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(54) Silencer

(57) The present invention relates to a silencer for weapons comprising an attachment part (1), an intermediate part (2) and an outer muzzle part (3), where the intermediate part (2) comprises at least a module element (10, 100) and a baffle element (30, 300),
- where the module element (10, 100) comprises a sleeve portion (11, 110) which in section forms a part of an outer surface (12, 120) of the silencer and an internal abutment shoulder (14, 140) for the baffle element (30, 300), and a radial portion (19, 190) extending in a substantially radial direction inwards from the sleeve portion (11, 110) and an inner deviated termination portion (20, 200) which is terminated in a central opening (21, 210), and
- the baffle element (30, 300) abuts against the abutment shoulder (14, 140) and comprises a substantially radial portion (33, 330) and an inner deviated termination portion (34, 340) which is terminated in a central opening (36, 360),
where the deviated termination portions (20, 34, 200, 340) of the baffle element (30, 300) and the module element (10, 100) are deviated in opposite axial directions.

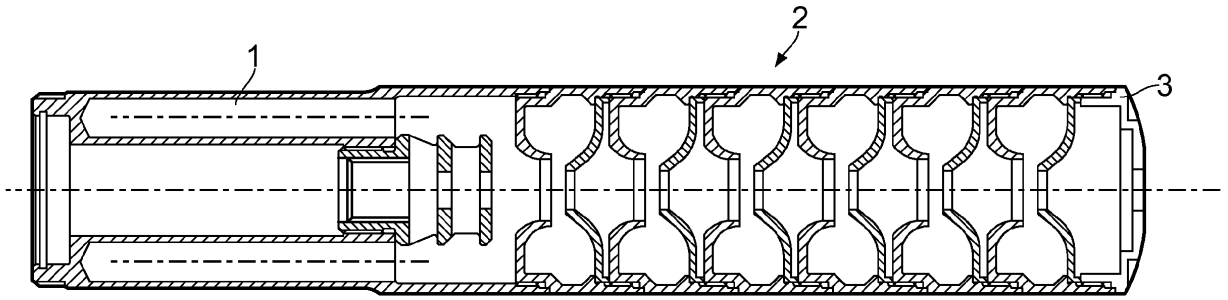

FIG. 1b

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Description

[0001] The present invention relates to a silencer for weapons and a method for manufacture of such a silencer.

[0002] A number of different types of silencer for weapons are known. One type of silencer employs the principle of setting the exhaust gases following the projectile in a rotating motion, thereby lowering the velocity of these exhaust gases before they leave the silencer. An early example of such a solution is described in US patent 916.885. In the patent US 5,029,512 the principle of setting the exhaust gases in rotation is also employed. In both these solutions a plurality of elements are arranged one behind the other internally in an external tube, which elements interact and set the exhaust gas in rotation internally in the tube. In US 4,907,488 elements are also used internally in a tube in order to change the direction of flow of the exhaust gases, in order thereby to achieve a sound suppression. In US 5,679,916 the exhaust gases are also diverted, but in this solution there are modular units which are assembled, thereby forming both an outer surface of the silencer and an inner configuration which changes the direction of flow of the exhaust gases.

[0003] The present invention seeks to provide an alternative silencer, which offers satisfactory diversion of the exhaust gases' direction of flow while at the same time being modular and consisting of a small number of parts.

[0004] This is accomplished with a silencer as indicated in the following claims.

[0005] A silencer for weapons is provided consisting of an attachment part, an intermediate part and an outer muzzle part, where the intermediate part according to the invention comprises at least a module element and a baffle element. The intermediate part will normally comprise sets of a module element and a baffle element, but it may also have differing numbers of these. With such a module-based design of the silencer, the length of the silencer can be adjusted and thereby the effect thereof.

[0006] According to the invention the module element comprises a sleeve portion which in section forms a part of an outer surface of the silencer and an internal abutment shoulder for the baffle element. The baffle element will normally be located internally in the module element. In another variant a solution may also be envisaged where the baffle element also has a sleeve portion and forms a part of an outer surface of the silencer. The module element further comprises a radial portion extending in a substantially radial direction inwards from the sleeve portion and an internal deviated termination portion terminating in a central opening. This radial portion may be in the form of an extension of the sleeve portion at one end of the sleeve portion. Alternatively, it may extend inwards from the sleeve portion at a distance from one end of the sleeve portion.

