

SONIC SIGNATURE SUPPRESSOR FOR FIREARMS AND FIREARM EQUIPPED WITH SUCH

Field of the Invention

The present invention relates to a silencer or sound suppressor or sonic signature suppressor for firearms, the use thereof, and a firearm equipped with such.

Orientation terms in this document, such as “up,” “down,” “front,” “back,” etc. refer to a handgun when the bore axis is horizontal and rounds are fired forwards, away from the shooter.

Background of the Invention

The invention relates in general to a so-called sonic signature suppressor, also referred to colloquially as a silencer. Sonic signature suppressors are devices that can be attached to the barrel of a firearm, or to additional elements attached thereto such as a flash suppressor or muzzle brake. They are used to suppress the blast and flash created when a gun is fired, reducing the acoustic and visual impact of the muzzle report.

In simple terms, they function as follows: when firing a gun, the propellant gas propels a bullet through the gun’s barrel and muzzle, and the bullet enters and passes through the sonic signature suppressor, specifically a bullet channel at the muzzle. This propellant expands inside the sonic signature suppressor, thus reducing the pressure thereof, suppressing the noise it emits. To dissipate the kinetic energy in the propellant before exiting the suppressor, there are normally structures inside the suppressor that act on the flow of propellant. These structures form sound baffles, for example, that minimize the noise by redirecting the gas flow, thus slowing it down and cooling it. Sonic signature suppressors also reduce recoil and suppress the muzzle flash.

Firearms, in particular self-loading firearms, have been constructed since ca. 2006 such that they can be used immediately after being removed from water or other liquids, and can be fired safely, even if there is still some liquid inside the firearm. When a sonic signature suppressor is attached thereto, however, if the firearm is fired immediately after removing it from the water, and the suppressor is full of water, it may explode, or the bullet may exit the suppressor sideways. This is because the bullet and propellant strike a water column in the suppressor that cannot be compressed, releasing all of the kinetic forces therein into the water. The water destabilizes the bullet striking it, such that its flight path becomes erratic. This endangers the shooter and any other people in the area.

Prior Art

EP 2018 508 B1 by the applicant discloses a firearm with a more robust breechblock system that renders the firearm fully functional within 1 to 3 seconds after removing it from water or other liquids. There are various drain holes for this, in particular in the housing for the breechblock spring, through which the liquid can be quickly and easily drained.

A sonic signature suppressor for fully automatic self-loading firearms is disclosed in US Pat. No. 10,909,032 B1 that is designed in particular to withstand high temperatures generated during sustained firing. This has a sleeve with an inner lining made of a heat-resistant and thermally insulating material and two end attachments that encompasses the sonic signature suppressor. The end attachment at the front end, where the bullet exits, has numerous holes for discharging propellant gas on its end surface. There is a pressure releases valve and chamber at the bottom inside the sonic signature suppressor.

Sonic signature suppressors generally have holes and discharge valves. These (excess pressure) holes are supposed to be open when discharging the firearm. They must be open because they are supposed to discharge gas to prevent the breechblock in a self-loading firearm from malfunctioning. By way of example, the Russian AK-74 has a sonic signature suppressor in which the excess gas pressure is discharged through side holes at the front end of the suppressor, thus emitting no noise directly toward the enemy. There are holes for reducing pressure because

the AK-74 does not have a gas valve, and the sonic signature suppressor is therefore responsible for eliminating the excess pressure formed by the propellant.

US Pat. No. 2017/0299314 A1 discloses a sonic signature suppressor for firearms that can at least partially be encompassed on the outside by a thermally insulating material.

There are also various silicon sleeves for sonic signature suppressors available that are intended to prevent surface damage in particular. There are also insulating sleeves for sonic signature suppressors made of a large variety of materials.

The company OSS (USA) sells a sonic signature suppressor with so-called flow-through ® technology under the trademark name HUXWRX Safety – FLOW 22 Ti (huxwrx.com), which is patented by the company UT-Batelle LLC, US Pat. No. 10,753,699 B2. This sonic signature suppressor has numerous expansion chambers and helical structures that spiral the gas flow within the suppressor, subsequently discharging the propellant through holes at the front.

US Pat. No. 2022 0221243 A1 discloses a sonic signature suppressor with a blow-out feature that opens a hole in the suppressor in the case of excess pressure, in the manner of a pressure release valve. The housing for the suppressor has windows, or circular structures at the front end, or on the side at the front end, that yield and open when subjected to excess pressure. These structures are made of a thinner or different material than the housing, such that when subjected to excess pressure caused by the propellant forced through the suppressor, they give way and open up. There are also numerous holes in the end surface where the bullet exits.

US Pat. No. 2024 0077272 A1 discloses the introduction of a small amount of fluid, or other liquids or foams, into a sonic signature suppressor to discharge rounds while the suppressor is “moist.” The suppressor has a fluid chamber, which partially moistens the inner surface of the housing. This is intended to prevent, or at least reduce, a “first round pop.” This is based on the fact that when firing a firearm with a sonic signature suppressor, the first shot differs from subsequent shots with regard to both the point of impact and sound.

Object and Solution of the Invention

Based on the prior art, the object of the invention is to create a different, in particular improved, sonic signature suppressor for firearms, specifically self-loading firearms, that increases safety and at least partially overcomes the disadvantages of the prior art.

This problem is solved by a sonic signature suppressor for firearms that has the features of claim 1 and its use for draining liquids through at least one drain hole from the sonic signature suppressor according to claim 19.

The sonic signature suppressor for firearms obtained with the invention has at least one housing with a bullet channel passing through it, at least one liquid discharge hole formed on or near the end of the housing where it is attached to the weapon, where liquid can be drained from the suppressor prior to firing a round, which, when attached to a firearm, connects the interior of the housing to the exterior such that any liquid inside the housing can be drained within a few seconds, in particular within 1 to 6 seconds, preferably within 1 to 3 seconds, in order to be able to fire a round safely.

Draining liquid from the sonic signature suppressor as intended with the invention comprises a passive draining of liquid and/or an active forcing of the liquid out of the suppressor.

The invention also results in a firearm according to claim 17 that has a sonic signature suppressor. This sonic signature suppressor is preferably attached directly to the barrel of the firearm, or a flash suppressor thereon, with an orientation that can be reproduced precisely.

