suppression core (i.e., core) of Muceus corresponds to the structure and function as the channel of the ’906 patent, and as such, the gap of Muceus is the claimed channel.

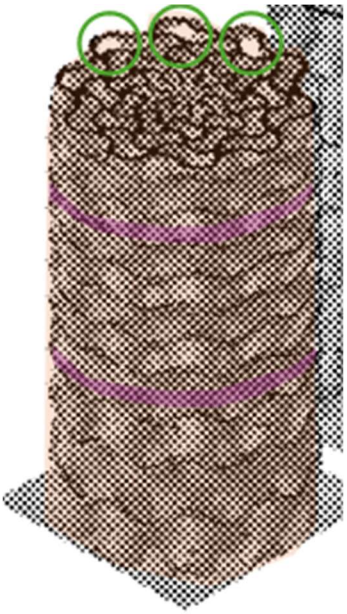
379. In addition to the radial volume discussed above, Muceus also discloses a core that comprises a plurality of channels formed along the exterior of the core. For example, as shown in the annotated Figs. 3, 10A, and 12, below, at least suppressor core 300a of Fig. 3, suppressor core 1000a of Fig. 10A, and suppressor core 1200a of Fig. 12 depict channels (examples highlighted in purple) that are between the inner surface of the housing and an outer surface of the core 300a, 1000a (i.e., core) and extend circumferentially around the core.



Muceus, Fig. 3 (annotated, excerpt)



Muceus, Fig. 10A (annotated)



Muceus, Fig. 12 (excerpt, annotated)

380. Similarly, with reference to annotated Fig. 10B below, Muceus discloses spiral shaped channels (examples highlighted in purple) that are between the inner surface of the housing and an outer surface of the core 300a, 1000a (i.e., core) and extend circumferentially around the core.

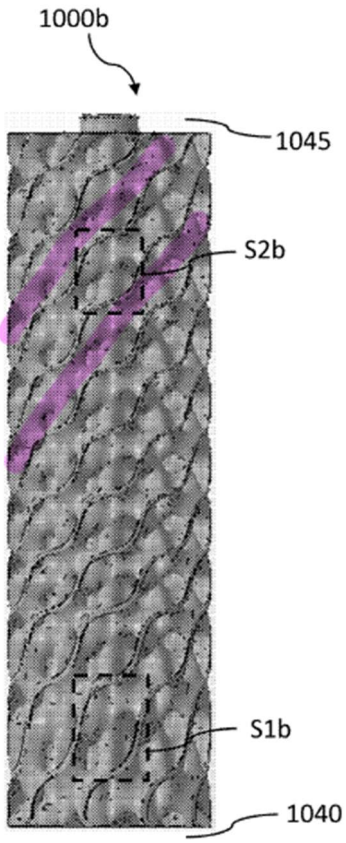


FIG. 10B

Muceus, Fig. 10B (annotated)

381. Muceus further discloses that a plurality of core apertures on the outer surface of the core allow gas passing from a projectile and cartridge to pass to the channel between the inner surface of the housing and an outer surface of the core. Specifically, Muceus discloses that "[t]he TPMS structures of the present disclosure provide improved performance over conventional suppressors by providing a high surface area-to-volume ratio to slow rapidly expanding gases" and "[b]ecause of *the tortuous, connected pathways* created in TPMS structures, energy is dissipated over

a much longer time interval than in conventional suppressors, using the TPMS surfaces to trap the gases in effectively long channels." Ex. 1005 ¶ 33 (emphasis added).

382. Figs. 3, 10A, and 12 show TPMS structures. Ex. 1005 ¶ 31, 48, 57. The TPMS structures of suppressor core 300a of Fig. 3, suppressor core 1000a of Fig. 10A, and suppressor core 1200a of Fig. 12, as depicted, are visually similar, if not the same. Also, suppressor core 300a of Fig. 3 and suppressor core 1000a of Fig. 10A are both described as a "Gyroid" TPMS structure, which "can be approximated by: cos(x)sin(y) + cos(y)sin(z) + cos(z)sin(x) = 0". Ex. 1005 ¶ 26, 31, 48. As such, the TPMS structures 300a of Fig. 3, suppressor core 1000a of Fig. 10A, and suppressor core 1200a of Fig. 12 are either the same suppressor core or substantially similar cores such that teachings of one of the cores 300a, 1000a, 1200a are applicable to the others, or at least an obvious variant thereof.

383. The annotated excerpt of Fig. 12 above shows a view of suppressor core 1200 at an intermediate stage of being built by additive manufacturing. Ex. 1005 ¶ 57. As depicted, portions of the connected pathways (examples circled in green) extend through a wall of the TPMS structure (e.g., openings to the outside of the core), which would allow the expanding gases" to flow to the channels (examples highlighted in purple). Therefore, the TPMS structure of Fig. 12 provides "connected pathways" (i.e., a plurality of core apertures) on an outer surface of the core that

allow gas passing from a projectile and cartridge to pass to channels (areas highlighted in purple) between the inner surface of the housing and an outer surface of the core 1200a. Various other embodiments shown in Muceus likewise include channels along the exterior, such as the spiraling channels illustrated in the core 300c shown in Fig. 3.

384. The teachings of one of the TPMS structures of suppressor core 300a of Fig. 3, suppressor core 1000a of Fig. 10A, and suppressor core 1200a of Fig. 12 would apply to the other TPMS structures. Therefore, the TPMS structures of Figs. 10A and 12 also provide "connected pathways" (i.e., a plurality of core apertures) on an outer surface of the core that allow gas passing from a projectile and cartridge to pass to the channels (areas highlighted in purple) between the inner surface of the housing and an outer surface of the core 300a, 1000a.

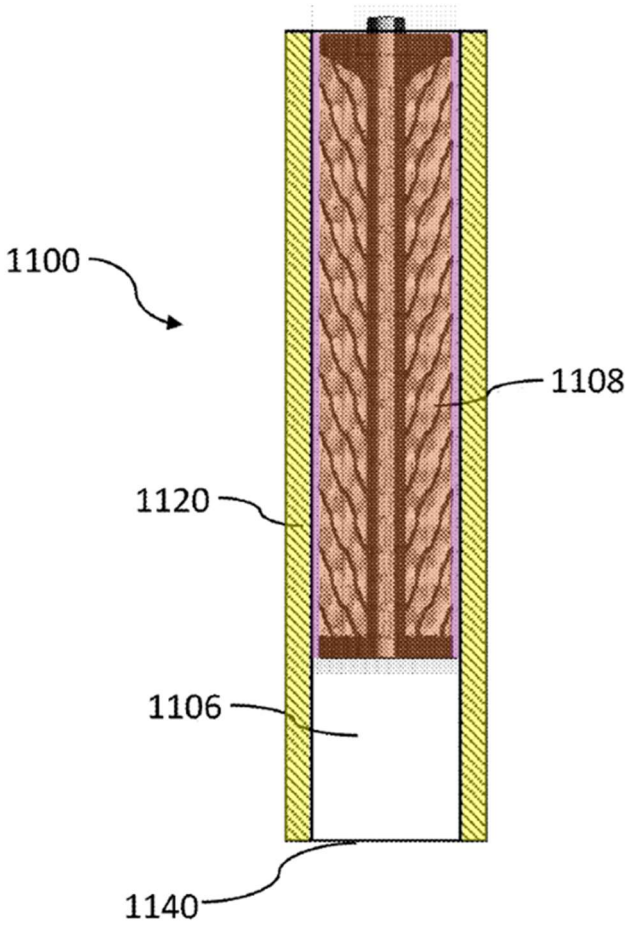
Claim 1, Element [1.5]: the channel circumscribes the outer surface of the core and equalizes pressure that begins at the first end of the housing and terminates at the second end of the housing.

385. Muceus discloses this limitation. Specifically, Muceus describes that the suppressor core can extend "partially in the *radial volume* of the chamber", thereby indicating that the suppression core may occupy less than the entire internal *volume* of the main body (i.e., housing), and the suppression core (i.e., core) may leave a circumferential space or gap between the outer surface of the suppression

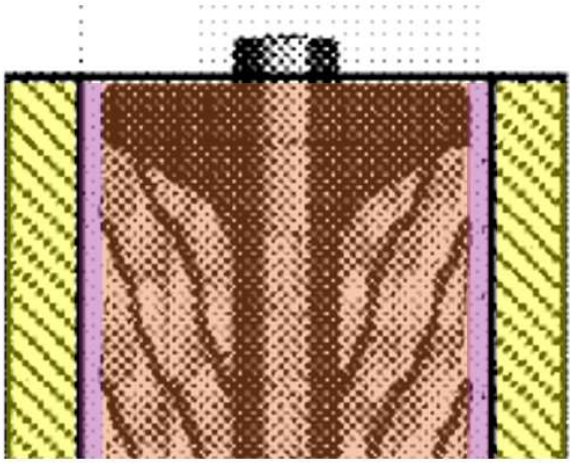
core (i.e., core) and the inner surface of the main body (i.e., housing). Ex. 1005 ¶ 54 (emphasis added). The term "volume" refers to the *three-dimensional* space that an object occupies and the "radial volume" would refer to a volume defined relative to an axis from which a radius would be measured. As such, the phrase "partially in the radial volume" refers to a concentric shrinking (i.e., a radial symmetrical shrinking) of the suppression core (i.e., core) about a center axis of the core. Moreover, this shrinking is depicted in Fig. 11 as described above. Ex. 1005 Fig. 11. Positioning the suppression core (i.e., core) concentrically within the main body (i.e., housing) would have various benefits, such as preserving the path of the projectile down a center of the center bore and preserving the balance and symmetry of the gas dispersion throughout the suppression core (i.e., core). As such, Muceus' disclosure of the suppressor core extending "partially in the *radial volume* of the chamber", as recited in Muceus ¶ 54 and shown in Fig. 11, refers to a 360 degree shrinking of the core relative to the main body (i.e., housing), and this radial volume would extend the full length of the core. Ex. 1005 P 54 (emphasis added). Thus, Muceus shows a channel circumscribing the suppressor core and it would be obvious to leave or add the channel concentrically circumscribing the core in Muceus' embodiments having a partial radial volume filled by the suppressor core.

386. This structural arrangement is illustrated in annotated Fig. 11 (provided below) and excerpt annotated Fig. 11 (provided below), which show a gap

(highlighted in purple) between the outer surface of the suppression core (i.e., core) (highlighted in orange) and the inner surface of the main body (i.e., housing) (highlighted in yellow) that gas could flow into. Ex. 1005 Fig. 11; ¶ 54. This teaching of a suppressor core that only partly extends into the radial volume of the chamber of the main body is not limited to a specific embodiment and likewise applies to at least the embodiments of Fig. 13 discussed herein. For example, Muceus discloses that "features illustrated or described as part of one embodiment may be used with another embodiment to yield a still further embodiment."



Muceus, Fig. 11 (annotated)

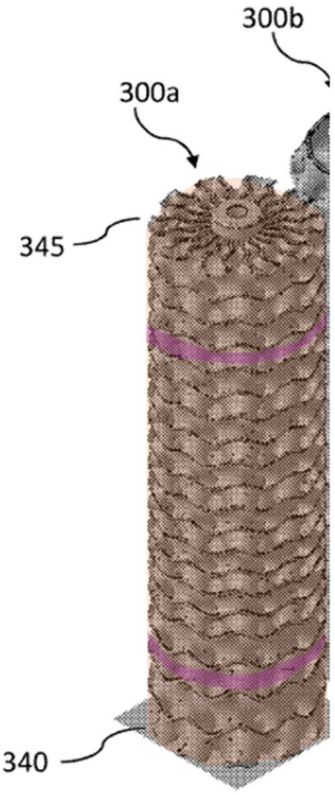


Muceus, Fig. 11 (excerpt, annotated)

387. Muceus discloses a circumferential space or gap between the outer surface of the suppression core (i.e., core) and the inner surface of the main body (i.e., housing) that extends entirely around the circumference of the core at all locations along the length of the core, thus appearing equally on both sides of the depicted cross section, such that the gap (i.e., channel) between the suppression core (i.e., core) and the main body (i.e., housing) circumscribes the outer surface of the suppression core (i.e., core). Further, Muceus Fig. 11 also discloses a clear path from the entry end 1140 of the suppressor to the gap between the core 1108 (i.e., core) and the main body 1120 (i.e., housing) confirming that the pressure is equalized from the first end of the main body (i.e., housing) to the second end of the main body (i.e., housing). Ex. 1005 Fig. 11.

388. In addition to the radial space, the additional circumferential channels of Muceus discussed with regard to Element [1.4] and regarding suppressor core 300a of Fig. 3, suppressor core 1000a of Fig. 10A, and suppressor core 1200a of Fig. 12 are also channels that circumscribe the outer surface of the core. Ex. 1005 Figs. 3, 10A, 12. For example, as shown in annotated Figs. 3, 10A, 10B, and 12, below, the suppression cores 300a, 1000a, 1000b, 1200a (i.e., cores) disclose circumferentially-extending channels (i.e., channels) (examples highlighted in purple) between the inner surface of the housing and an outer surface of the core.

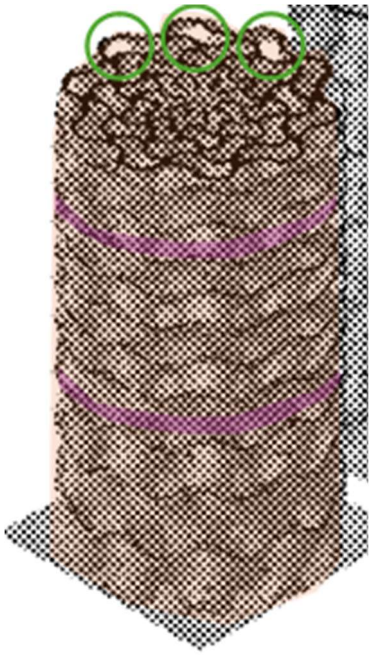
Ex. 1005 Figs. 3, 10A, 12. These circumferentially-extending channels may or may not extend in the axial direction (e.g., compare Fig. 10A with 10B).