[0007] Furthermore, the baffle element abuts against the abutment shoulder of the module element and the baffle element comprises a substantially radial portion and an internal deviated termination portion terminating in a central opening. The central opening of the module element and the central opening of the baffle element are centred and coincide with a centre axis for the sleeve portion of the module element. The openings form part of the barrel for a projectile fired by a weapon secured to the silencer. According to the invention the deviated termination portions of the baffle element and the module element are deviated in opposite axial directions. The term deviated should be understood to mean that they have a shape that changes direction from a radial direction to another direction. The deviated termination portions are designed to have a substantially conical surface or in other words they are trumpet-shaped. They are shaped in such a manner that the smallest diameter of the cone is at the central opening. The termination portions of the baffle element and the module element are preferably designed differently, even though the basic shape is similar. The termination portions are formed in such a manner that they have a curvature from a substantially radial direction to a substantially axial direction. The curvature may be varied along the termination portion. The termination portion may also be provided with a section which has a more linear conical shape in addition to a curved conical shape. The termination portions may also be provided with varying wall thickness, so that they have less wall thickness near the central opening than near the radial portion. The configuration of the deviated termination portions with their rounding and relative size on the central openings and their relative positioning along a centre axis of the silencer will be such that they will lead exhaust gases generated by firing a projectile in a weapon attached to the silencer away from a linear flow path. The exhaust gases will be diverted radially outwards from an axial flow direction, thereby creating a turbulent flow in an annulus formed round the central openings and the deviated termination portions. In an embodiment this annulus is radially outwardly limited by the sleeve portion of the module element forming the outer surface of the silencer and in the axial direction of the radial portion and the deviated portion by the module element on one side and the baffle element on the other side. This annulus and the rotation of the exhaust gas will reduce the velocity of flow of the exhaust gases and thereby suppress the sound.

[0008] According to an aspect of the invention the termination portions of either the module element or the baffle element may have a larger internal diameter on the central opening than the other deviated termination portion belonging to the other element, either the baffle element or the module element. The central opening of the module element's termination portion may therefore have a different diameter opening from the central opening of the baffle element's opening. In a possible configuration the central opening of the module element is smaller than the central opening of the baffle element, while in another configuration the central opening of the

module element is larger than the central opening of the baffle element.

[0009] According to another aspect the silencer's intermediate portion may comprise at least three termination portions, for example at least two baffle elements and at least one module element, or at least two module elements and at least one baffle element, preferably at least two baffle elements and at least two module elements. In such a version baffle element and module element will be arranged alternately, with the result that with different opening diameters, each alternate element in succession has a larger and smaller central opening in the direction of travel for the projectile. The direction of travel for the projectile will also correspond to a main direction of flow for the exhaust gases. In such a configuration the opening of a termination portion with the largest central opening will be arranged nearer a downstream smaller central opening than an upstream smaller central opening.

[0010] According to an aspect of the invention the module element may comprise attachment devices for securing the module element to an adjacent module element, attachment part or muzzle part. The attachment devices may be inner and outer threads provided in the surface of the module element so as to interact with corresponding threads provided in adjacent module elements, attachment elements or muzzle part. Alternatively, they may interact with corresponding threads provided in a baffle element, since in an embodiment this forms a part of an outer surface of the silencer. Alternatively, the attachment devices may be attachment devices other than threads, such as twisting and locking devices, rapid couplings, etc.

[0011] According to an aspect the attachment devices may be arranged in relation to the abutment shoulder of the module element, with the result that the baffle element is securely locked between two module elements or a module element and the muzzle part when they are secured to each other. Alternatively, the abutment shoulder may be arranged in such a manner that the baffle element is locked between it and a locking ring provided in an internal groove in the module element.

[0012] According to an aspect the baffle element may comprise an outer flange portion for abutment against the abutment shoulder of the module element. This flange portion will extend in an axial direction of the silencer. A flange portion of this kind may be provided both in the solution where the baffle element is locked between two module elements and in the case where the baffle element is locked between the module element and a locking ring.

[0013] According to an embodiment of the invention a central opening of the baffle element may have a smaller diameter than the central opening of the module element. In another embodiment the central opening of the baffle element may have a larger diameter than the central opening of the module element.

[0014] According to another aspect the inner termination portion of the module element and the inner termination portion of the baffle element may be designed so as to conduct an exhaust gas flow in order to form a turbulent flow in an annulus formed between the module element and the baffle element round the central openings.