The firearm obtained with the present invention can be handgun or long gun, in particular a pistol, assault rifle, sniper rifle, machine gun, machine pistol; in general a self-loading firearm, in particular a gas-operated autoloading firearm.

The coupling device for attaching the suppressor to the firearm, as well as the size, weight, material, external shape, and inner structure of the suppressor may vary. In particular, the baffle

chambers and baffles may be placed arbitrarily, and are not limited to the illustrations thereof in the drawings. The baffles and chambers can be designed such that the gas flows in a helical path through the sonic signature suppressor. The suppressor can also have a double casing or radial double chambers. The suppressor can also contain additional gas expansion chambers placed at suitable positions therein.

The sonic signature suppressor can have a rotationally symmetrical or asymmetrical outer shape, in relation to the bore for the bullets. The latter is the case with so-called pelican suppressors, which have rectangular or square chambers on the bottom, thus enlarging the inner volume of the suppressor.

The sonic signature suppressor has at least one drain hole. These holes can have an arbitrary shape and size. By way of example, a simple design of the drain hole can be a bore hole or cut-out, forming a rectangle, slot, square, or oval. By way of example, at least two of the drain holes can form an elongated slot, groove, trough, etc.

There can also be one or more drain holes extending over nearly the entire length of the sonic signature suppressor. This also connects the interior chambers in the suppressor, in particular when additional drain holes extend through the baffles.

For use in or under water or other liquids, the sonic signature suppressor is made of a corrosion-resistant material, or coated therewith, and can therefore also be used in saltwater.

The sonic signature suppressor can be used with subsonic ammunition, in particular due to the low gas pressures, but can also be used with supersonic ammunition. Because of the significantly different gas pressures for these types of ammunition, there may be restrictions to the use with regard to the functionality of the firearm.

The at least one drain hole is preferably at the back end of the sonic signature suppressor, preferably on the side. It can, however, be placed at any suitable position on the housing of the suppressor.

In particular if there are two or more drain holes, they can be placed at different positions on the housing. The at least two drain holes are ideally placed as far as possible toward the front in order to suppress the flash and gas pressure. For rapid firing when the firearm is pointed upward, the at least one drain hole is ideally as far back as possible.

The at least one drain hole ensures that water or other liquids are removed from the firearm as quickly as possible after it has been removed therefrom and before firing a round, to ensure the safety of the shooter and other people in the vicinity. The liquid can simply drain out and/or be actively forced out by the propellant gas.

In comparison with self-loading firearms, there is more water in a sonic signature suppressor due to its significantly larger volume and the chambers therein, which is to be drained off and/or safely forced out. The size of the at least one drain hole therefore depends on the overall inner volume of the housing for the sonic signature suppressor and any of its internal structures.

For this, the at least one drain hole can be manually or automatically opened in order to drain off, discharge, or remove the water from the sonic signature suppressor.

The at least one drain hole in the sonic signature suppressor can be shaped and sized such that 50% to 60% of the interior of the housing for the suppressor can be drained within 1 to 6 seconds, preferably within 1 to 3 seconds.

Removal of ca. 55% to 60% of the water or liquid from the interior of the sonic signature suppressor clears the hollow bore, and thus the flight path of the bullet, as long as the shooter holds the firearm basically horizontally. If the firearm and sonic signature suppressor are pointed upward, more liquid should be drained, i.e. 60% to 80%, to ensure that a shot can be fired safely.

Any residual water or liquid can be forced out of the sonic signature suppressor through the at least one drain hole and/or the hollow bore by the propellant gas when firing a round. This may

require numerous rounds, in which liquids exhibit good suppression properties, such that any residual water can be advantageously exploited.

The at least one drain hole in the sonic signature suppressor can be closed with an element that at least partially encompasses the suppressor.

The closure element can be moved to either close or open the hole. In the open setting, the at least one drain hole is exposed, or opened, such that liquid can drain out of it. In the closed setting, this element covers the drain hole, preventing any liquid from escaping the suppressor.

This allows for use of the sonic signature suppressor in which the at least one drain hole can be closed shortly before firing a round. This allows for maximum acoustic and optical suppression.

In the case of an emergency, e.g. when there is not enough time to drain or close the suppressor, the shooter can nevertheless shoot when at least one of the drain holes is at most only partially closed. This results in limited acoustic or optical suppression.

The at least one drain hole can also be opened and closed manually or automatically.

Closure elements can be formed by collars, flaps or sliders, for example. The closure element can at least partially encompass the sonic signature suppressor, e.g. from below, above or the side. This type of collar can be placed on the suppressor from below, prior to attaching it to the firearm, or it can be slid on from the end where the bullets exit.

The sonic signature suppressor can also comprise two parts that can move in relation to one another when placed together, to close the at least one drain hole.

The closure mechanism on the sonic signature suppressor, in particular the at least one closure element, can be moved back and forth between the open and closed setting by a coupling mechanism.

The coupling mechanism can be a telescoping or bayonet coupling, a rail guide, slider guide, tongue and groove connection, or formed by a control curve with a bolt hole on or in the sonic signature suppressor housing, or inside the closure element, in the manner of a pump action rifle or some other suitable firearm.

The coupling mechanism can also simply be a coarse or fine threaded mechanism. A coarse thread is advantageous when dealing with foreign matter such as sand or mud. Depending on the thread pitch, a collar can be moved from the open setting to the closed setting with just a one third, half, or two thirds rotation, thus allowing for a quick closing and therefore quick use of the firearm. There can also be a lever, grip, or handle, like that on a pump action firearm, formed on the closure element.

To obtain the coupling mechanism, part or all of the wall of the sonic signature suppressor housing can easily be made thicker, and then the coupling mechanism, e.g. a thread, groove, rail guide, control curve, etc. can be cut into it. This coupling mechanism, e.g. thread, groove, rail guide, control curve, etc. can also be placed thereon and attached to the housing. The same applies to the complementary closure element, which has the complimentary part, e.g. counter-thread, control bolt, etc. on its inner surface.

The at least one closure element can be moved radially, axially, diagonally, and/or horizontally on the sonic signature suppressor.

Depending on the design and placement of the closure element, it can advantageously be moved safely to the closed setting, ensuring that the at least one drain hole is closed.