Muceus, Fig. 3 (annotated, excerpt)



Muceus, Fig. 10A (annotated)



Muceus, Fig. 12 (excerpt, annotated)

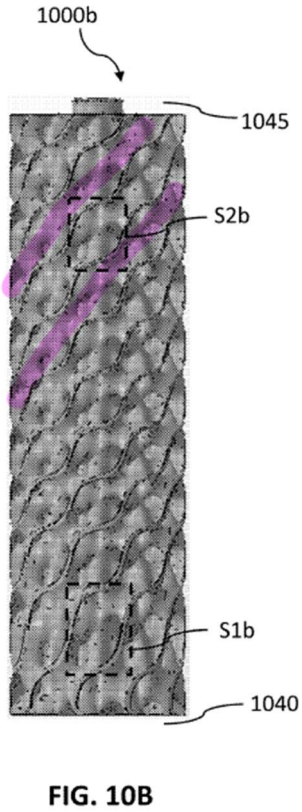


FIG. 10B

Muceus, Fig. 10B (annotated)

389. In particular, the entirety of the circumferentially-extending channels (i.e., channels) are radially outward of an outer surface of the core at the locations of the channels and are disposed 360 degrees around the core. Additionally, with regard to the radial gap discussed above (left in an instance in which the core occupies a partial radial volume of the main body), the circumferentially-extending channels (i.e., channels) would fluidically connect with the circumferential space or gap between the outer surface of the suppression core (i.e., core) and the inner surface of the main body (i.e., housing).

390. In addition, Muceus equalizes pressure that begins at the first end of the housing and terminates at the second end of the housing. Indeed, with reference to Fig. 11 of Muceus, the gap between the core 1108 and the main body 1120 is shown with a direct fluid path to both the channels of the core and to the expansion chamber 1106, which provides evidence that leads me to conclude that Muceus would equalize pressure that begins at the entry end 1140 (i.e., first end) of the main body (i.e., housing) and terminates at the exit end (i.e., second end) of the main body (i.e., housing).

391. Also, Muceus discloses that channels connecting the first openings and the second openings (i.e., plurality of core apertures) "provide flow pathways for gases to travel from the entry end 440 of the suppressor core 400, along the center

bore 410, *radially outward* and *along the length of the suppressor core* 400". Ex. 1005 ¶ 32; Fig. 4 (emphasis added). This configuration "trap[s] gas efficiently and generally do not require significantly increased gas flow to cycle the weapon", which suggests that the pressure is effectively equalized by the device of Muceus, while still achieving superior noise reduction. *See* Ex. 1005 ¶ 34. The channels of Muceus, which are connected to the openings at the inner diameter of the suppressor core, "create turbulent flow which increases friction on the surfaces to slow the gases and then finally release the gases *at the lowest possible pressure relative to the ambient pressure at the exit of the suppressor end*." Ex. 1005 ¶¶ 32, 33 (emphasis added). Releasing gases at the lowest possible pressure relative to the ambient pressure would equalize pressure since gas flows from areas of high pressure to areas having lower pressure, causing the higher pressure areas to decrease in pressure as the suppressor core of Muceus slows and cools the gasses and the gasses move out of the high pressure areas towards the ambient exterior. Thus it is my opinion that the device of Muceus discloses that it equalizes pressure that begins at the first end of the outer tube (i.e., housing) and terminates at the second end of the outer tube (i.e., housing).

392. In addition to the gap left between the core and the main body as discussed with respect to Fig. 11, the circumferentially-extending channels (i.e., channels) and the other embodiments of channels formed along the exterior

indentations of the core would equalize pressure that begins at the first end of the housing and terminates at the second end of the housing. For example, pressurized gas flowing along the prescribed path can pass through a respective channel as shown in Fig. 4. Ex. 1005 Fig. 4. Moreover, Muceus discloses that the TPMS structures (i.e., gas flowing through the apertures and channels within the core), "effectively *reduce the exit pressures*, cool and slow the gases, and enable greatly improved passive noise suppression." Ex. 1005 ¶ 30 (emphasis added). Thus, the gas exiting the core structure at the circumferentially-extending channels (i.e., channels) would similarly have reduced pressure (and the other listed properties) because they are at least an exit path for at least a portion of the gas traversing the suppressor. These circumferentially-extending channels (i.e., channels) thus, equalize pressure that begins at the first end of the housing and ends at the second end of the housing by serving as a conduit for the gas traversing the length and radial width of the suppressor. Because the circumferential channels and radial gap form a continuous annular plenum around the core, pressure differentials between upstream and downstream sections are reduced as gases expand circumferentially and axially through the connected volume, producing an equilibrium pressure gradient along the length of the housing consistent with standard fluid dynamic diffusion and expansion behavior.

393. Muceus also discloses that the channels, which are the open spaces within the TPMS structure, "create turbulent flow which increases friction on the surfaces to slow the gases and then finally release the gases *at the lowest possible pressure* relative to the ambient pressure at the exit of the suppressor end. This expansion of gases in the increased volume created by the channels of the TPMS causes decreases in pressure, followed by further decreases in pressure as energy transfer (temperature change and heat transfer) from the gases to the suppressor core occurs." Ex. 1005 ¶ 32-33 (emphasis added). As such, because the open areas within the TPMS structure are all fluidically connected and connected to the circumferentially-extending channels (i.e., channels) (and the radial and axial gaps around the suppressor as well), the circumferentially-extending channels (i.e., channels) would equalize pressure that begins at the first end of the housing and terminates at the second end of the housing in addition to the radial and axial gaps between the core and the main body described above.

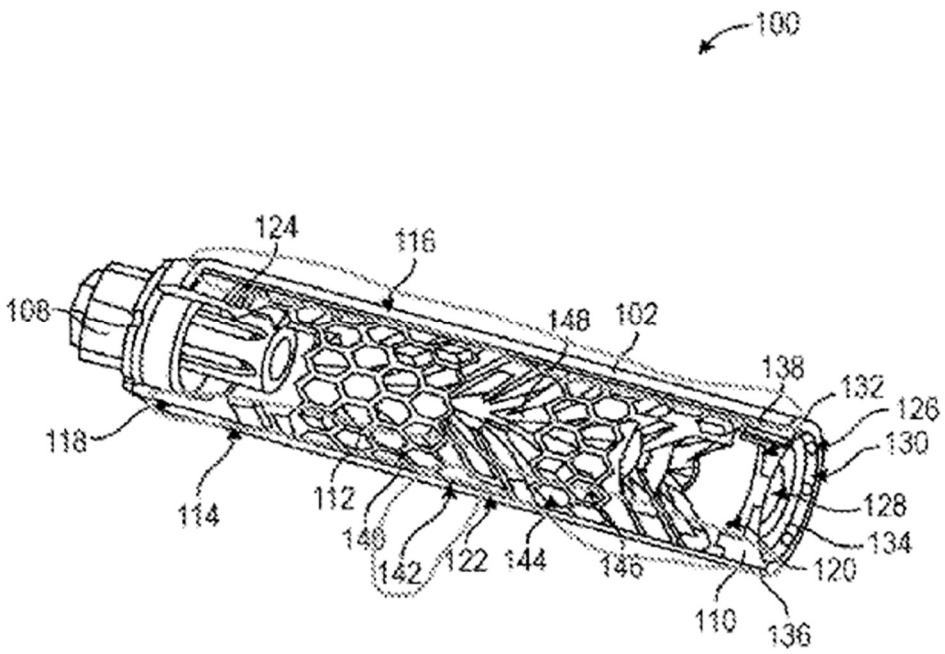
394. Thus, it further clear that the concentric rings (highlighted in purple in annotated Figs. 3) of channels along the outer surface of the core 300a (i.e., core) and the various other permutations of external channels in the various other embodiments (e.g., the spiral channels show in the core 300c of Fig. 3) also facilitate equalization of pressure at least via their connection to the radial volume and their connection to the various openings and channels formed in the core.

395. For the avoidance of doubt, and to the extent it is argued that Muceus does not include a channel circumscribing the outer surface of the core and equalizing pressure that begins at the first end of the housing and terminates at the second end of the housing, the structure and purpose of the gap (i.e., channel) of Muceus corresponds to the structure and purpose of the channel 142 of the '906 patent, which the '906 patent describes as performing the claimed equalization function, such that the gap of Muceus also equalizes pressure that begins at the first end of the housing and terminates at the second end of the housing based on the principles set out in the '906 patent. For example, in Muceus, the gap (i.e., channel) is between the outside of the suppression core (i.e., core) and the inside of the main body (i.e., housing), and Muceus discloses second openings (i.e., plurality of core apertures) that are dispersed along a substantial length of the suppression core (i.e., core) that allow gas (i.e., gas passing from a projectile and cartridge) to enter the gap (i.e., channel) created between the core and main body. Ex. 1005 ¶ 31, Fig. 3. Thus, Muceus funnels at least a portion of the gas pressure from the projectile to this void along the inner surface of the main body and external to the outer surface of the core.

396. Similarly, the '906 patent's channel is between the core 112 and the housing 102, and the core apertures 144 of the '906 patent are dispersed along a substantial length of the core 112 "that allow gas passing from the projectile and operating system to pass to the channel 142." Ex. 1001 col. 6, ll. 62-34, col. 7, ll. 22-

25; Fig. 5. Therefore, the structure and purpose of the ***gap*** (i.e., channel) of Muceus corresponds to the structure and purpose of the channel 142 of the ’906 patent and both would have the same gas equalization properties. Moreover, because the gas of Muceus is channeled to this region and Muceus intentionally includes a portion of the radial volume without the suppressor core to which the gas exiting the core is configured to flow, Muceus includes sufficient spacing to receive the gas and equalize the pressure that begins at the first end of the housing and terminates at the second end of the housing.

397. In the Response to the Office Action dated February 16, 2024, Patent Owner cited to the preceding passage from its specification for support for the amendment that included Element [1.5] and asserted that “[t]he following screenshot of Fig. 2 illustrates the channel 142 that is positioned between the housing and the core and that circumscribes the core, running the entire length of the core.” Ex. 1002 p. 104.



Annotated Fig. 2 of the '906 patent (annotated by Patent Owner in the Response to the Office Action dated February 16, 2024)

398. As discussed above, and with reference to annotated Fig. 2 above and annotated Fig. 3 below, the device of the '906 patent includes a threaded fastener 124 (highlighted in red) connecting the core 112 (highlighted in orange) to the housing 102 (highlighted in yellow) at the first end 104 and includes a sidewall 138 that "may be threaded" to the inner surface 114 of the housing 102. Ex. 1001 col. 6, ll. 39-42, Fig. 2.

399. Thus assuming, for purposes of argument, that the channel 142 of the '906 patent performs the claimed function of equalizing pressure that begins at the first end of the housing and terminates at the second end of the housing (e.g., the equalization as described at col. 6, ll. 62-67 of the '906 patent), the gap (i.e., channel)

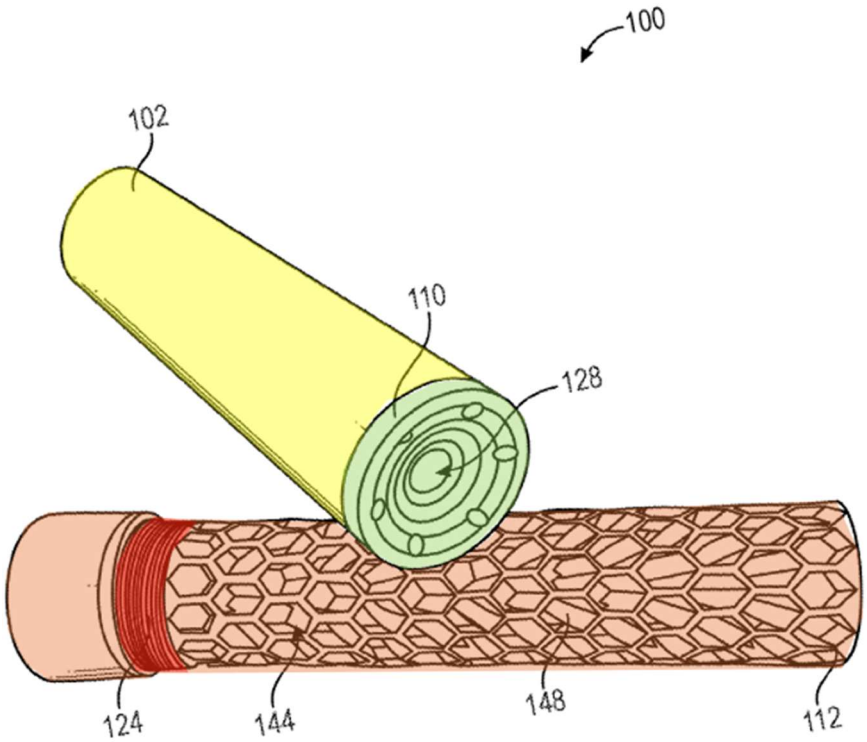
of Muceus would also perform the claimed function of equalizing pressure due to the corresponding structures and purposes of the gap (i.e., channel) of Muceus and the channel 142 of the ’906 patent.

400. To the extent it is argued that the channel equalizing pressure that begins at the first end of the housing and terminates at the second end of the housing requires the pressure within the channel itself to extend from the first end of the housing to the second end of the housing, this is contrary to the plain and ordinary meaning of the claim and contrary to the disclosure of the ’906 patent and representations made by the Applicant of the ’906 patent during prosecution.