[0015] According to an aspect the module element may be designed in such a manner that the sleeve portion has an end section with an internal diameter at an end of the sleeve portion which is larger then an outer diameter of the radial portion and the deviated termination portion. Furthermore, this end section has a length in the axial direction which is longer than an axial length of the termination portion of the module element. The result of this is that in an embodiment a portion of a module element will be arranged internally in the adjacent module element when they are secured to each other.

[0016] The invention will now be explained with references to the attached figures where;

Figs. 1a-f illustrate six embodiments of a silencer according to the invention,

Fig. 2 illustrates in greater detail a section of the intermediate part employed in the silencers in figs. 1a-f, and

Fig. 3 illustrates details of a second embodiment of the intermediate part.

[0017] Fig. 1 illustrates a first embodiment of a silencer according to the present invention. The silencer comprises an attachment part 1, an intermediate part 2 and an outer muzzle part 3. All parts are arranged in alignment with one another and have a common centre axis 4. The attachment part 1 can be secured to a weapon 5, as indicated in figs. 1c-1e. The actual attachment part may also have a different configuration as illustrated in figures 1a-1f. A type of telescopic design is possible where a section of the attachment part is arranged over the barrel, thereby forming an overlying structure where an inner part with internal threads for attachment is arranged internally in the attachment part, as indicated in figs. 1a-1b, a rapid coupling type is also possible as indicated in figs. 1c-1e or a pure threaded connection as indicated in fig. 1f. Furthermore, the attachment part may also comprise other elements such as different types of flash reducer or other elements, such as, for example, those described in the applicant's previously filed patent application NO 20093290. The outer muzzle part may also have a different shape depending on its use.

[0018] The intermediate part 2 is composed of module units $10,10^{i},10^{ii},10^{iii}...10^{vi}$ and baffle elements $30,30^{i},3^{ii},30^{iii},...30^{vi}$. In fig. 1a the intermediate part comprises seven module units 10 and seven baffle elements 30. In fig. 1b the intermediate part comprises six module units 10 and six baffle elements 30. In figs. 1c-1e an intermediate part is shown with six, five and four module units respectively and seven, six and five baffle elements respectively. The intermediate part 2 in these versions comprises

in addition a modified lead-in module 24, mounted between the attachment part 1 and the first module unit 10. Lead-in module 24 is a version of the module unit 10 which is shorter in the axial direction, and in addition it does not have a deviated termination portion either, with the result that a portion corresponding to the radial portion forms an opening of the lead-in module 24 internally. In fig. 1f an intermediate part 2 is illustrated comprising five module units 10 and five baffle elements 30.

[0019] A possible configuration of the module units 10 and the baffle elements 30 is illustrated in more detail in fig. 2. The module unit 10 comprises a sleeve portion 11. In section, the sleeve portion 11 forms an outer surface 12 of the silencer. At an end of the sleeve portion 11 which forms an open end, internal threads 13 are provided in the inner surface near the end at the inside of the sleeve portion 11. Axially inside this threaded portion 13 an abutment shoulder 14 can be found. The abutment shoulder 14 is in the form of a ring surface with an orientation substantially transverse to the centre axis of the sleeve portion. The abutment shoulder 14 is also in a position which is radially inside the internal threaded portion 13 viewed from the open end. Axially inside the abutment shoulder 14, viewed from the open end of the sleeve portion 11, there is a groove 15 in the wall of the sleeve portion 11. Externally the sleeve portion 11 forms an external surface 12 of the silencer from the open end, whereupon the sleeve portion 11 is reduced in the axial direction to a smaller external diameter, thereby forming a guide edge 16 round the circumference of the sleeve portion 11. Furthermore, in the axial direction from the open end, the sleeve portion is further reduced and provided with external threads 17. The opposite end of the sleeve portion 11 relative to the open end forms a locking edge 18. The module unit 10 continues at this end with the locking edge in a radial portion 19 which extends radially inwards from the sleeve portion 11. This radial portion 19 changes into a deviated inner termination portion 20, which is terminated radially internally in a central opening 21. In the illustrated example the inner termination portion 20 deviates in the direction towards the open end of the sleeve portion. The inner termination portion 20 is terminated in a radial surface 21. In the illustrated example, the baffle element 30 which is mounted internally in the module element 10 comprises an abutment surface 31 for abutment against the abutment shoulder 14. In connection with this abutment surface 31 there is a flange portion 32. This flange portion 32 extends in a substantially axial direction and is linked to a radial portion 33 of the baffle element 30, which extends radially inwards from this flange portion 32 or the flange edge, which is arranged round the periphery of the baffle element 30. The radial portion 33 changes into a deviated inner termination portion 34 which is terminated in a central opening 36. In the illustrated example the deviated inner termination portion 34 is deviated in the opposite axial direction compared with the termination portion 20 of the module element 10. The termination portion 34 is terminated with a radial surface 35 round the central opening 36. This radial surface 35 is also facing the main direction of flow of the exhaust gas. The central opening 36 of the baffle element 30 is smaller in diameter than the central opening 21 of the module element 10. The baffle element 30 which is mounted internally in the module element is also arranged downstream of the central opening 21 of the module element, and the deviated termination portions 20, 34 are deviated towards each other. The two openings 21, 36 of the module element 10 and the baffle element 30, which are arranged internally in the module element, are mounted much nearer each other than the openings 36*, 21° for the baffle element 30*, which is arranged upstream of the module element 10, and the module element 10°, which is arranged downstream of the baffle element 30 respectively. Together with the difference in size of the opening diameter and the deviation of the termination portions, this forms an annular chamber 40 between the module element 10 and the baffle element 30, into which the exhaust gases are conducted, thus achieving a diversion of the direction of flow and thereby a reduction in velocity. The baffle element 30, which is mounted internally in the module element 10, has its opening arranged downstream of the opening for the module element 10.