A thread, slider guide, bayonet coupling, rail guide, or other guide can be used to guide the closure element. The closure element can also be clipped, snapped, or otherwise secured in position.

The closure element can also be clamped in the closed setting against the housing for the sonic signature suppressor, e.g. by at least one tensioner, e.g. a screw. When such an element is used, it

can even be secured wearing gloves. If additional seals are used, this ensures that no propellant is discharged.

The invention provides for various scenarios, such as being able to close the at least one drain hole.

By way of example, the at least one drain hole on the sonic signature suppressor can be opened and closed by one or more radial closure elements, in particular one or more collars, which are moved horizontally (basically comparable to operating a pump action firearm).

In both of the above cases, the sonic signature suppressor and collar(s) can be sealed against vapors and gasses, particularly at the rear ends of the collar(s) by corresponding rims or undercuts as far back as possible. The interfaces facing forward do not need to be sealed as tightly, in order to facilitate the discharge of propellant and residual water toward the front, in the direction of firing, to compensate for pressures.

The sonic signature suppressor can also have a two-part design, such that the rear part of the suppressor is securely attached to the muzzle, and the front part closes or opens the drain holes when moved back and forth by twisting it if it is attached with a thread, or sliding it if it forms a sleeve thereon.

In this case, the rear part of the suppressor can have the at least one drain hole, which can then be closed by the front part.

Alternatively, the at least one drain hole can be formed on the front part of the suppressor, which then has a smaller diameter. The at least one drain hole can then be closed or opened by inserting or twisting it into the rear part of the suppressor. This advantageously results in an annular gap between the two parts of the suppressor that is automatically directed forwards, through which vapor and propellant are automatically directed away from the shooter, in the direction the rounds are fired.

One possible application could be that in which a shooter dives with the firearm, with the at least one drain hole open. In this case, the at least one drain hole is preferably at the bottom of the sonic signature suppressor. Immediately upon surfacing, the water simply drains relatively quickly and quietly from the suppressor due to gravity. The shooter then closes the at least one drain hole with a mechanism that can be operated as simply and quickly as possible, e.g. by twisting or sliding the moving closure element or flap, such that it is immediately ready for firing.

The closure mechanism on the sonic signature suppressor can have at least one seal, in particular on the closure element and/or the suppressor, to prevent liquid from escaping.

The seal forms a seal between the closure element(s) and the housing for the sonic signature suppressor. The seal can bear entirely or partially on the closure element(s) and/or the suppressor housing, and/or it can be a separate sealing element. It can be thicker at the edges, forming a bulge, in the manner of an O-ring, etc. The shape and/or attachment depend on the size and shape of the at least one drain hole. The seal can be made of conventional materials, particularly heat resistant materials such as silicone, etc.

The points where the moving sonic signature suppressor element are attached are advantageously designed such that they are as airtight as possible. This allows vaporized water and propellant to be safely removed with regard to the shooter and other people in the vicinity, ideally (diagonally) toward the front.

The at least one drain hole can be on the bottom of the sonic signature suppressor.

The drain hole is preferably on the very bottom of the sonic signature suppressor, i.e. at 6:00 o'clock. This drains the water using gravity, in particular when the firearm is held horizontally, in the conventional manner.

The drain hole can also have a protective structure formed by a net, grid, or fibers. If there are two or more drain holes, each of them can have this protective structure, or one such structure

can encompass all of the drain holes. This structure can be placed in the drain hole, or it can cover it and be attached thereto by conventional means. A simple design of the structure is obtained with a grid, net, rhombus or fiber structure made of a material that can withstand very high temperatures.

This keeps foreign matter such as coarse particles, sand, mud, seaweed, algae, etc. out during underwater use, in particular in choppy water, increasing the reliability of the firearm.

The sonic signature suppressor can contain at least one baffle chamber that is connected by the at least one drain hole to the exterior of the suppressor in order to drain liquid.

At least one drain hole in the sonic signature suppressor can connect at least two chambers to the exterior to drain liquid and/or at least one second internal drain hole can connect two such chambers inside the suppressor.

One or more of these chambers is at least partially open to the exterior, or at least partially opened, or the chambers are at least partially connected to one another. In particular, the at least one second drain hole is preferably near the suppressor housing wall.

This ensures sufficient drainage or discharge, preventing water or other liquid from accumulating in isolated chambers.

There is a drain hole in at least one, ideally all, of the baffles in a preferred design.

The sonic signature suppressor can also have a recess along at least part of the length of the suppressor on the closure element and/or the suppressor, to discharge liquid and/or mixtures or gas and liquid in the direction in which the firearm is fired.

The recess can form a groove extending over the drain hole(s) through which gas and/or a mixture of liquid and gas can be discharged away from the shooter, toward the end of the suppressor where the bullets exit.

The recess can also extend in a spiral along the inner wall of the closure element. This is advantageous with a circumferential closure element, e.g. a collar.

The recess can be sealed at the weapon end, and open toward the front, where the bullets exit. This prevents propellant from exiting backward toward the shooter, and expels liquid and/or a mixture of gas and liquid toward the front, away from the shooter.

The width of the recess can be smaller than, equal to, or greater than the diameter of the at least one drain hole.

Fundamentally, a relatively narrow recess, in particular a groove, is sufficient for gas discharge. A wider recess is advantageous in that, if the drain hole is not entirely closed, any liquid and/or mixture of gas and liquid is safely discharged toward the front, away from the shooter.

The sonic signature suppressor can contain a coupling ensuring a precisely reproduceable orientation when it is attached to a firearm.

In a simple design, the barrel can be threaded at the muzzle or there can be a thread on an element attached to the muzzle, onto which an internal thread on the sonic signature suppressor can be screwed.

Because of exposure to heat, smoke and foreign matter, these threaded connections normally cannot be released without a tool, which could damage the sonic signature suppressor. Moreover, depending on how tightly the sonic signature suppressor is screwed on, it may end up in a different position on the barrel or the attachment thereto.

Both the sonic signature suppressor and the barrel have bore axes, which must be aligned to be able to shoot accurately. The position of the bore axis in the suppressor changes in relation to the bore axis of the barrel, depending on the position of the suppressor on the barrel or the attachment.