401. The ’906 patent states that “[t]he 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”, which “equalizes the high pressures [sic] gas through the entire system 100 rapidly…”. Ex. 1001 col. 6, line 67 to col. 7 line 5. As such, the suppressor disclosed by the ’906 patent does not include “immediate” gas transfer to the channel at the first end of its housing despite disclosing and arguing during prosecution that the channel 142 performs the claimed function. As can be seen in annotated Fig. 3 of the ’906 patent below, the earliest instance that gas would be permitted to flow from the interior of the core 112 to the channel adjacent the housing 102 would be downstream of the threads 124 and downstream of the first

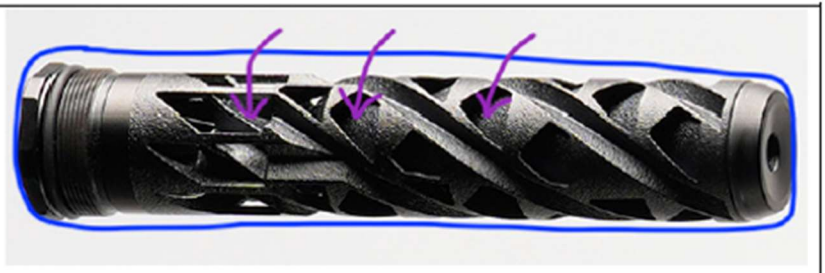
end of the housing since the core apertures 144 do not begin until after the threads 124 while the housing 102 extends to the proximal (i.e., to the left in Fig. 3 below) end of the threads.

402. Moreover, in the Office Action response discussed above, and with reference to the Applicant's annotated Fig. 2 above, the claimed "channel" includes the region that is threaded, which would not, in my opinion, allow pressure to escape through the threads. Thus, it is clear from the Patent Owner's statements and the corresponding disclosure that the "pressure" which begins at the first end of the housing and terminates at the second end of the housing does not "begin" within the channel at the first end of the housing and the claims do not require it. Further, the structure of the core of the '906 patent does not include core apertures at a first extremity of the core, and the claim language does not require a specific radial location for the pressure. Instead, for the pressure of the '906 patent to "begin[] at the first end of the housing", the pressure may begin within the core (e.g., along the projectile path into the suppressor) and may enter the channel through core apertures that are not at a first extreme end of the core.



'906 Patent, Annotated Fig. 3

403. For further avoidance of doubt, it is also my understanding that Patent Owner believes and has asserted in a claim chart (excerpt provided below) that a suppressor design that allows a "core to slide into the housing" would inherently include a channel meeting the requirements as recited in claim 1. Ex. 1011 p. 32.

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.	 Company's Suppressor includes a core (blue), a plurality of core apertures (purple arrows), and a channel. While the channel is not shown, it is inherent in the design so as to allow Company's core to slide into the housing. As such, a channel surrounds the core and is positioned between an outer surface of the core and an inner surface of the housing/shell.

core apertures (purple arrows), and a channel. While the channel is not shown, it is inherent in the design so as to allow Company's core to slide into the housing. As such, a channel

Patent Owner's Claim Chart (excerpt, annotated)

404. The Muceus suppressor features a main body (i.e., core) that slides into a body (i.e., housing). Ex. 1005 Figs. 11, 13. As such, according to Patent Owner's definition, the Muceus device would have a channel surrounds (i.e., circumscribes) the core, is positioned between the outer surface of the core and the inner surface of the housing/shell, and equalizes pressure that begins at the first end of the housing and terminates at the second end of the housing. Ex. 1005 Fig. 11, 13; Ex. 1011 p. 32.

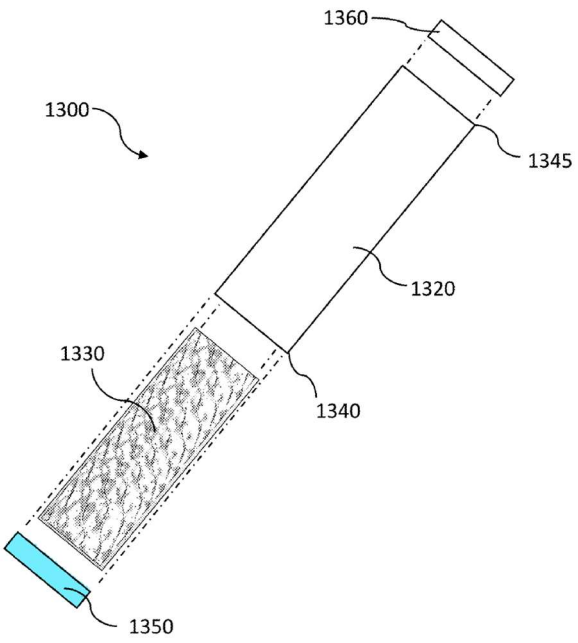
Dependent Claim 2: The firearm suppression system of claim 1, wherein the core is printed from a three-dimensional printer.

405. Muceus discloses the limitations added in dependent claim 2. Specifically, Muceus discloses that "suppressors having TPMS structures in accordance with the present disclosure are fabricated using additive manufacturing, which is also known as three-dimensional (3D) printing." Ex. 1005 ¶ 56. As described above, each of the suppression cores (i.e., cores) of Muceus may be manufactured according to this process. Ex. 1005 ¶¶ 31-32, 37-40, 42, 46, 48, 54, 57, 59, Figs. 3-13.

406. Also, Muceus provides Fig. 12, which shows the 3D printing process, noting that Fig. 12 "shows perspective views of three suppressor structures (i.e., cores) 1200a, 1200b and 1200c being built by additive manufacturing" and "shows entire *suppressor cores* being built as one piece." Ex. 1005 ¶ 57; Fig. 12 (emphasis added). Suppression cores (i.e., cores) that are constructed using a 3D printing technique are printed from a three-dimensional printer. *See also* Ex. 1005 ¶ 57 ("if a 3D printer is limited in the size of a part that can be produced, two or more lengthwise portions of a core can be built individually and then joined together by welding or other bonding methods"). As such, Muceus discloses that the suppression cores (i.e., cores) are printed from a three-dimensional printer, as required by claim 2.

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

407. Muceus discloses the limitations added in dependent claim 4. Referring to annotated Fig. 13 of Muceus below, the suppressor assembly 1300 (i.e., firearm suppression system) includes a baseplate 1350 that is attached at the firearm (i.e., entry) end of the suppressor assembly. Ex. 1005 Fig. 13, ¶ 59. Muceus, in particular, states that the "baseplate 1350 is coupled to the entry end 1340 of the suppressor 1300*, for attaching the suppressor to a firearm barrel*" and "[t]he components may be screwed and/or welded together to contain the TPMS structure inside the body 1320 […] either as *separate components* or as a monolithic piece. *For pistols, on non-fixed barrel models, the addition of a linear inertial decoupler (LID), Nielsen device, or recoil booster may be added to the system.*" Ex. 1005 ¶ 59 (emphasis added). A muzzle adapter may be changeable so as to adapt to different types of muzzle interfaces. Muceus highlights this by discussing how one can have a version of it for pistols that require a booster instead of just a threaded muzzle adapter. Therefore, because the baseplate attaches the suppressor to a firearm barrel in this modular way, the baseplate of Muceus is a muzzle adapter.



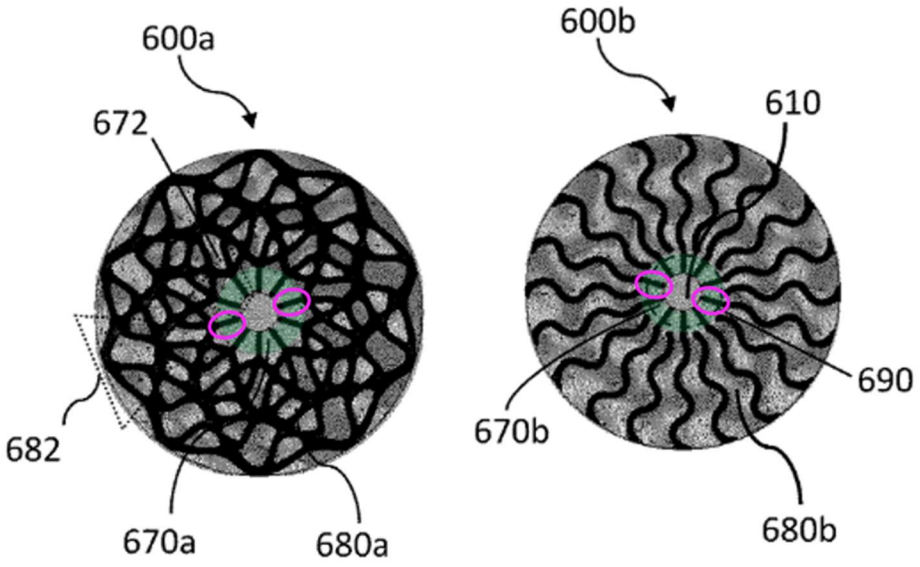
Muceus, Fig. 13 (annotated)

Dependent Claim 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.

408. Muceus discloses the limitations added in dependent claim 10. Muceus discloses that its suppressor core may include an inner portion and an outer portion. Ex. 1005 ¶37-38. In particular, Muceus discloses that "[i]n various embodiments, the geometry of the *baffle structures* within *the inner portion* is different from those in the outer portion. For example, the *inner portion may have baffles* with a non-TPMS geometry," Ex. 1005 ¶ 38 (emphasis added). Muceus further provides that "In this disclosure, suppressor cores (which may also be referred to herein as suppression cores) are the suppressor structures that fill all or some of an annular

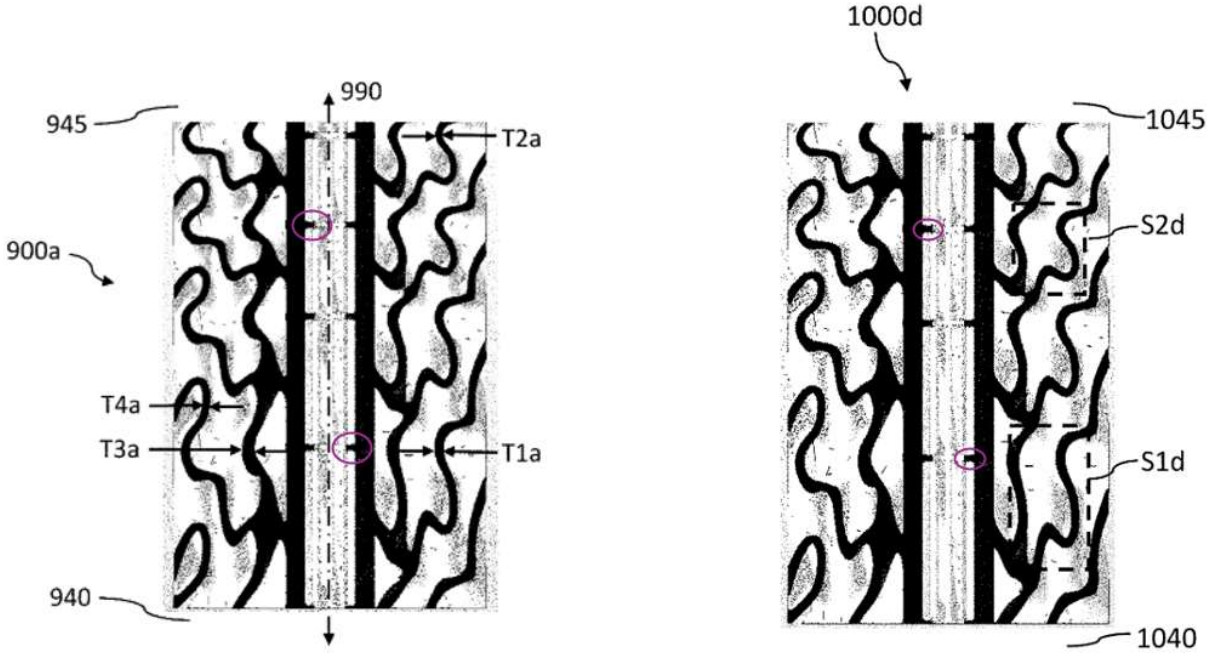
chamber in a suppression device, to serve as baffles." EX1005 ¶31. Thus, the body of the core itself (both inner portion and outer portion) comprises the baffles from the center bore (e.g., center bore 610 shown in annotated Figs. 7A-7B below) to the exterior openings and surfaces on the outside of the core. Each of the various baffle surfaces described above extends from another adjacent surface. Muceus discloses that the "inner portion [is] adjacent to the center bore." Ex. 1005 ¶ 6, 51-53. (emphasis added). As such, the inner portion of the core has at least one inner surface, including the inner portion as well as various surfaces within the interior of the core.

409. Further, Muceus shows at least suppressor cores 600a of Figs. 6A and 7A, 600b of Fig. 6B and 7B, 800a of Fig. 8A, 800b of Fig. 8B, 900a of Fig. 9A, 900b of Fig. 9B, 1000c of Fig. 10C, 1000d of Fig. 10D, and 1200a-c of Fig. 12 have inner surfaces that include baffles. Ex. 1005 Figs. 6A, 6B, 7A, 7B, 8A, 8B, 9A, 9B, 10C, 10D, 12. For example, and with reference to annotated Figs. 7A and 7B, below, Muceus discloses that the geometry of the baffle structures (examples circled in magenta) in the inner portions 670a, 670b (highlighted in green) "have a rectangular cross-section in the longitudinal direction". Ex. 1005 ¶ 38; Figs. 7A, 7B.