[0020] In fig. 3 an alternative, but similar embodiment of module elements 100 and baffle elements 300 is illustrated in order to form an intermediate part of a silencer. The module elements 100 comprise a sleeve portion 110, which in section forms an external surface 120. The sleeve portion 110 is provided with an internal threaded portion 130 near an open end of the sleeve portion 110. The sleeve portion 110, moreover, has an external reduced section in which a guide edge 160 and external threads 170 are provided. In the transition between the sleeve portion 110 and a radial portion 190 extending radially inwards from the end of the sleeve portion 110 which is opposite the open end, an abutment shoulder 140 is provided. The radial portion 190 continues in a deviated termination portion 200 which is terminated in a central opening 210. In contrast to the previous embodiment which was explained above, this termination portion 200 is deviated in the direction away from the open end of the sleeve portion 110. In this embodiment the baffle element 300 is also provided with a flange portion 320 arranged round the periphery, which forms an abutment surface 310 at an end edge for abutment against the abutment shoulder 140 of the module element 100. The module element comprises an internal groove 230 for mounting a non-illustrated locking ring, for securing the baffle element 300 relative to the module element 100. The opposite end of the flange portion 320 continues in a radial portion 330 which extends radially inwards from the flange portion 320 and changes into a deviated termination portion 340 which is terminated in a central opening 360. In this embodiment the termination portion 340 is deviated in the direction towards the open end of the module unit 100 and thereby away from the

central opening 210 of this module unit 100. In this embodiment the central opening 210 of the module unit 100 has a smaller diameter than the central opening 360 of the baffle element 300. The central opening 360 of the baffle element 300, which is mounted internally in a module element 100, is therefore located nearer a central opening 210* of an adjacent module element 100* than the central opening 210 of the module element 100 in which the baffle element is internally mounted. In this embodiment too an annulus 400 is created for diversion of the exhaust gas by means of the termination portions 340, 200. In this embodiment this annulus 400 is formed by a side of the baffle element 300, the sleeve portion 110 of a module element 100 and the radial portion 190* and the termination portion 200* of an adjacent, downstream-located module element 100*.

[0021] The present invention has now been explained with reference to embodiments, but a person skilled in the art will understand that changes and modifications will be able to be made to these embodiments which lie within the scope of the invention as defined in the following claims.

Claims

1. A silencer for weapons comprising an attachment part (1), an intermediate part (2) and an outer muzzle part (3), where the intermediate part (2) comprises at least a module element (10, 100) and a baffle element (30, 300),

   - where the module element (10, 100) comprises a sleeve portion (11, 110) which in a section forms a part of an outer surface (12, 120) of the silencer and an internal abutment shoulder (14, 140) for the baffle element (30, 300), and a radial portion (19, 190) extending in a substantially radial direction inwards from the sleeve portion (11, 110) and an inner deviated termination portion (20, 200) which is terminated in a central opening (21, 210), and
   - the baffle element (30, 300) abuts against the abutment shoulder (14, 140) and comprises a substantially radial portion (33, 330) and an inner deviated termination portion (34, 340) which is terminated in a central opening (36, 360),

   where the deviated termination portions (20, 34, 200, 340) of the baffle element (30, 300) and the module element (10, 100) are deviated in opposite axial directions.