Unfortunately, different positions of the sonic signature suppressor when it is attached to the firearm result in the suppressor bore axis not lining up with the bore axis of the barrel. This misalignment alters the aim and increases the size of dispersion pattern. This is disadvantageous with precision firearms used by sharpshooters.

To counteract this, there can be three symmetrical lugs, as is the case with the MP5 by the applicant, for attaching a suppressor to the firearm, allowing for three different mounting positions of the suppressor.

This can be improved on by adding at least three lugs to the attachment and/or the coupling sleeve, or other projecting elements, at least one of which is asymmetrical. These elements, or lugs, engage with complementary recesses formed in either the coupling sleeve and/or the firearm component, such that the sonic signature suppressor can only be attached to the firearm component or barrel with a specific orientation.

The shooter places the coupling sleeve, and the suppressor connected thereto, onto the barrel or a muzzle attachment on a firearm from above and turns the coupling sleeve until the recesses or lugs therein align and engage with the complementary lugs or recesses.

This sonic signature suppressor functions reliably and thus increases the reliability of a firearm equipped therewith. In particular, the suppressor can be attached and removed easily without tools and in the dark as a result of the tactile shape of the component and stress-free operation of the mechanism.

Firearm components in the case of the present invention include a barrel and muzzle attachment, e.g. a flash suppressor, muzzle brake, blank-firing adaptor, etc.

In general, the lugs can be of appropriate shapes, e.g. rounded or with sharp corners. An asymmetrical lug is shaped differently than the other, symmetrical, identical lugs, i.e. it can be larger or smaller, shorter or taller, and/or wider or narrower than the other lugs, and/or it can have

a different outer shape, e.g. with a bulge and/or notch. Furthermore, there is only one complementary, and therefore asymmetrical, recess, such that only the asymmetrical lug can engage with this recesses.

The asymmetrical shape of the lug can be easily produced by making it taller or shorter and/or wider or narrower than the two other lugs. The shooter can feel the correct attachment position of the suppressor as a result of the asymmetrical lug, even in the dark.

The coupling interface can also be a chuck or collet. To be able to precisely place the suppressor on the barrel or flash suppressor in a reproduceable manner, there can be at least one formation on the firearm that interacts, specifically engages, with at least one complementary formation on the suppressor. By way of example, this can be a recess, in which a projection engages, such that the suppressor can only be attached in one position. The two formations can take different forms on the suppressor or firearm, e.g. as a projection or recess on the barrel, and the opposite on the suppressor.

The barrel can have a positioning means that is coaxial to the bore axis, in particular a positioning means in the form of a pin. This allows for a precise, reproduceable positioning, orientation, and attachment of the collet adapter, which can have a complementary recess. By placing and sliding the collet adapter into the positioning recess, a precise, reproduceable coupling can be ensured. It is only possible to attach the suppressor when the positioning means finds the recess, because the shape automatically blocks this otherwise.

The collet adapter can have numerous slits over its circumference. After a tensioning means has been placed and screwed into position, in particular a coupling nut, the collet adapter is tightened onto the barrel or flash suppressor. This compresses the slits. A torque wrench can be used to tighten it down, although it can also be tightened by hand. The sonic signature suppressor can be coupled to the coupling nut or the collet adapter.

A coupling sleeve can also be used to attach the sonic signature suppressor, e.g. using a threaded connection, or some other conventional means of attachment. The sonic signature suppressor,

barrel, or flash suppressor can have at least one asymmetrical element at the muzzle end, in particular an asymmetrical lug, and at least one symmetrical element, in particular one or more symmetrical lugs, that allow for a precisely reproduceable positioning in the coupling sleeve or of the coupling sleeve on the barrel or flash suppressor. The coupling sleeve can have an asymmetrical recess for the asymmetrical element, and at least two recesses for the symmetrical elements. This advantageously results in only one possible positioning and coupling.

After the lugs have been sufficiently inserted, the coupling sleeve can be rotated, and the lugs can be locked in position in undercuts. The applicant reserves the right to claim independent protection for these or other variants or designs.

The sonic signature suppressor can also have at least one pressure relief valve for removing liquids and/or gas and liquid mixtures in the case of excess pressure.

The pressure relief valve can be formed by a relief nozzle or opening facing forward and/or below the suppressor housing. Any other suitable type of pressure relief valve can also be used. This type of pressure relief valve can be placed at a front baffle chamber, or each baffle chamber. This becomes relevant if the at least one drain hole is not sealed entirely when shooting. Likewise, if the suppressor is filled with water or some other liquid, and the drain holes are inadvertently closed, this pressure relief valve becomes relevant, because it can ensure the safety of the shooter, since the liquid can be drained through the relief valve.

The sonic signature suppressor can also have drain holes that are always open, or cannot be closed, which are ideally located at the front end of the suppressor. This results in targeted and enhanced removal of vaporizing residual water and propellant gasses in the firing direction.

The sonic signature suppressor can also have a protective device that prevents damage to the suppressor caused by excess pressure and/or uncontrolled firing of a bullet when there is liquid in the suppressor.

In a simple design of the sonic signature suppressor, there are no drain holes, and instead there is only a protective device.

The protective device can encompass the sonic signature suppressor and/or reinforce the housing thereof, such that it cannot be damaged by liquid therein.

The protective device can be an integral part of the suppressor, or it can be removable. It can be made of any of the fiber reinforced materials listed below. If there are no drain holes, there can be one or more pressure relief valves through which liquid is forced out by the pressure of the propellant gas when a shot is fired. This pressure relief valve is optional. The applicant reserves the right to claim independent protection for this or other variants or designs.

The protective device in the sonic signature suppressor can form a heat-protection sleeve to prevent overheating the suppressor and/or to protect the shooter. The heat-protection sleeve can be an integral or removable part of the suppressor.

The heat-protection sleeve can be made of a variety of suitable materials. By way of example, any composite material that provides adequate thermal insulation against the heat generated when firing a round can be used. Reinforcement materials in the composite can comprise short, long, or continuous fiber reinforcement material, carbon fibers, glass fibers, flexible ceramics, metal fibers, powdered metals, aramid fibers, fibrous silicon dioxide, nanomaterials, etc.

Suitable matrix materials for the composite are polyesters, vinyl esters, epoxy, phenols, polyamides, polypropylene, polyether ether ketone (PEEK), etc. In particular, heat-resistant resins such as MVK-19-ultra-high-temperature polyimide resins are ideal. Reinforced heat-resistant silicone elastomers or reinforced foams can also be used.