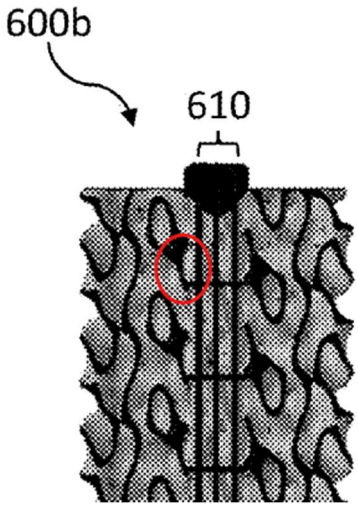
Muceus, Fig. 7A (annotated) **Muceus, Fig. 7B (annotated)**

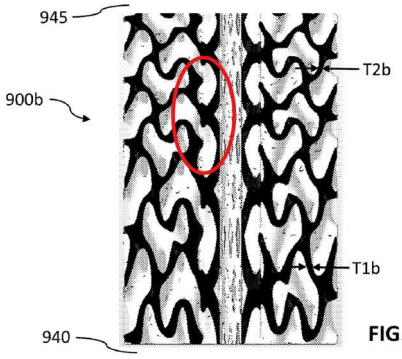
410. As yet another example, and as shown in annotated Figs. 9A and 10D, Muceus discloses baffles (examples circled in magenta) that extend from inner surfaces that face towards the center axis (e.g., center axis 990 of Fig. 9A). Ex. 1005 Figs. 9A, 10D. As such, Muceus discloses a core that comprises an inner surface that includes baffles.



Muceus, Fig. 9A (annotated, excerpt) **Muceus, Fig. 10D (annotated)**

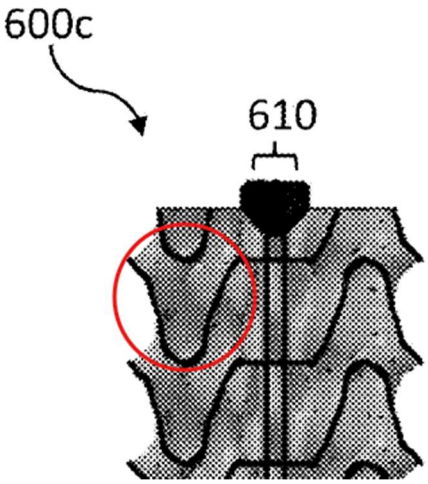
411. Further, other embodiments of the suppressor core of Muceus also show baffles of various inner surfaces. For example, referring to annotated excerpts of Figs. 6B and 9B below, the baffles (red circle) along the interior of the central bore (labeled 610 in Fig. 6B) extend inward towards the firearm muzzle and radially toward the central bore from an inner surface of the suppressor core (i.e., the surface outward of the indicated baffles).

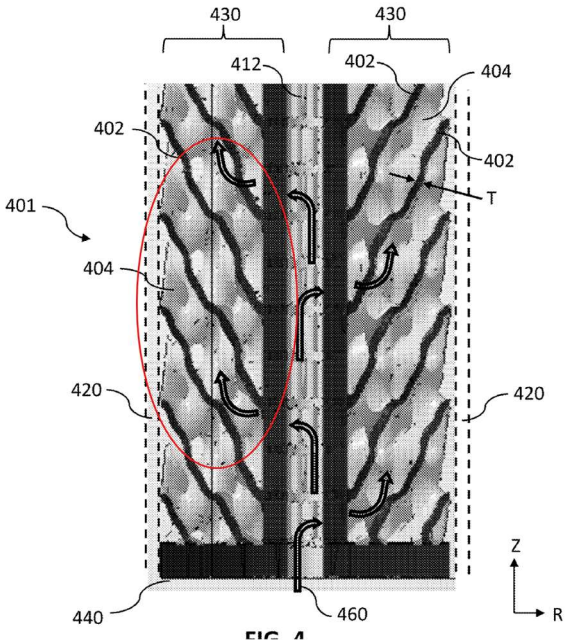




Muceus Fig. 6B (excerpt, annotated) **Muceus Fig. 9B (annotated)**

412. The '906 patent does not give further definition to the term "inner surface" and it is my opinion that an "inner surface" can refer to any surface within the exterior perimeter of the core (e.g., in the interior of the core). While the foregoing examples show the baffles extending inwardly from the innermost surfaces in the core adjacent to the bore of the core (e.g., center bore 610, for the avoidance of dobut, the baffles shown in some embodiments, such as Figs. 4 and 6C below, include inwardly extending baffle surfaces that extend from an inner surface elsewhere in the interior of the suppressor core.





Muceus Fig. 6C (excerpt, annotated) **Muceus Fig. 4 (excerpt, annotated)**

413. Moreover, with respect to Fig. 3, Muceus describes that the suppressor cores 300a, 300b, and 300c have "TPMS structures, in accordance with some embodiments. In this disclosure, suppressor cores (which may also be referred to herein as suppression cores) are the suppressor structures that fill all or some of an annular chamber in a suppression device, to serve as baffles." Ex. 1005 ¶ 25. Thus, referring to annotated Fig. 3 below, the TPMS structure includes at least some inner surfaces that define the "suppressor structures . . . [that] serve as baffles" and similarly interact with the core apertures as they are intertwined as discussed above with respect to claim 1. Ex. 1005 ¶ 31, Figs. 2-3. For further confirmation, Fig. 2 of Muceus, also reproduced below, shows an example of a TPMS gyroid surface (as

discussed above) showing the layers of TPMS structure each having a portion facing inwardly from an inner surface.

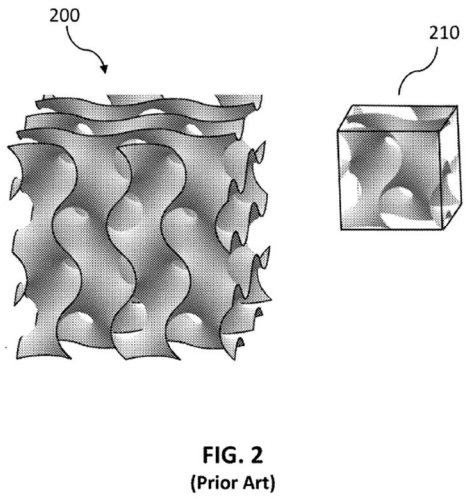


FIG. 2
(Prior Art)

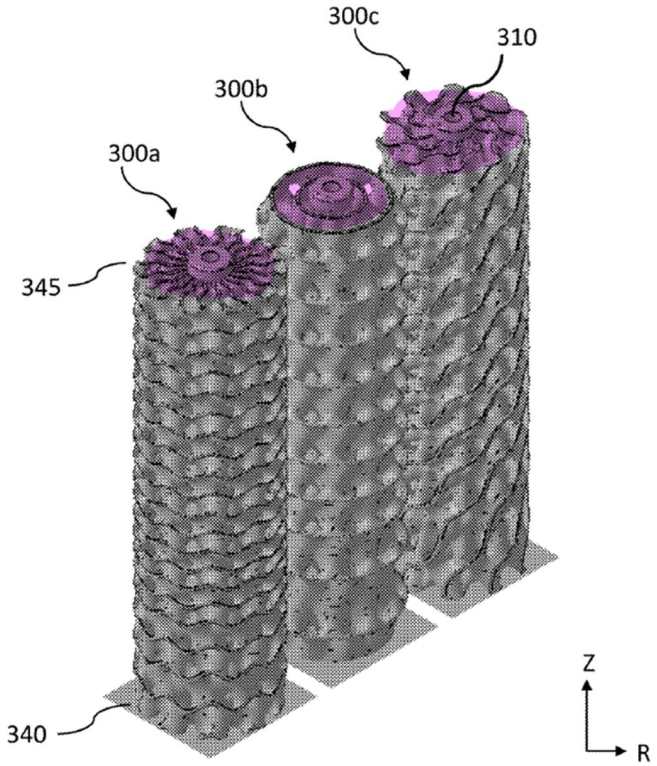


FIG. 3

Muceus, Fig. 2 **Muceus, Fig. 3 (annotated)**

414. As such, the inner portion of the suppression core (i.e., core), which includes the baffles, has channels that fluidically connect the center bore with the outer portion, which includes the outlet openings of the channels (i.e., plurality of core apertures). Thus, the baffles (i.e., baffles) of the inner portion of the core interact with the outlet openings of the channels (i.e., plurality of core apertures).

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

415. Muceus discloses the limitations added in dependent claim 11. The ’906 patent uses the term in the description as follows: “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.” Ex. 1001 col. 3, ll. 14-17. We can see the ’906 patent means that the shapes protrude inward at an angle. In computer-aided design (“CAD”), however, extruding is a tool for generating or expanding a three dimensional model of a part from a pattern by displacing it shape along aa straight or curved path. For example, Solidworks - probably the most commonly used CAD tool for silencer design - calls this tool “Extrude Boss/Base.” Fusion (formerly known as Fusion 360), simply calls it “Extrude.” Alternatively, in the manufacturing context, “extrusion” may refer to a high-pressure die-based forming process (i.e., not 3D printing).

416. In either of the foregoing instances, “extrusion” refers to the method by which the shape of the component is formed or designed to achieve a resulting shape, and not a manufacturing method for the final product. Given that the ’906 patent discloses three dimensional printing but not a die-based manufacturing process, the baffles being “extruded” inward refers to the baffles “extending” inwardly, such as might be created by using the “extrude” function for the CAD model of the part. The

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plain and ordinary meaning of "inwardly" in the firearm suppressor arts either refer to the direction toward the shooter (e.g., aft towards the firearm muzzle) or radially inward. For example, the '906 patent describes, with respect to the end cap 110, that the "end cap 100 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." Ex. 1001 col. 6, ll. 26-29. With respect to the baffles, the '906 patent states that "These baffles 608 may be extruded inward, toward a muzzle when coupled to a firearm, at various prescribed angles" thus confirming my understanding of the term "inward" as used in '906. Ex. 1001 col. 10, ll. 51-53. At least Muceus' baffles depicted in Figs 7A, 7B, 9A, and 10D are extruded radially inward. Ex. 1005 Figs. 7A, 7B, 9A, and 10D. As will be discussed, Muceus' baffles depicted in Fig. 4 are extruded both inward toward the shooter and also inward radially. Ex. 1005 Fig. 4.

417. As described above, the various patterns of the suppressor cores, such as the gyroid pattern demonstrated in Fig. 2 and the examples in Figs. 3, 4, 6B, 6C, 7A, 7B, 9A, 9B, and 10D illustrated above include numerous surfaces oriented in every direction, including inwardly towards the shooter, as can be seen, for example, by the layer pattern of Fig. 2. Ex. 1005 Fig. 2. For example, in the embodiment of Fig. 3 below, suppressor core 300a (i.e., core) is described as being a gyroid TPMS structure (Ex. 1005 ¶ 31), and comparing Figs. 2 and 3, resembles the gyroid of Fig.

2 with the pattern being oriented such that the outermost lines are extending circumferentially around the suppressor core 300a (i.e., core). Thus, referring to the adjacent sides and the interior of the gyroid of Fig. 2, one can see that numerous of the surfaces within the suppressor extend inwardly towards the user as the TPMS structure is convoluted and extends in many directions. Moreover, Muceus discloses that the "suppressor structures . . . [that] serve as baffles" and similarly interact with the core apertures as they are intertwined as discussed above with respect to claim 1. Ex. 1005 ¶ 31, Figs. 2-3. Thus, the "baffles" of Muceus are both intertwined with the respective core apertures and extend at least inwardly in the depicted configurations. For example, in the perspective shown in Fig. 2, assuming for purposes of reference that the shooter is positioned towards the bottom of the figure, the baffle patterns extend inwardly towards the shooter from each of the top surfaces and each intermediate surface between the top and bottom of the gyroid shape.

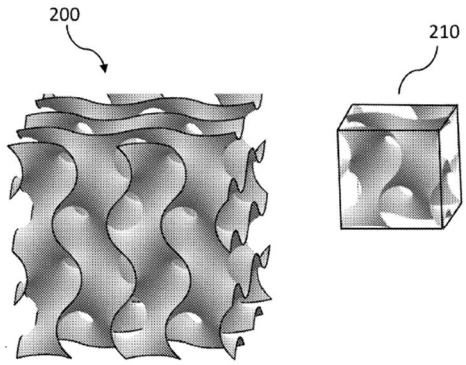


FIG. 2
(Prior Art)

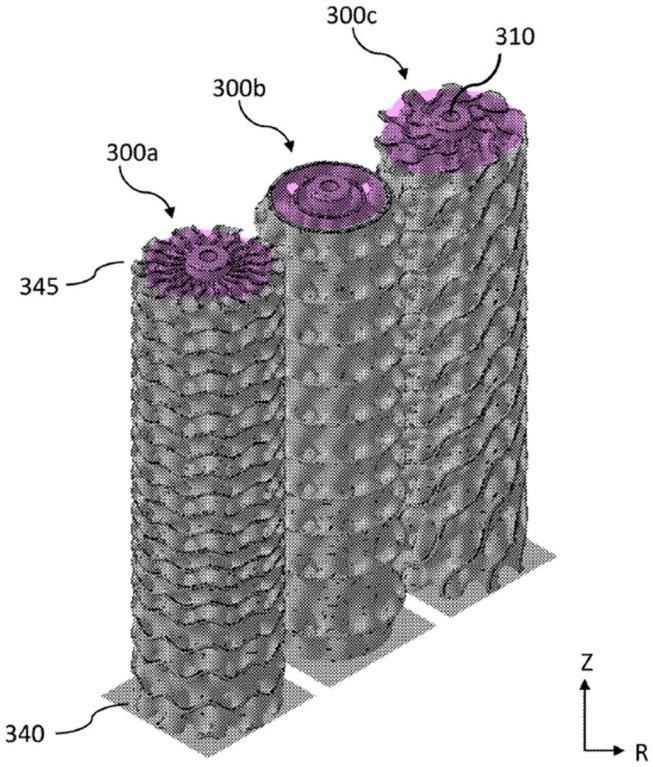
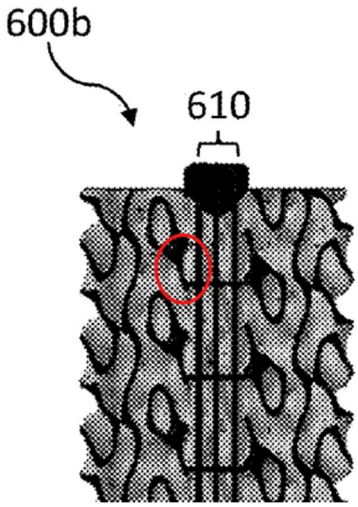
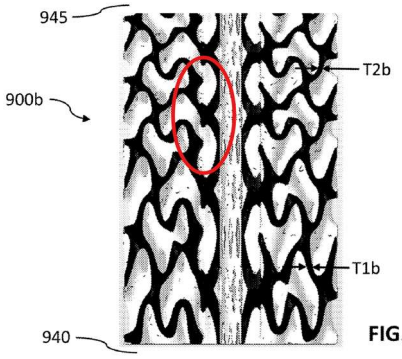


FIG. 3

Muceus, Fig. 2 **Muceus, Fig. 3 (annotated)**

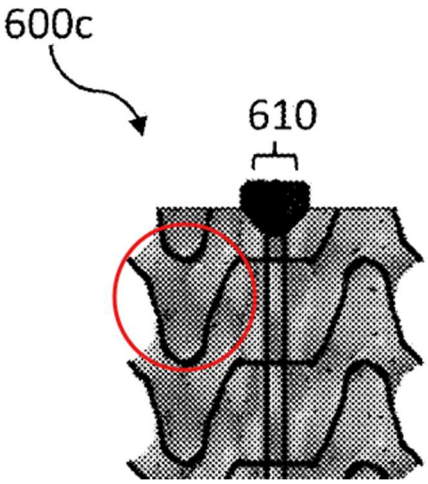
418. Further, other embodiments of the suppressor core of Muceus also show inwardly extending (i.e., extruded inward) baffles. For example, referring to annotated excerpts of Figs. 6B and 9B below, the baffles (red circle) along the interior of the central bore (labeled 610 in Fig. 6B) extend inward towards the firearm muzzle and radially toward the central bore from an inner surface of the suppressor core.