The above composites remain stable at high temperatures, and are therefore able to withstand the high operating temperatures that arise when using a sonic signature suppressor.

The heat-protection means can at least partially encompass the sonic signature suppressor, and can also be designed to prevent a bullet exiting in a direction other than where it is aimed.

Description of the Drawings

Exemplary embodiments of the invention shall be explained in greater detail below in reference to the drawings. Therein:

- Fig. 1 shows a schematic longitudinal cutaway illustration of a conventional sonic signature suppressor;
- Figs. 2a-e show schematic longitudinal cutaway illustrations of other conventional sonic signature suppressors;
- Fig. 3 shows a schematic longitudinal cutaway illustration of a first embodiment of the sonic signature suppressor obtained with the invention;
- Fig. 4 shows a schematic longitudinal cutaway illustration of a second embodiment of the sonic signature suppressor obtained with the invention;
- Fig. 5 shows a schematic longitudinal cutaway illustration of a third embodiment of the sonic signature suppressor obtained with the invention;
- Fig. 6 shows a schematic longitudinal cutaway illustration of a fourth embodiment of the sonic signature suppressor obtained with the invention;
- Fig. 7a shows a perspective illustration of another embodiment of a sonic signature suppressor obtained with the invention;
- Fig. 7b shows a perspective illustration of the embodiment of the sonic signature suppressor in Fig. 7a, with a collar placed thereon;

- Fig. 8 shows a perspective illustration of another embodiment of the sonic signature suppressor obtained with the invention, with a closure element placed thereon;
- Fig. 9 shows a perspective illustration of another embodiment of the sonic signature suppressor obtained with the invention, with a closure element placed thereon;
- Fig. 10a shows a perspective illustration of another embodiment of the sonic signature suppressor obtained with the invention;
- Fig. 10b shows a perspective illustration of the embodiment of the sonic signature suppressor shown in Fig. 10a, with a collar placed thereon;
- Fig. 11a shows a perspective illustration of another embodiment of the sonic signature suppressor obtained with the invention;
- Fig. 11b shows a perspective illustration of the embodiment of the sonic signature suppressor shown in Fig. 11a, with a seal placed thereon;
- Fig. 12 shows a perspective illustration of another embodiment of the sonic signature suppressor with a collar;
- Fig. 13 shows a perspective illustration of another, two-part embodiment of the sonic signature suppressor obtained with the invention;
- Fig. 14 shows a perspective illustration of another two-part embodiment of the sonic signature suppressor obtained with the invention;
- Fig. 15 shows a perspective illustration of an inner view of a collar;

Fig. 16 shows a perspective illustration of an inner view of a closure element from the exemplary embodiment shown in Figs. 8 and 9;

Fig. 17 shows a perspective illustration of an embodiment of a coupling interface for attaching a sonic signature suppressor to a gun barrel;

Figs. 18 and 19 show perspective illustrations of another embodiment of a coupling interface for attaching a sonic signature suppressor to a gun barrel;

Figs. 20 to 21b show illustrations of another embodiment of a coupling interface for attaching a sonic signature suppressor to a gun barrel; and

Fig. 22 shows a perspective illustration of a partially cutaway embodiment of the coupling interface in Figs. 20a to 21b, in the assembled state.

After explaining the general functioning of sonic signature suppressors in reference to Figs. 1 to 2e, the construction and functioning of the sonic signature suppressor obtained with the invention shall be explained in reference to Figures 3 to 7.

Firearms, in particular self-loading firearms, already exist and do not need to be explained herein. The functional sequence of firing and automatically reloading a self-loading firearm can be explained in simple terms as follows:

There is a breechblock system for discharging shots that can be moved longitudinally in the firearm, which can eject a spent cartridge and reload the firearm. This breechblock system is a slide formed on the top of the receiver. To fire a round, the breechblock system chambers a cartridge from the magazine in a cartridge chamber in the barrel. When squeezing the trigger, a firing pin strikes the back of the cartridge and ignites a propellant, such that a projectile is fired out of the shell and through the barrel.

When a shot is fired, the breechblock moves backward. An extractor grabs the shell on the edges at the back, and pulls it out of the chamber as a result of the backward movement of the breechblock. An ejector then ejects the shell in the conventional manner. When the breechblock moves backward, it slides over the magazine.

In order to load a round, the top of the back and front walls of the magazine are cut away to a certain extent. The side walls of the magazine are extended upward and form so-called magazine lips that prevent rounds from falling out of the top of the magazine. A spring in the magazine forces a cartridge retriever upward inside the magazine housing, thus pushing the rounds upward. They can then push the breechblock out of the magazine and into the cartridge chamber.

When the breechblock slides forward, it pushes the uppermost round out of the magazine and into the cartridge chamber, and the cycle is repeated when the next round is fired in the single shot mode after the trigger is pulled again, or automatically in the continuous firing mode.

After the last round has been fired, the magazine can be removed in the conventional manner, and a new magazine can be inserted.

There are numerous designs for sonic signature suppressors 1. They can be attached with a conventional coupling mechanism to a barrel (not shown) of a firearm (not shown), or to other attachments, e.g. a flash suppressor or muzzle brake (not shown). Sonic signature suppressors 1 suppress optically as well as acoustically, thus reducing noise emissions and muzzle blast as well as the flash when a round is fired.

The sonic signature suppressor 1 shown in a schematic longitudinal cutaway illustration in Fig. 1 comprises a housing 3 with an interior 4. One end 5 of the suppressor 1 has a coupling interface 7 for attaching it to the firearm. In a simple design, the coupling interface is a thread (see Figs. 2a to e). A channel 11 for bullets 9 passes through the interior 4 and has an exit hole 13 at the muzzle end 15 of the suppressor 1 where the bullets 9 exit the interior 4. The exit hole 13 is surrounded by the end surface 17 of the suppressor 1.

The sonic signature suppressor 1 functions as follows: when a round is fired, gas propels the bullet 9 in a gas flow 19 through the barrel of the firearm, where it then enters and passes through the bullet channel 11 in the suppressor 1. The propellant gas expands inside the suppressor 1, without generating noise. This is illustrated schematically by the cross-hatching indicating the gas flow 19.

The gas is shown flowing over the bullet here, thus clearing the path for the bullet, forcing any residual liquid out of the path and/or out of the suppressor.

To absorb the energy from the propellant prior to its exiting the sonic signature suppressor 1, there are so-called baffle chambers 21 in the housing interior 4, that block the gas flow 19 and thus the noise generated by turbulence therein, with an associated reduction in the speed of the gas flow, thus cooling the propellant. The baffle chambers 21 are formed by baffles or deflectors 23, which are at an angle to the direction of firing in the top and bottom of the interior 4. The sonic signature suppressor 1 also reduces recoil and muzzle flash.

Figs. 2a-e show longitudinal sections of various sonic signature suppressors 1. They differ from the embodiment in Fig. 1 by the design of the coupling interface 7 in the form of a thread 25 that is screwed onto the thread on the firearm barrel. Furthermore, the baffle chambers 21 have different shapes, and the baffle walls 23 have different alignments in the sonic signature suppressors 1 in Figs. 2a-e, in that they are tilted in the firing direction in Fig. 2a, alternate between being tilted in the firing direction and counter to the firing direction in Fig. 2b, tilted on both sides against the firing direction in Fig. 2c, K-shaped in Fig. 2e, and perpendicular to the firing direction in Fig. 2e, in which case the first two chambers 21 from the left are larger, providing more space for the propellant to expand in at the weapon end. There are therefore numerous possible designs for the interior structure in the sonic signature suppressor 1 obtained with the invention in addition to the embodiments shown herein, in that the chambers 21 and baffles 23 can have any arbitrary design and position, depending the specific application.

Fig. 3 shows a schematic longitudinal section of a first embodiment of the sonic signature suppressor 1 obtained with the invention. The baffles 23 basically form funnels opening toward

the firing direction. The coupling interface 7 can be a thread, or it can have a collet adapter (Figs. 13 and 14) or an asymmetrical coupling interface (Figs. 15a to 17). Other means of attaching it to the firearm can also be used. The first two chambers 21 from the left are larger, and the first baffles 21 from the left are at a right angle in the interior 4. There is also a basically rectangular drain hole 27 cut into the housing wall 3 of the sonic signature suppressor 1. The size of the drain hole 27 allows liquid to be drained within a few seconds, usually 1 to 3 seconds, after removing it from the water.

The first four baffles from the left have four second drain holes 29 at the bottom. These holes connect the chambers 21 such that liquid can be drained therefrom toward the first chamber 21, where the first drain holes 27 are located. They are large enough for the chambers 21 to drain through the first drain holes 27 within 1 to 3 seconds. Any residual water can remain in the first two chambers 21 from the right without impacting the functional reliability when firing a round.

The embodiment of the sonic signature suppressor 1 in Fig. 4 differs from that in Fig. 3 in that there is a second drain hole 29 in each baffle 23 in order to drain all of the chambers quickly.

The embodiment of the sonic signature suppressor 1 in Fig. 5 differs from those in Figs. 3 and 4 in that the first drain hole 27 is larger and extends over the first two chambers 21 from the right into the third chamber 21. This also results in a quick draining from all of the chambers 21. A larger drain hole 27 results in quicker draining after removing the firearm and sonic signature suppressor 1 from water or liquid.

The embodiment of the sonic signature suppressor 1 in Fig. 6 differs from those in Figs. 3, 4 and 5 in that the first drain hole 27 is even larger, and extends at the bottom of the housing 3 over all of the chambers 21 until shortly before reaching the muzzle end of the sonic signature suppressor 1. Second drain holes 29 and in internal path between the chambers 21 are unnecessary in this embodiment, because all of the chambers 21 are connected to the exterior by the first drain hole 27.

Fig. 7a shows a perspective illustration of another embodiment of the sonic signature suppressor obtained with the invention, with a closure mechanism 30, and Fig. 7b shows a perspective illustration of this embodiment. The first drain holes 27 in this case are four parallel slots in the bottom of the first chamber 21. There is also a second drain hole 29 at the bottom of each baffle near the lower housing wall.

The sonic signature suppressor in Fig. 7a also has a closure mechanism 30 with a collar 31 forming the closure element. This can be rotated from the open position shown in Fig. 7b to a closed position, where the collar covers and seals the four drain holes 19. The collar 31 is threaded on the inside, such that it interacts with the thread 33 on the outside of the housing 3 for the sonic signature suppressor 1, thus moving it toward the barrel end 5 of the suppressor 1 when rotated in the direction of the arrow 35. There is a stop 36 that the collar 31 snaps into when it reaches the end position.

A shooter, e.g. a frogman or diver, can carry the firearm with the sonic signature suppressor 1 attached to it while the at least one drain hole is open when diving or swimming. Because the four drain holes 27 are on the bottom of the suppressor 1, most of the water is drained from the suppressor 1 due to gravity relatively quickly and quietly within a few seconds after surfacing. The shooter then closes the drain holes 27 with the collar 31 by rotating it, as explained above, and the firearm is ready for firing. A steeper thread requires less rotation, e.g. such that it only needs a half or full rotation.

Fig. 8 shows a perspective illustration of another embodiment of the sonic signature suppressor 1 obtained with the invention, with a closure element, and Fig. 9 shows a perspective illustration of another embodiment of the suppressor 1 with a closure element.

The two embodiments differ from that in Figs. 7a and b with regard to the design of the closure element. This is a slider 37 in both cases that partially encompasses the suppressor. The slider can be rotated in Fig. 8, and slid lengthwise in Fig. 9. The slider 37 encompasses a fourth to a third of the outer circumference of the housing 3. There are rails 39 for the slider 37 in both embodiments, which are above and below the four drain holes 27 in Fig. 8, and are parallel to the

bore axis 12 of the suppressor 1 in Fig. 9. There is a stop 36 that the collar 31 snaps into or onto in the closed setting.

The embodiment of the sonic signature suppressor with a collar shown in a perspective illustration in Figs. 10a and 10b only differs from that in Figs. 7a and b with regard to the design of the first drain hole 27. Instead of four parallel drain holes 27, there is just one larger drain hole 27 on the bottom of the housing wall, which extends over about 2/3 of the length of the first chamber 21 at the bottom.