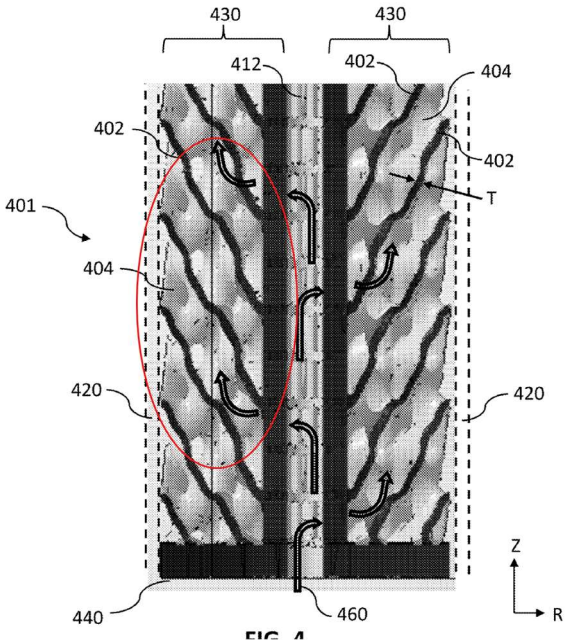




Muceus Fig. 6B (excerpt, annotated) **Muceus Fig. 9B (annotated)**

419. The ’906 patent does not give further definition to the term “inner surface” and it is my opinion that an “inner surface” can refer to any surface within the exterior perimeter of the core (e.g., in the interior of the core). While the foregoing examples show the baffles extending inwardly from the innermost surfaces in the core adjacent to the bore of the core, for the avoidance of doubt, the baffles shown in some embodiments, such as Figs. 4 and 6C below, include inwardly extending baffle surfaces that extend from an inner surface elsewhere in the interior of the suppressor core.





Muceus Fig. 6C (excerpt, annotated) **Muceus Fig. 4 (excerpt, annotated)**

420. Thus, Muceus discloses numerous instances of baffles being extruded inward.

G. Ground 7: Claims 3 and 4 are rendered obvious by Muceus in view of Slack and Belykov

421. For at least the reasons below, claims 3 and 4 of the '906 patent are unpatentable as rendered obvious by Muceus in view of Slack and Belykov.

Motivation to Combine Muceus, Slack, and Belykov

422. It is my opinion that a POSITA would have been motivated to combine Muceus (e.g., as modified by Slack in Ground 6 above), Slack, and Belykov, and would have had a reasonable expectation of success.

423. Muceus and Slack are directed to the same field of endeavor, firearm suppressors, and address similar problems related to noise and gas management in firearm suppression systems. Ex. 1005 ¶ 2; Ex. 1006 ¶ 2, 4. Moreover, there is a motivation to combine Muceus and Slack and reasonable expectation of success in the combination as discussed above with respect to Ground 6, which demonstrates their complementary structures and functions.

424. Belykov is also directed towards firearm suppressors and addresses similar problems related to noise and gas management in firearm suppression system. Specifically, Belykov is about "a silencer for a firearm" and states that "[a] so-called gas accumulation inside the silencer 1 which also causes the silencer to overheat and supports spark formation is improved." Ex. 1003 ¶¶ 1, 49. Accordingly, Muceus, Slack, and Belykov all share the same field of endeavor.

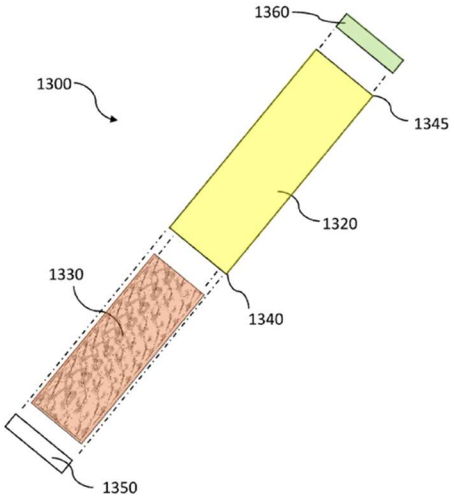
425. Muceus, Slack, and Belykov are analogous art because they are from the same field of endeavor and address the same problems—improving firearm suppressors, specifically managing combustion gas flow and sound attenuation in firearm suppressors. Even if Muceus, Slack, and Belykov were not from the same field of endeavor (which they are), Slack, and Belykov would still be reasonably pertinent to the problem addressed by Muceus, and vice versa, given their overlapping purpose and design constraints.

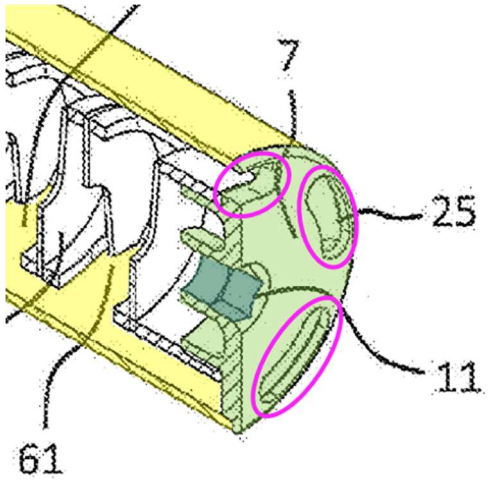
426. A POSITA would have been motivated to combine the teachings of Muceus, Slack, and Belykov to arrive at the subject matter of claim 3. As discussed with reference to Ground 6, Claim 1, Element 1.2, Muceus, both alone and in view of Slack, discloses an end cap with a projectile aperture. Neither Muceus nor Slack explicitly describe an end cap that comprises a plurality of vent apertures, as required by claim 3.

427. Belykov discloses venting openings 25 (i.e., vent apertures) on a front end wall 7 (i.e., end cap). Ex. 1003 ¶ 32. Specifically, Belykov discloses "at least one venting opening, preferably two, three, more than three, four and five, preferably less than ten venting openings, is additionally formed in the front end wall, in particular on the radial height of the annular space to release the gas to the outside into the atmosphere." Ex. 1003 ¶ 5. Belykov's venting openings 25 (i.e., vent apertures) improve "gas accumulation inside the silencer 1 which also causes the silencer to overheat and supports spark formation" "in particular if several shots are fired from the firearm in short intervals." Ex. 1003 ¶ 49. As such, a POSITA would have recognized that incorporating Belykov's vent apertures into Muceus' endcap 1360 (i.e., endcap) would enhance gas dissipation and cooling, particularly during high-rate firing, by providing an additional outlet for high-pressure gases that relieves localized overpressure zones and promotes even gas discharge across the suppressor face.

428. The POSITA would have been motivated to use the venting openings, as taught by Belykov with the endcaps of Muceus (e.g., as modified by Slack) and/or Slack to reduce residual gas accumulation, overheating, and spark formation in the suppressor. The POSITA would have further been motivated to add venting openings as taught by Belykov to Muceus' suppressor to improve performance of Muceus' suppressor when firing multiple rounds in short intervals.

429. A POSITA would have had a reasonable expectation of success in combining these teachings by using the venting openings, as taught by Belykov with the endcaps of Muceus and/or Slack. As shown in annotated Fig. 13, below, Muceus discloses an endcap 1360 (highlighted in green) that is separate from the body 1320 (i.e., housing) and the suppressor core 1330 (i.e., core). Ex. 1005 ¶ Fig. 13. Muceus discloses that the "endcap 1360 may be machined out of metal." Ex. 1005 ¶ 59. Belykov's venting openings 25 (i.e., vent apertures) are compatible with a machining fabrication method, demonstrating the mechanical feasibility of the proposed combination without design conflict. As such, a POSITA would have had a reasonable expectation of success in incorporating the venting openings 25 (i.e., vent apertures) into Muceus' endcap 1360 (i.e., end cap).





Muceus, Fig 13 (annotated) **Belykov, Fig. 5 (annotated, excerpt)**

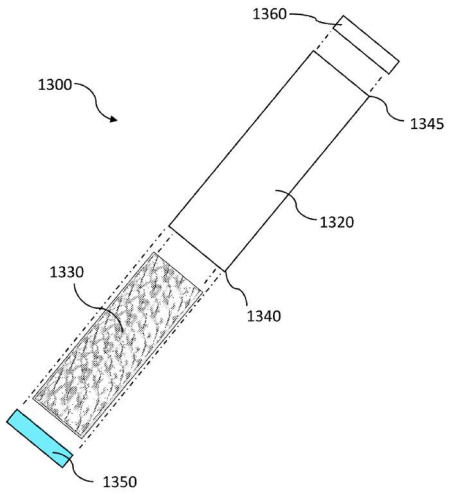
430. Further, the integration of Belykov's venting openings 25 (i.e., vent apertures) into Muceus' endcap 1360 (i.e., end cap) would have had a reasonable expectation of success because they would not require undue experimentation and would have been well within the capabilities of a POSITA. Specifically, Belykov provides detailed guidance on the geometry, placement, and function of the venting openings 25 (i.e., vent apertures), including their role in preventing overheating and spark formation. Ex. 1003 ¶ 5, 32. For example, Belykov discloses that the front end wall 7 (i.e., end cap) has "at least one venting opening, preferably two, three, more than three, four and five, preferably less than ten venting openings, is additionally formed in the front end wall, in particular on the radial height of the annular space to release the gas to the outside into the atmosphere," the venting openings 25 are "designed in a curved long shape, wherein an arc line extends longitudinal to a circular line with constant radial distance to the axis G" and "completely formed into

the material of the front end wall 7." Ex. 1003 ¶ 5, 32. Therefore, a POSITA would have been motivated to incorporate Muceus' endcap 136 (as modified by Slack) to include a plurality of venting openings 25 (i.e., vent apertures), yielding a reasonable expectation of success including predictable and beneficial results consistent with the objectives of Belykov. Accordingly, a POSITA would have been motivated to combine, and would have had a reasonable expectation of success in combining, Muceus in view of Slack and Belykov.

431. It is further my opinion that a POSITA would have been motivated to combine the teachings of Muceus, Slack, and Belykov to arrive at the subject matter of claim 4. As discussed in reference to Ground 7, claim 4, the baseplate 1350 of Muceus is a muzzle adapter. For the avoidance of doubt, Belykov discloses a front wall 13 (i.e., muzzle adapter) and an alternate assembly including an unlabeled adapter in place of the front wall 13 that receives a muzzle brake 17, each of which the POSITA would have been motivated to incorporate into Muceus' suppressor assembly 1300 to provide equivalent attachment in Muceus.

432. For example, Muceus, in particular, states that the "baseplate 1350 is coupled to the entry end 1340 of the suppressor 1300*, for attaching the suppressor to a firearm barrel*". Ex. 1005 ¶ 59 (emphasis added). Similarly, and as shown in Belykov's annotated Fig. 7, below, Belykov's replacement for the front wall 13 (i.e., muzzle adapter) (highlighted in blue) in Fig. 6 couples to a muzzle brake 17, which

is a "silencer-unrelated component". Ex. 1005 ¶ 28. Both the front wall 13 by itself and the muzzle break 17 and front wall based adapter would be obvious to combine with Muceus such that, while Muceus already includes a muzzle adapter as baseplate 1350, the POSITA would have been motivated to incorporate any of the foregoing features from Belykov into Muceus to configure Muceus' suppressor for the same functionality as Belykov.