There is a seal (not shown) on the outside of the housing 4 and/or the inner surface of the closure element, i.e. the collar 31 or slider 37, or the half-shell 41. This seal can be applied to part or all of the surface area. The seal is reinforced at the edges of the closure element in order to obtain a reliable seal.

Figs. 11a and 11b show perspective illustrations of another embodiment of the sonic signature suppressor 1 obtained with the invention. This embodiment differs from that in Figs. 10a and b with regard to the design of the first drain hole 17 and the closure element. In this case, there is a larger drain hole 27 on the bottom of the housing wall, which extends over the first five chambers 21 from the left at the bottom of the housing 4. The last two chambers 21 are each connected to the first drain hole 27 by second drain holes 27. The closure element is formed by a half-shell 41 that can be moved back and forth between the open setting and closed setting along a rail 39. There is also a stop (not shown), for securing it in the closed setting.

Fig. 12 shows a perspective illustration of another embodiment of the sonic signature suppressor 1 with a collar 31 forming the closure element. This embodiment differs from that in Figs. 10a and b with regard to the design of the first drain hole 27 and the size of the collar 31. This also has a larger drain hole 27 on the bottom of the housing wall, which extends over the first five chambers 21 from the left along the bottom of the housing 4. The last two chambers 21 are each connected to the first drain hole 27 by second drain holes 27. The collar 31 extends over nearly the entire length of the suppressor 1 and moves along a coarse thread 33 between the open setting and closed setting. There is also a stop 36 for securing it in the closed setting.

Fig. 13 shows a perspective illustration of another, two-part embodiment of the sonic signature suppressor obtained with the invention. This embodiment differs from the above embodiments, in particular in Figs. 7a and b, with regard to the two-part design of the housing 4 for the suppressor 1 and the design of the collar 31. This also has four drain holes 27 on the bottom of the housing wall, which extend over the first chamber 21 from the left at the bottom of the housing 4. The chambers 21 are each connected to the first drain holes 27, or first chamber 21, by second drain holes 29. The collar 31 extends over nearly the entire length of the suppressor 1, and can be moved from the open setting to the closed along a coarse thread 33. There is also a stop 36 for securing it in the closed setting. The suppressor 1 is assembled by pushing or holding the two parts together, and connecting them with the collar 31 and the thread 33. The thread extends over both parts of the suppressor 1, but is not shown in its entirety for purposes of clarity.

Fig. 14 shows an alternative perspective illustration of another two-part embodiment of the suppressor obtained with the invention. This embodiment differs from the above embodiments, in particular in Fig. 13, with regard to the two-part design of the housing 4 for the suppressor 1, and the design of the collar 31. This also has four drain holes 27 on the bottom of the housing wall that extend over the first chamber 21 from the left on the bottom of the housing 4. The chambers 21 are each connected to the first drain hole 27 by second drain holes 29.

The collar 31 also extends over the length of the suppressor 1 and can be moved between the open setting and closed setting along a coarse thread 33. In this case, the collar 31 is permanently connected to the housing part on the right in Fig. 14, or is an integral part thereof. To assemble the suppressor 1, the part on the right is screwed onto that on the left, and they are connected to one another by the collar 31 and the thread 33. The thread only extends over the part on the left in Fig. 14, but is not shown in its entirety for purposes of clarity. The collar 31 can therefore be screwed on only partially, to keep the suppressor 1 the open setting. To close the drain holes 27, the collar is simply tightened.

Fig. 15 shows a perspective illustration of an inner view of a collar, and Fig. 16 shows a perspective illustration of an inner view of the closure element shown in Figs. 8 and 9. The collar 31 and closure element 37 each have a recess 32 or groove 38 on their inner walls, which opens toward the end the bullets exit, thus forming a gap opening toward the muzzle. The groove 32 or 38 conducts excess propellant toward the muzzle. When the collar 31 or slider 37 is closed, the middle of the groove 32 or 38 is opposite the respective drain hole(s) 27. If the stop is not reached when closing the collar 31 or slide 37, the groove 32 or 38 is wide enough that residual propellant can still be safely discharged forwards at the end the bullet exits, without endangering the shooter.

Figs. 17 to 19 show perspective views of two embodiments of a coupling interface for attaching a sonic signature suppressor to a gun barrel or flash suppressor attached thereto.

The coupling interface is a chock or collet 47. The muzzle end of a barrel 43 is shown schematically. A pin-shaped positioning element 45 extends to the muzzle that is parallel to the bore axis. This positions and orients the collet 47 in a reproduceable manner during assembly, which has a complementary recess 49 for this. When the positioning element is inserted in the recess 49, the collet 47 is coupled to the firearm in a position that can be precisely reproduced. It is only possible to do so when the positioning element 45 is in the recess 49, because the collet is otherwise blocked automatically, and cannot be slid onto the muzzle. After it has been put in place, a coupling nut is tightened down on the schematically shown thread, tightening the collet 47 onto the barrel 43, compressing the tensioning slits 51. There is a torque wrench that can be used for tightening it, although it can also be tightened by hand. The suppressor 1 is not shown, but is coupled to the nut.

The embodiment shown in Figs. 18 and 19 differs from that in Fig. 17 in that, instead of the positioning element 45 on the barrel 43, there is a recess 46 into which a positioning element 48 inside the collet 47 is fitted. There can also be bevels on the barrel 43. Both measures allow for precisely reproduceable positioning and orientation of the collet 47 during assembly. There can also be a first recess on the barrel in the form of a groove 53, and/or a second recess in the form of depression 55 in which complementary elements on the inside of the collet 47 can engage.

The collet can be placed on or attached to the coupling interface. The suppressor 1 is not shown, and is coupled in the conventional manner to the nut. The applicant reserves the right to claim independent protection for these and other variation(s) or embodiments.

Figs. 20 to 21b show illustrations of another embodiment of the coupling interface for attaching a sonic signature suppressor 1 to a gun barrel, and Fig. 22 shows a perspective cutaway illustration of the embodiment of the coupling interface in Figs. 20a to 21b, in the assembled state.