Muceus, Fig. 13 (annotated)

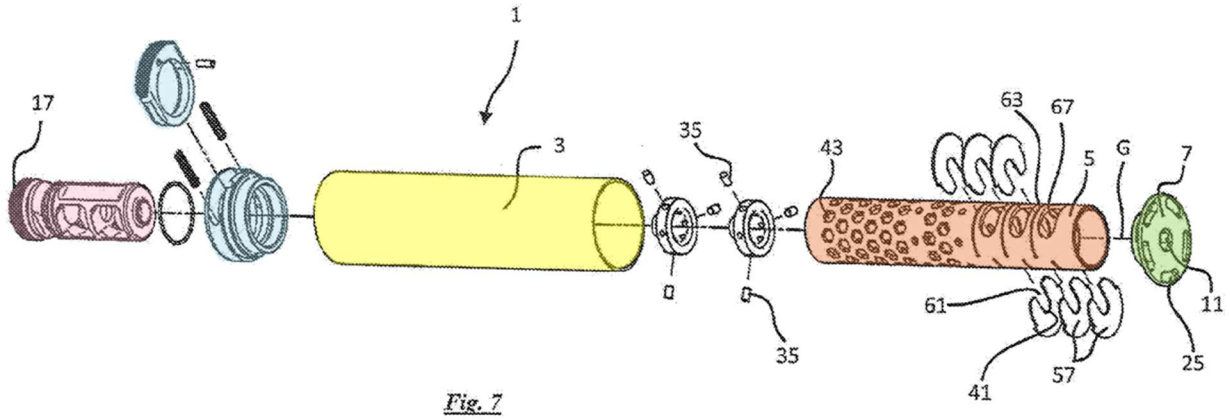


Fig. 7

Belykov, Fig. 7 (annotated)

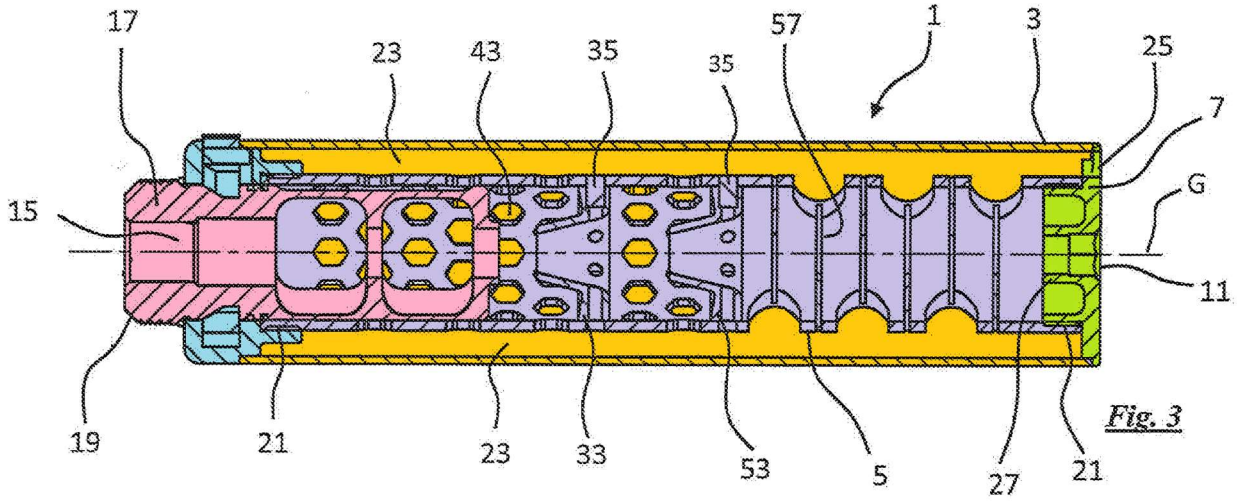


Fig. 3

Belykov, Fig. 3 (annotated)

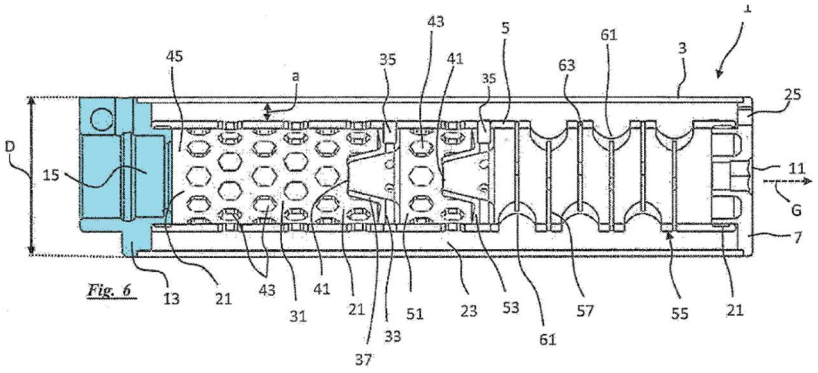


Fig. 6

Belykov, Fig. 6 (annotated)

433. The POSITA would have been motivated to configure the baseplate of Muceus, as modified by Slack in Ground 6 above, to receive a muzzle brake (though I further note that the baseplate of Muceus is already a muzzle adapter) to make the baseplate of Muceus more versatile and configurable. Moreover, the removability of Belykov's end wall 13 would have motivated the POSITA to make Muceus' baseplate 1360 removable (to the extent not already removable) to allow interchangeability of muzzle attachment mechanisms and intermediate devices between the barrel and the suppressor.

434. The POSITA would have had a reasonable expectation of success in combining Muceus, Slack, and Belykov because the respective suppressors include baseplate like structures (e.g., the baseplate 1350 of Muceus, the muzzle end with flange 150 of Slack, and the end wall 13 of Belykov) that are each configured to adapt the corresponding suppressor to a firearm barrel. Thus, the POSITA would have had a reasonable expectation that using the exchangeable end wall options from Belykov would improve the interoperability of Muceus' baseplate. Moreover, the POSITA would have had a reasonable expectation of success in modifying Muceus in view of Slack, as discussed with respect to Ground 6, and further modifying Muceus in view of Belykov.

435. Moreover, Belykov's front face 13 is designed such that the "outer tube 3 is, depending on the screwing situation, axially clamped between the front ends 7,

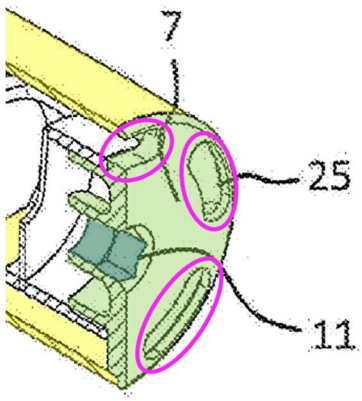
13", which aligns with Muceus' disclosure that the baseplate 1350 may be screwed to the suppressor body. Ex. 1003 1005 ¶ 29; 1003 ¶ 59. As such, the integration of Belykov's front face 13 and unlabeled front face substitute with muzzle brake 17 into Muceus would have a reasonable expectation of success because it would have not require undue experimentation and would have been well within the capabilities of a POSITA. Accordingly, a POSITA would have been motivated to combine, and would have had a reasonable expectation of success in combining, Muceus in view of Slack and Belykov. This conclusion is further supported by the explicit threaded couplings and interchangeable features shown in both references.

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

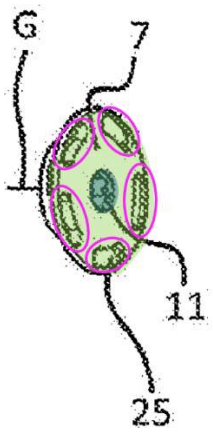
436. Belykov discloses the limitations added in dependent claim 3. As discussed with regard to claim 1, Element [1.2] of Ground 6, Muceus discloses an end cap with a projectile aperture, and Muceus and Slack render obvious the limitation of an end cap with a projectile aperture. Neither Muceus nor Slack explicitly disclose that the end cap comprises a plurality of vent apertures.

437. As discussed with regard to Element [1.2] of Ground 1, and as depicted in Belykov's annotated Fig. 3 and annotated excerpt of Fig. 7, both below, Belykov discloses an end wall 7 (i.e., end cap) (highlighted in green) with a projectile exit opening 11 (i.e., projectile aperture) (highlighted in blue). Ex. 1003 Figs. 3, 7.

Belykov also discloses "five venting openings 25 extend *concentrically around* the projectile exit opening 11 and are completely formed into the material of the front end wall 7." Ex. 1003 ¶ 32 (emphasis added). Belykov explains that "muzzle gas can also reach via the annular space 23 and the respective venting openings *25 the outside of the silencer 1*." Ex. 1003 ¶ 48 (emphasis added). As such, "[a] so-called gas accumulation inside the silencer 1 which also causes the silencer to overheat and supports spark formation is improved due to the additional venting via the venting openings 25." Ex. 1003 ¶ 49.



Belykov, Fig. 5 (excerpt, annotated)



Belykov, Fig. 7 (excerpt, annotated)

438. Similarly, the '906 patent discloses that the vent apertures "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." Ex. 1001 col. 6, ll. 14-20 (emphasis added). The channel 142 "moves the pressure towards and *out of the vent apertures 126*." Ex. 1001 col. 7, ll. 10-12 (emphasis added). "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." Ex. 1001 col. 6, ll. 14-20 (emphasis added).

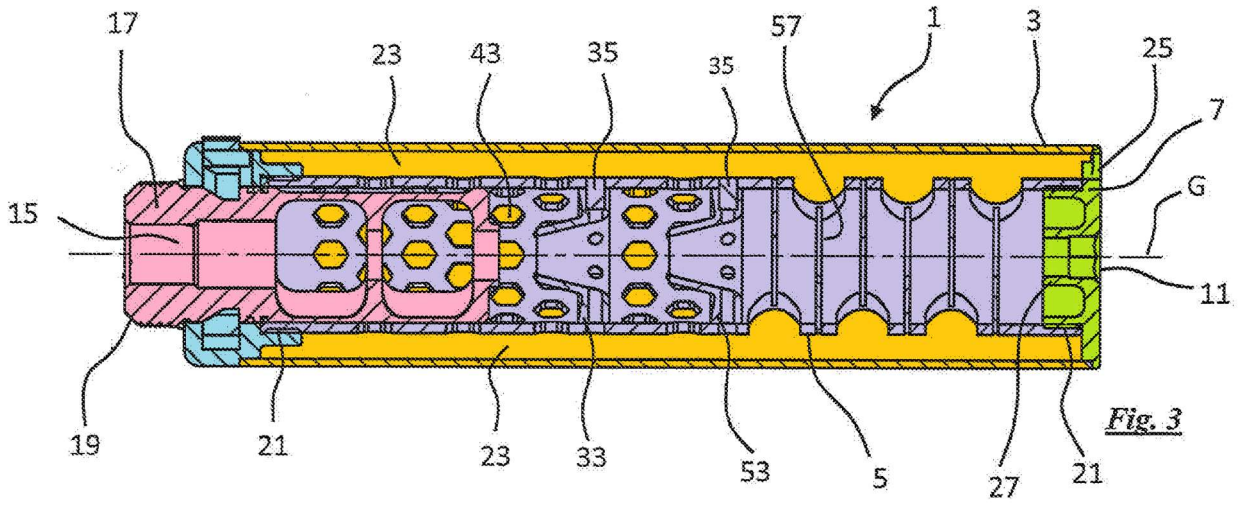
439. Because Belykov's venting opening 25 in the end wall 7 (i.e., end cap) allow muzzle gas to reach the outside of the silencer via the annular space 23 (i.e., channel) and the respective venting opening 25 extend concentrically around the projectile exit opening 11 (i.e., projectile aperture), which correspond to the structure and function of the '906 patent's vent apertures, Belykov's venting openings 25 are the claimed plurality of vent apertures.

440. It would be obvious to modify Muceus or Muceus in view of Slack to incorporate Belykov's venting openings 25 (i.e., plurality of vent apertures) into the endcap 1360 of Muceus. For example, a POSITA would have been motivated to incorporate Belykov's venting openings 25 (i.e., plurality of vent apertures) to improve gas accumulation within the suppressor assembly 1300, which would prevent overheating and spark, as taught by Belykov.

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

441. Muceus and Belykov disclose the additional limitations of dependent claim 4. As discussed in Ground 6, Muceus discloses a muzzle adapter. In addition, for the avoidance of doubt, it would be obvious to add the muzzle adapter embodiments of Belykov to the device of Muceus. Specifically, Belykov discloses " *a front face 13 with a projectile entry opening 15 to be coupled with the firing arm* [sic] (not shown), wherein the face wall 13 on the side of the firearm *can optionally be replaced by silencer-unrelated components, such as a muzzle brake 17 which can be coupled to the silencer 1 via a detachable fastening device 19*." Ex. 1003 ¶ 28 (emphasis added). Both the front face 13 and the unlabeled adapter (highlighted in blue) in Fig. 3, which holds "silencer-unrelated components" such as the muzzle brake 17 are "on the side of the firearm" and thus configured to attach to the barrel of the firearm, such that each would function as a muzzle adapter connecting the

silencer with the barrel of the firearm. As such, Belykov discloses a front face 13 (highlighted in blue) and a muzzle brake 17 (highlighted in pink) with an unnamed attachment component (i.e., muzzle adapter) (highlighted in blue) each of which may be added to the device of Muceus in place of or in addition to the baseplate to include a muzzle adapter according to claim 4.



Belykov, Fig. 3 (annotated)

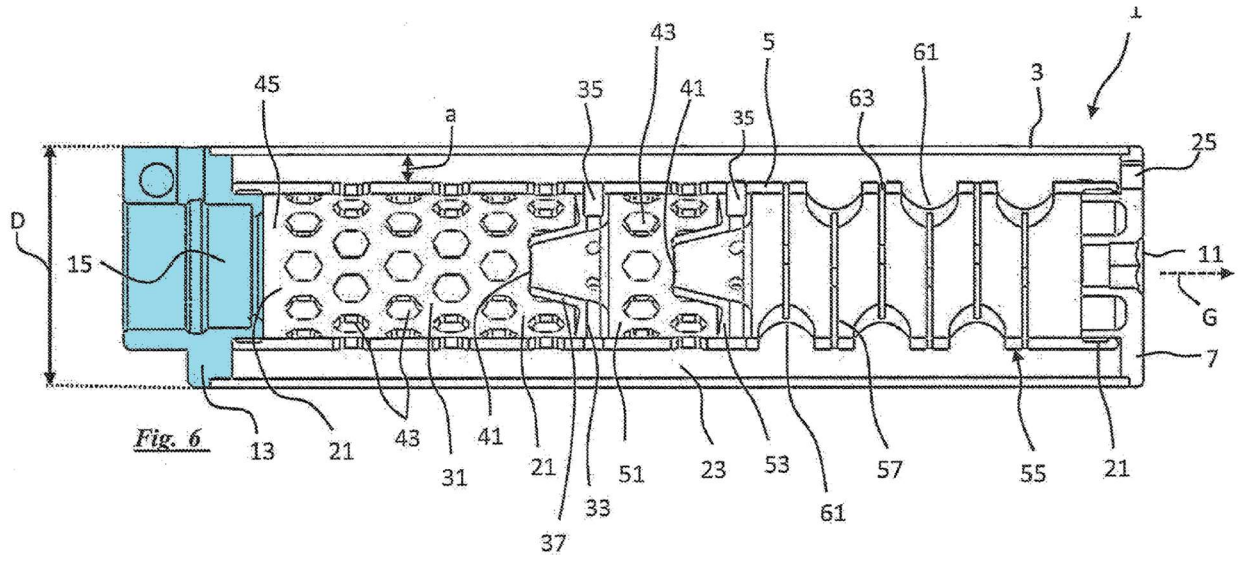


Fig. 6

Belykov, Fig. 6 (annotated)

H. Ground 8: Claims 6 and 7 are rendered obvious by Muceus in view of Slack and Noonan.

442. For at least the reasons below, claims 6-7 of the '906 patent are unpatentable as rendered obvious by Muceus and Slack, and in further view of Noonan.

Motivation to Combine Muceus, Slack, and Noonan

443. A POSITA would have been motivated to combine the teachings of Muceus, Slack, and Noonan to arrive at the subject matter of claims 6 and 7 of the '906 patent. As discussed, Muceus, Slack, and Noonan are directed to the same field of endeavor, firearm suppressors, and address similar problems related to noise and gas management in firearm suppression systems. Ex. 1005 ¶ 2; Ex. 1006 ¶ 2, 4; Ex. 1004 col. 1, ll.26-29; col. 22, ll. 56-58.

444. Noonan is also directed towards firearm suppressors and addresses similar problems related to noise and gas management in firearm suppression systems. Specifically, Noonan is directed towards an expansion chamber assembly 10 that "reduce[s] muzzle flash and/or recoil generated by the firearm when firing the bullet." Ex. 1004 col. 1, ll. 26-29; col. 2, ll. 56-58. Noonan explains that "the expansion chamber assembly 10 is configured to decelerate and cool at least a portion of the expanding gasses thereby reducing the noise and/or flash created when the bullet is fired from the firearm." Ex. 1004 col. 5, ll. 9-13. As such, Muceus, Slack, and Noonan are all directed to the same field of endeavor.

445. Muceus, Slack, and Noonan are analogous art because they are from the same field of endeavor and address the same problem—improving firearm suppressors, specifically by managing combustion gases and sound attenuation in firearm suppressors. Even if Muceus, Slack, and Noonan were not from the same field of endeavor (which they are), Slack, and Noonan would still be reasonably pertinent to the problem addressed by Muceus, and vice versa.

446. A POSITA would have been motivated to combine the teachings of Muceus (e.g., as modified by Slack as discussed in Ground 6 above), Slack, and Noonan to arrive at the subject matter of claim 6. As discussed at Ground 6 (Claim 1, Element 1.2), Muceus, —alone and in combination with Slack— discloses an end cap with a projectile aperture. Muceus in view of Slack disclose that the end cap may

include a sidewall positioned in the inner compartment that rests against the inner surface of the housing.

447. For the avoidance of doubt, Muceus (in view of Slack and Noonan) discloses an end cap that can comprise a sidewall positioned in the inner compartment and resting against the housing's inner surface. A POSITA would have been motivated to modify Muceus (as modified by Slack) to have an end cap with a sidewall that rests against an inner surface of the housing because the modification would increase sealing between the end cap and the housing, which would prevent expanding gases from escaping between the end cap and the housing. As a result, this would slow the expansion of gas passing from the projectile and cartridge and thereby improve the suppression performance.

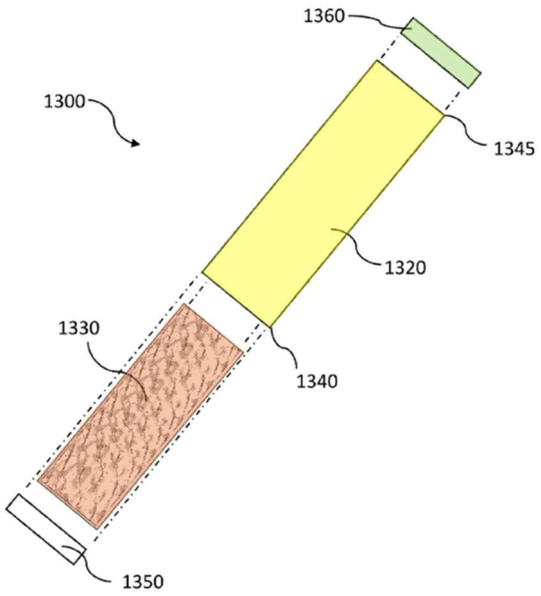
448. A POSITA would have recognized that the structural elements and features of the housing and endcaps of Muceus, Slack, and Noonan are compatible and complementary and, as such, a POSITA would have had a reasonable expectation of success in combining them. For example, each of Muceus, Slack, and Noonan have cylindrical, tube-like housings. Specifically, Muceus discloses that a noise suppressor for a firearm includes a "cylindrical body" (i.e., housing) extending along a longitudinal direction. Ex. 1005 ¶ 51. Slack discloses that the external component 22 (i.e., housing) "may include or be made of a generally cylindrical member". Ex. 1006 ¶ 42. Noonan discloses that the inner tube 20 (i.e., housing) may

be a "hollow cylinder[]". Ex. 1004 col. 3, ll. 12-14. Given these similar disclosures, a POSITA would have had a reasonable expectation of success in modifying Muceus (as modified by Slack) with the teachings of Noonan.

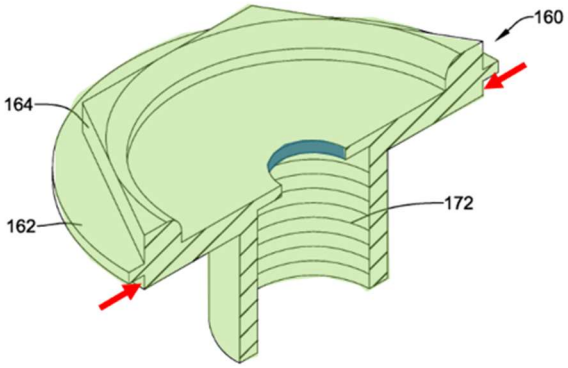
449. Further, each of Muceus, Slack, and Noonan disclose that the housing is captured at least by their respective endcaps. For example, and as depicted in annotated Fig. 13, below, Muceus discloses that "[t]he baseplate 1350 is coupled to the entry end 1340 of the suppressor 1300, for attaching the suppressor to a firearm barrel, and *an endcap 1360 attaches to the exit end 1345*." Ex. 1005 ¶ 59; Fig. 13 (emphasis added). Slack discloses "[t]he external component 22 is thereby captured between the flanges 162 and 150", as depicted in annotated Figs. 9 and 10. Ex. 1006 ¶ 63, Figs. 9-10. Noonan shows in Fig. 3b that "the inner tube 20 is sandwiched inside the outer tube 15 between the front cap 25 and the rear cap 30." Ex. 1004 col. 3, ll. 45-57, Fig. 3b. As such, the POSITA would have been motivated to replace the endcap 1360 of Muceus with Slack's end cap 160 (as optionally modified by Noonan), so that Muceus' end cap 1360 would comprise a sidewall positioned in the inner compartment and resting against the housing's inner surface. Noonan would also motivate the POSITA to modify the end cap of Muceus as modified by Slack to include a sidewall that is positioned in the inner compartment and rests against an inner surface of the housing as taught by Noonan to improve the seal between the exterior components of the suppressor and facilitate easier and more cost effective

manufacture of the core of Muceus by reducing the need for additional threading or other fastening mechanisms. Thus, the POSITA would have been motivated to combine Muceus, as modified by Slack, and Noonan.

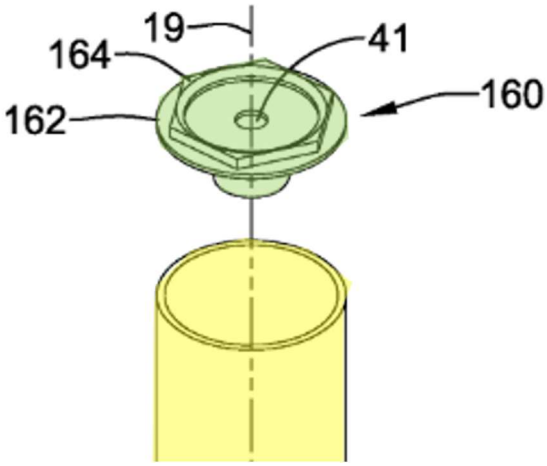
450. Moreover, the POSITA would have had a reasonable expectation of success in combining Noonan with Muceus as modified by Slack based on the corresponding structures and functions of each of the three respective references, and of Muceus as modified by Slack. In particular, modifying Muceus as modified by Slack to include a sidewall at its end cap that is positioned in the inner compartment and rests against an inner surface of the housing as disclosed by Noonan would have yielded predictable results and would have had a reasonable expectation to improve the attachment of the end cap to the main body of Muceus while improving the manufacturability and performance of the suppressor of Muceus. Accordingly, a POSITA would have been motivated to combine, and would have had a reasonable expectation of success in combining Muceus, as modified by Slack in Ground 6, and Noonan.



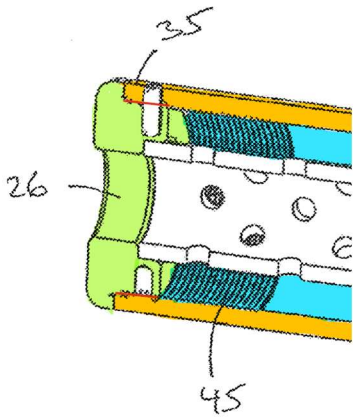
Muceus, Fig. 13 (annotated)

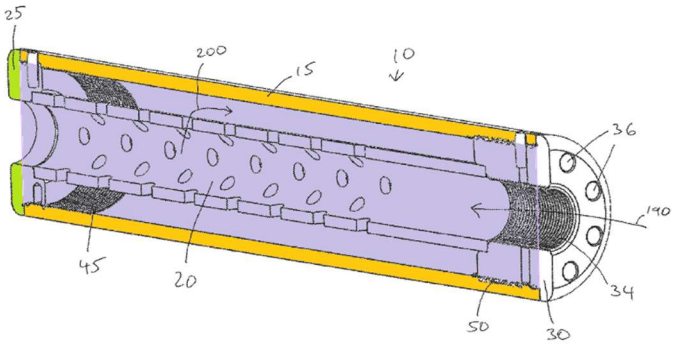


Slack, Fig. 10 (annotated)



Slack, Fig. 9 (annotated, excerpt)





Noonan, Fig. 3a (excerpt, annotated) **Noonan, Fig. 3b (annotated)**

451. Regarding claim 7, neither Muceus nor Slack explicitly disclose that the sidewall comprises threads that couple to the housing. However, a POSITA would have been motivated to combine the teachings of Muceus, Slack, and Noonan so that the sidewall of Muceus in view of Slack comprise threads, as taught by Noonan. Specifically, the use of threaded interfaces for securing endcaps and to their housings is a well-established design practice. *See* Ex. 1004 Figs. 3a-3b; see also Ex. 1007 Fig. 3. A POSITA would have been motivated to combine the threads of Noonan with the device of Muceus in view of Slack to prevent the end cap from being unattached from the housing due to the forces exerted on the end cap by escaping propellant gases.

452. Noonan provides sufficient detail to enable a POSITA to implement the combination without undue experimentation. The proposed combination would have a reasonable expectation of success because each reference has structural elements and features of the housing and endcaps that are compatible and complementary and

would have predictably improved the suppressor of Muceus in view of Slack. Accordingly, a POSITA would have been motivated to combine, and would have had a reasonable expectation of success in combining Muceus, in view of Slack, and Noonan.

453. Thus, it is my opinion that modifying Muceus' end cap (in view of Slack) to include a sidewall that rests against the housing's inner surface, and further providing that sidewall with threads as disclosed by Noonan, would have been obvious.

454. I further opine that the modification is obvious as a simple substitution of one known element for another to obtain predictable results. MPEP § 2143(I)(B). Specifically, the prior art contained a device which differed from the claimed device by the substitution of some elements with other elements. For example, as discussed with reference to Ground 6, Claim 1, Element [1.2], Muceus discloses an end cap with a projectile aperture, and Muceus in view of Slack render obvious the limitation of an end cap with a projectile aperture. As discussed with reference to Ground 3, claim 1, element [1.2], Noonan discloses an end cap with a projectile aperture. As will be discussed, both Slack and Noonan, independently and in combination, disclose an end cap that comprises a sidewall that is positioned in the inner compartment and rests against an inner surface. Muceus does not explicitly disclose an end cap that comprises a sidewall that is positioned in the inner compartment and

rests against an inner surface of the housing, and neither Muceus nor Slack explicitly disclose that the sidewall comprises threads that couple to the housing. Instead, Muceus discloses that

> [t]he suppressor core 1330 is inserted into the body 1320. The baseplate 1350 is coupled to the entry end 1340 of the suppressor 1300, for attaching the suppressor to a firearm barrel , and *an endcap 1360* attaches to the exit end 1345. The components may be *screwed* and / or welded together to contain the TPMS structure inside the body 1320.

Ex. 1005 ¶ 59 (emphasis added). As such, Muceus discloses that the endcap 1360 (i.e., end cap) could be screwed with the exit end 1345 of the suppressor, but does not explicitly disclose a sidewall or a sidewall that comprises threads that couples with the housing.