The coupling sleeve 57 can be attached to the suppressor 1 with a threaded connection, or some other suitable and conventional connecting means (see Fig. 22). The suppressor 1, barrel, or flash suppressor has one asymmetrical lug 59 and two symmetrical lugs 61 on its muzzle end in order to position it precisely in the coupling sleeve 57. The sleeve 57 has a recess for the asymmetrical lug 63 and two recesses for the symmetrical lugs 65. It is therefore only possible to place the lugs 59 and 61 in the sleeve 57 in one position. This is shown in Fig. 21a. After the lugs 63 and 65 have been inserted far enough, the sleeve 57 can be rotated and the lugs 63 and 65 are locked in place in undercuts 67. The applicant reserves the right to claim independent protection for these or other variation(s) or embodiments.

The sonic signature suppressor obtained with the invention, its use for draining liquid, and the firearm attached thereto increase the safety level for firearms, in particular self-loading firearms, particularly when used after removing them from water or other liquids.

Other embodiments of the invention can be derived by the person skilled in the art from the following claims and the drawings.

List of Reference Symbols

1	sonic signature suppressor
3	housing for the sonic signature suppressor
4	housing interior
5	barrel end of the sonic signature suppressor
7	barrel end coupling interface
9	round
11	bullet channel
12	bore axis
13	bullet exit hole
15	muzzle end of the sonic signature suppressor
17	end surface
19	gas flow
21	baffle chamber
23	baffle
25	thread
27	drain hole in the housing wall
29	drain hole in the baffle
30	closure mechanism
31	closure element; collar
32	recess; groove
33	coarse thread
35	direction arrow
36	end
37	closure element; slide
38	groove/recess
39	guide rail
41	closure element; half shell
42	recess in 31 or 41
43	barrel

45	element on barrel
47	collet
49	positioning recess on collet
51	tensioning slit on collet
53	first positioning recess on collet
55	second positioning recess on collet
57	coupling sleeve
59	asymmetrical lug
61	symmetrical lug
63	recess for asymmetrical lug
65	recess for symmetrical lug
67	undercut

Claims

1. A sonic signature suppressor (1) for firearms, that has:
 - at least one housing (4) with a bullet channel (11) passing through it, and
 - at least one drain hole (27) formed at or near the weapon end of the housing (4), through which liquid can be drained from the suppressor (1)wherein, when attached to a firearm, the at least one drain hole (27) connects the interior (4) of the suppressor (1) to the exterior such that liquid in the interior (4) can be discharged through the drain hole(s) (27) to clear the bullet channel (11) in order to safely fire a round within a few seconds.
2. The sonic signature suppressor (1) according to claim 1, in which the at least one drain hole (27) is large enough and placed and designed such that 50% to 60% of the volume of the interior (4) of the suppressor (1) can be drained within 1 to 6 seconds, preferably within 1 to 3 seconds.
3. The sonic signature suppressor (1) according to claim 1 or 2, wherein the at least one drain hole (27) can be closed by a closure mechanism (30), wherein the closure mechanism (30) has at least one closure element (31, 37, 41) designed to at least partially encompass the sonic signature suppressor (1).
4. The sonic signature suppressor (1) according to claim 3, in which the closure mechanism (30), in particular the at least one closure element (31, 37, 41), can be moved between a closed and open setting by a coupling mechanism (33, 39).
5. The sonic signature suppressor (1) according to claim 3 or 4, in which the at least one closure element (31, 37, 41) can be moved radially, and/or axially, and/or diagonally, and/or horizontally on the sonic signature suppressor (1) to close it.

6. The sonic signature suppressor (1) according to claim any of the claims 3-5, in which the closure mechanism (30), in particular the closure element (31, 37, 41), and/or the sonic signature suppressor (1), has at least one seal to retain liquid.
7. The sonic signature suppressor (1) according to any of the preceding claims, in which the at least one drain hole (27) is on the bottom of the sonic signature suppressor (1), and/or there is a net, grid, or fibrous protective structure in or on the drain hole that prevents the ingress of foreign matter.
8. The sonic signature suppressor (1) according to any of the preceding claims, which also contains at least one baffle chamber (21), wherein the at least one drain hole (27) connects the at least one baffle chamber (21) to the exterior of the sonic signature suppressor (1) to remove liquid.
9. The sonic signature suppressor (1) according to any of the preceding claims, in which at least one drain hole (27) connects at least two baffle chambers (21) to the exterior of the sonic signature suppressor (1) to remove liquid, and/or at least two baffle chambers (21) are connected by at least one second drain hole (29) inside the sonic signature suppressor (1).
10. The sonic signature suppressor (1) according to any of the preceding claims, in which a recess (42) extends entirely or partially along the length of the sonic signature suppressor (1) on the closure element (31, 37, 41) and/or on the sonic signature suppressor (1) to remove liquid and/or liquid/gas mixtures in the direction of firing.
11. The sonic signature suppressor (1) according to claim 10, in which the recess (42) is narrower than, the same width as, or wider than the diameter of the at least one drain hole (27).

12. The sonic signature suppressor (1) according to any of the preceding claims, which has a coupling mechanism (47-67) with which it is oriented precisely in relation to the firearm, in a reproduceable manner when attaching it thereto.
13. The sonic signature suppressor (1) according to any of the preceding claims, which also contains at least one pressure relief valve for removing liquids and/or gas/liquid mixtures in the case of excess pressures.
14. The sonic signature suppressor (1), in particular according to any of the preceding claims, which also contains at least one device (31) that protects the sonic signature suppressor (1) against excess pressures and/or prevents an uncontrolled shot (9) from exiting the sonic signature suppressor (1) when there is liquid in the sonic signature suppressor (1).
15. The sonic signature suppressor (1) according to any of the preceding claims, in which the protective device forms a heat protection sleeve (31) that protects the sonic signature suppressor (1) from overheating, and/or shields the shooter against heat, and which forms the closure element (31).
16. The sonic signature suppressor (1) according to any of the preceding claims, in which the heat protection sleeve (31) at least partially encompasses the sonic signature suppressor (1) and is also designed to prevent a bullet from exiting in any direction other than that in which it is fired.
17. A firearm that has a sonic signature suppressor (1) according to any of the preceding claims attached to it.
18. The firearm according to claim 17, wherein the sonic signature suppressor (1) is attached directly to the barrel, or to a flash suppressor on the firearm in an orientation that can be precisely reproduced.

19. Use of a sonic signature suppressor (1) according to any of the claims 1 to 16 to remove liquid from the sonic signature suppressor (1).