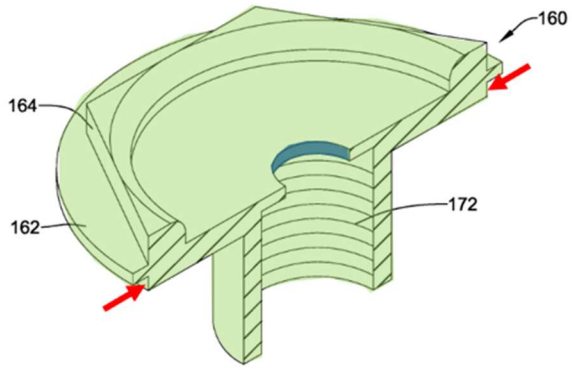
455. However, the substituted components (i.e., sidewall comprising threads that rests against an inner surface of the housing, the threads coupled to the housing) and their functions were known in the art. For example, end caps with sidewalls that rest against an inner surface of the housing, and end caps with sidewalls that comprise threads that couple to the housing were known in the art, as disclosed by Noonan. As discussed in Ground 3 (Claim 7), Noonan discloses an outer thread 28 of the front cap —a sidewall having external threads. One of ordinary skill in the art

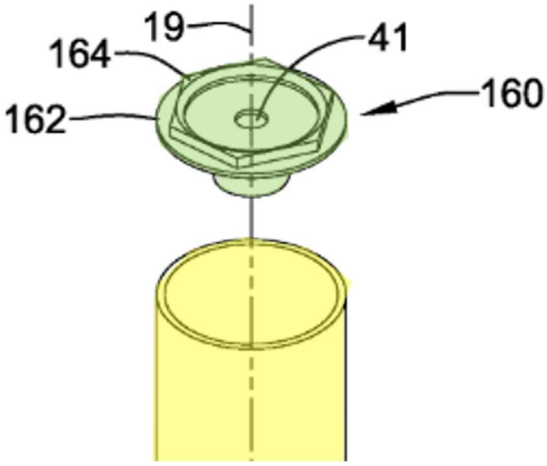
could have substituted one known element for another, and the results of the substitution would have been predictable. For example, one of ordinary skill in the art could have substituted Muceus' endcap 1360 (i.e., end cap) with an end cap that comprised a sidewall as taught by Slack's end cap 160 (i.e., end cap) or Noonan's front cap 25 (i.e., end cap) and corresponding housing (e.g., the external component 22 of Slack and the outer tube 15 of Noonan, respectively) engagement within the inner compartment to predictably result in Muceus' suppressor assembly having an end cap with a sidewall positioned against the housing's inner surface.. One of ordinary skill in the art could have substituted Muceus' endcap 1360 (i.e., end cap) with an end cap that comprised a sidewall comprising threads, as disclosed by Noonan's front cap 25 (i.e., end cap), to predictably result in the suppressor assembly of Muceus having an end cap with a sidewall with threads that coupled to the housing.

Dependent Claim 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.

456. As discussed with reference to Ground 6, Claim 1, Element [1.2], Muceus discloses an end cap with a projectile aperture, and Muceus in view of Slack render obvious the limitation of an end cap with a projectile aperture.

457. Slack discloses the limitations added in dependent claim 6. Specifically, Slack discloses "a removable end cap 160. The end cap includes a flange 162, and the internal component 124 includes a flange 150." Ex. 1006 ¶ 63. Slack describes that "[t]he outer diameter of the flanges 162 and 150 are slightly larger than the inner diameter of the external component 22." Ex. 1006 ¶ 63. As such, "[t]he external component 22 is thereby captured between the flanges 162 and 150, to thereby couple the external component 22 to the internal component 124." Ex. 1006 ¶ 63.





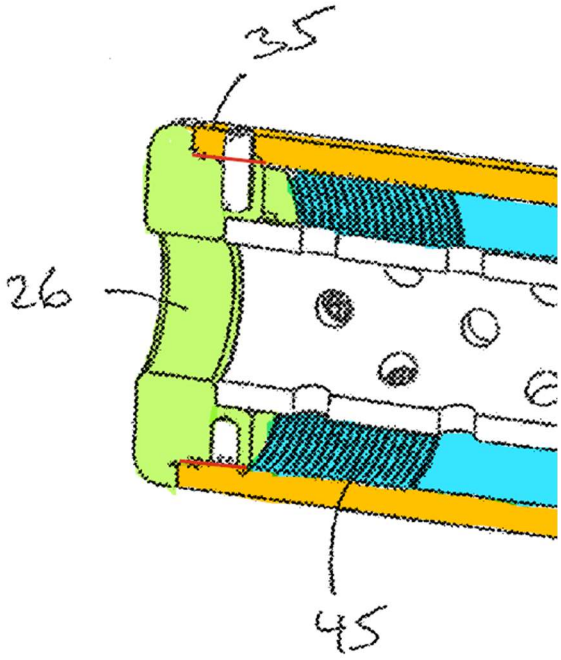
Slack, Fig. 10 (annotated) **Slack, Fig. 9 (annotated, excerpt)**

458. As shown in annotated Figs. 9 and 10, above, the flange 162 of the end cap 160 (i.e., end cap) includes a sidewall (red arrows). Ex. 1006 Figs. 9-10. The external component 22 (i.e., housing) is captured between the flange 162 of the end cap 160 (i.e., end cap) and the flange 150 of the internal component 124 (i.e., core). Ex. 1006 ¶63, Figs. 9-10. Therefore, the sidewall is disposed within the inner

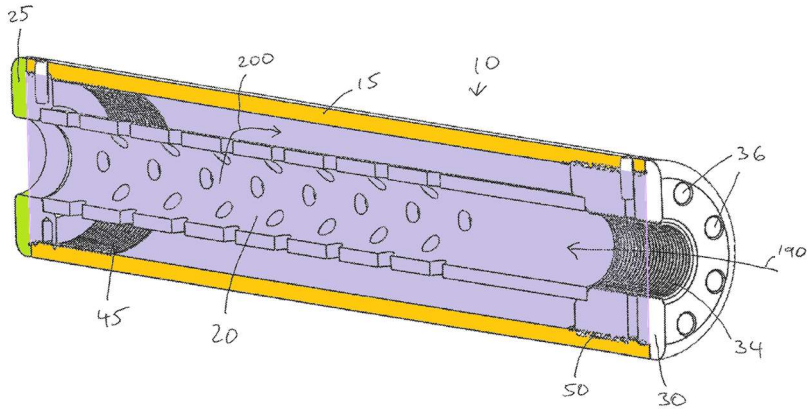
compartment of the external component 22 (i.e., housing) and rests against the sidewall of the end cap 160 (i.e., end cap), preventing radial movement of the housing relative to the end cap 160. Accordingly, Slack discloses that the end cap 160 (i.e., end cap) comprises a sidewall (red arrows) that is positioned in the internal component 124 (i.e., core) and rests against an inner surface of the external component 22 (i.e., housing).

459. For the avoidance of doubt, Noonan also discloses this limitation. Referring to the annotated excerpts of Figs. 3a and 3c below, the front cap 25 (i.e., end cap) (highlighted in green) at the front end 35 (i.e., second end) of the assembly 10 of Noonan includes an outer thread 28 (i.e., the sidewall being the wall defining the thread) (highlighted in red and red lines in annotated excerpts of Figs. 3a, 3c) that rests against the inner surface (highlighted in blue in annotated excerpts of Figs. 3a, 3c) of the outer tube 15 (i.e., housing) (highlighted in orange). Ex. 1004 Figs. 3a, 3c. Comparing annotated Fig. 3b below with annotated Figs. 3a and 3c, it is also clear that the outer thread 28 (i.e., the sidewall being the wall defining the thread) (highlighted in red and red lines in annotated excerpts of Figs. 3a and 3c) is positioned in the inner compartment (highlighted in purple in annotated Fig. 3b) of the housing. Ex. 1004 Figs. 3a-3c. The inner compartment can also be visualized as the extent of the inner surface (highlighted in blue in annotated excerpts of Figs. 3a,

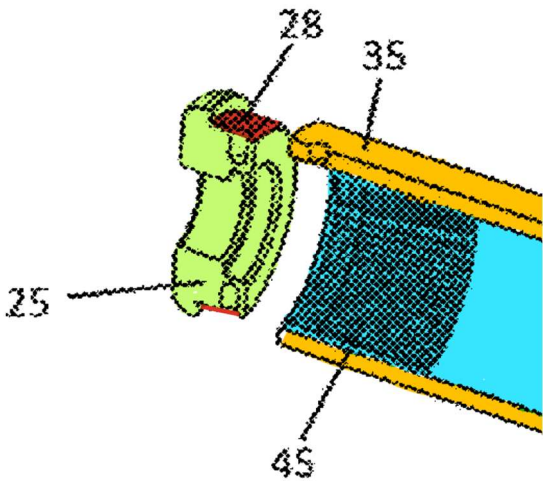
3c) of the outer tube 15 (i.e., housing) (highlighted in orange) shown in annotated excerpts of Fig. 3c below. Ex. 1004 Fig. 3c.



Noonan, Fig. 3a (excerpt, annotated)



Noonan, Fig. 3b (annotated)



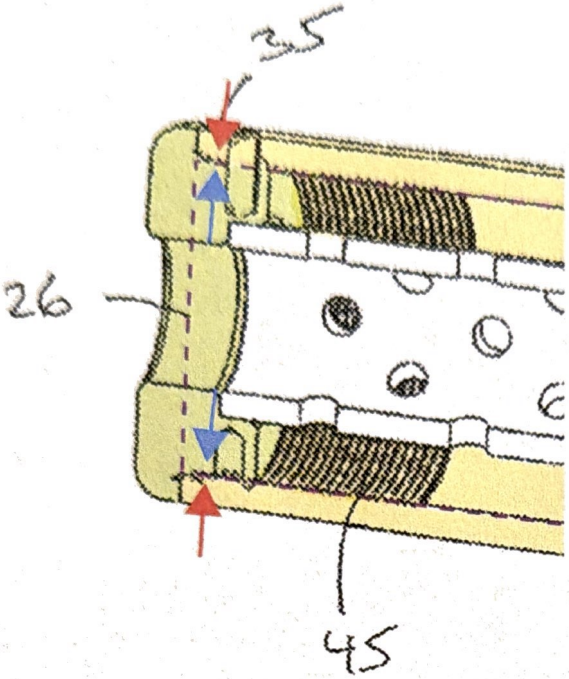
Noonan, Fig. 3c (excerpt, annotated)

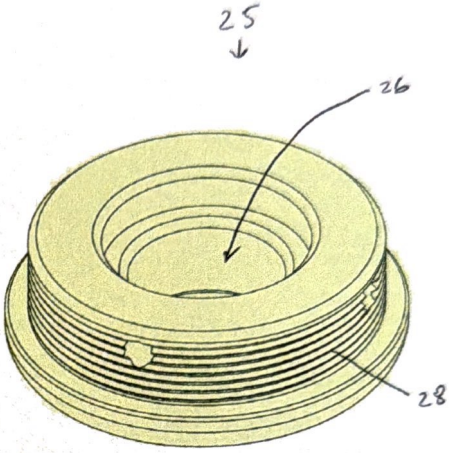
460. As described by Noonan, "[t]he front end 35 may comprise an inner screw threads 45 (shown in cutaway Figs. 3a-c) configured to accommodate and/or engage the outer thread 28 of the front cap 25." Ex. 1004 col. 3, ll. 36-39. The inner screw threads 45 of Noonan are on the interior surface (highlighted in blue in annotated excerpts of Figs. 3a, 3c) of the outer tube 15 (i.e., housing) (highlighted in orange), and the interior surface is within the inner compartment (highlighted in purple in annotated Fig. 3b). Moreover, Fig. 3a illustrates the front cap 25 (i.e., end cap) (highlighted in green) threaded into the inner compartment until the threads are entirely engaged and the ledge (discussed above with respect to Claim 5) abuts the outer tube 15 (i.e., housing) (highlighted in orange). Ex. 1004 Fig. 3a. Thus, the outer thread 28 (i.e., the sidewall being the wall defining the thread) (highlighted in red and red lines in annotated excerpts of Figs. 3a and 3c) of the front cap 25 (i.e., end cap) (highlighted in green) is positioned in the inner compartment (highlighted in

purple) and rests against the inner surface (highlighted in blue) of the outer tube 15 (i.e., housing) (highlighted in orange). As such, it would have been obvious to a POSITA to modify Muceus in view of Slack such that the sidewall of Slack's end cap 160 (i.e., end cap) is positioned in the internal component 124 (i.e., core) and rests against an inner surface of the external component 22 (i.e., housing), as taught by Noonan.

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

461. Noonan discloses the limitations added in dependent claim 7. In particular, with reference to annotated excerpts of Figs. 3a and 4a of Noonan below, as a result of the combination discussed in the foregoing Ground 9, Claim 6, Muceus as modified by Slack and Noonan includes a front cap 25 (i.e., end cap) (highlighted in green) with a sidewall (blue arrows) that is positioned in the inner compartment (bounded by the purple dashed lines) and rests against an inner surface (red arrows) of the outer tube 15 (i.e., housing) (highlighted in yellow). As depicted in annotated Figs. 3a and 4a, the resulting sidewall (blue arrows) may further include threading 28 for engaging the corresponding threading 45 on the inner surface of the outer tube 15 (i.e., housing). *See* Ex. 1004 Figs. 3a, 4a, col. 3, ll. 36-39.





Noonan, Fig. 3a (excerpt, annotated) **Noonan, Fig. 4a (annotated)**

IX. CONCLUSION

462. I declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: October 16, 2025

Robert S. Silvers

Dead Air Exhibit No. 1008
Dead Air Armament, LLC v. Jarvis Arms LLC
IPR2026-00013, U.S. Patent No. 12,018,906
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