2. A silencer according to claim 1,
   characterised in that one of the termination portions (20, 34, 200, 340) on the module unit (10) or the baffle element (30, 300) respectively has a larger internal diameter on the central opening (21, 36, 210, 360) than the other deviated termination portion, the baffle element (30, 300) or the module unit (10, 100) respectively.

3. A silencer according to claim 2,
   characterised in that at least three termination portions (20, 34, 200, 340) are arranged with alternate larger and smaller central openings successively in the direction of flow for the projectile, where a termination portion with the largest central opening (21, 360) is arranged nearer a downstream smaller central opening (36, 210) than an upstream smaller opening (36, 210).

4. A silencer according to one of the preceding claims,
   characterised in that the module element (10, 100) comprises attachment devices (13, 17, 130, 170) for securing the module element to an adjacent module element (10', 100*), attachment part (1) or muzzle part (3).

5. A silencer according to claim 4,
   characterised in that the attachment devices (13, 17) are arranged relative to the abutment shoulder (14) of the module element (10), in such a manner that the baffle element (30) is securely locked between two module elements (10, 10') or a module element (10) and the muzzle part (3) when they are secured to each other.

6. A silencer according to one of the preceding claims,
   characterised in that the baffle element (30, 300) comprises an outer flange portion (32, 320) for abutment against the abutment shoulder (14, 140) of the module element (10, 100).

7. A silencer according to one of the preceding claims,
   characterised in that the central opening (36) of the baffle element (30) has a smaller diameter than the central opening (21) of the module element (10).

8. A silencer according to one of the preceding claims,
   characterised in that the inner termination portion (20, 200) of the module element (10, 100) and the inner termination portion (34, 340) of the baffle element (30, 300) are designed in such a manner that they conduct an exhaust gas flow so that a turbulent flow is created in an annulus (40) formed between the module element (10, 100, 100*) and the baffle element (30, 300) round the central openings (21, 36, 210, 360).

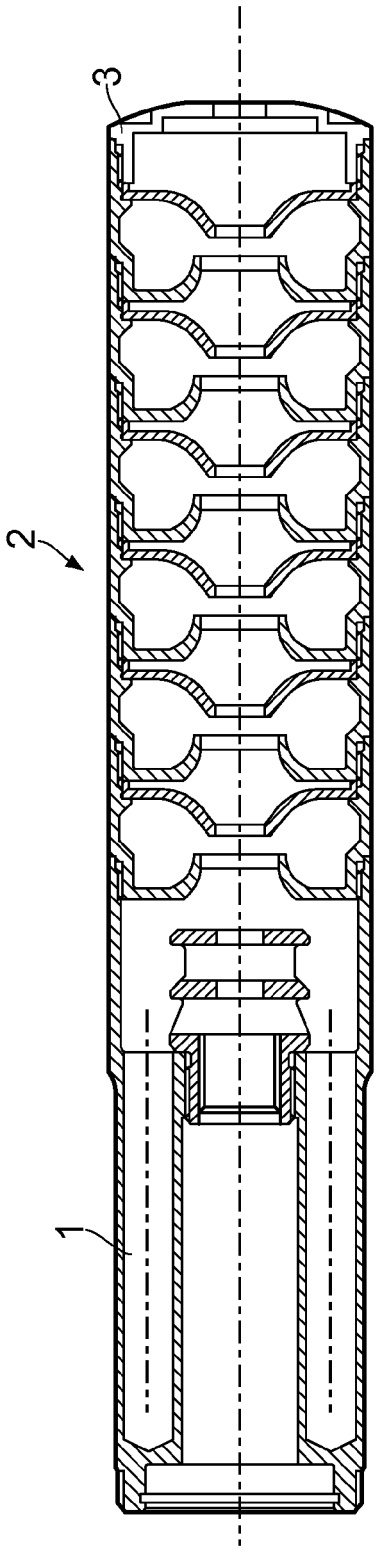
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FIG. 1b

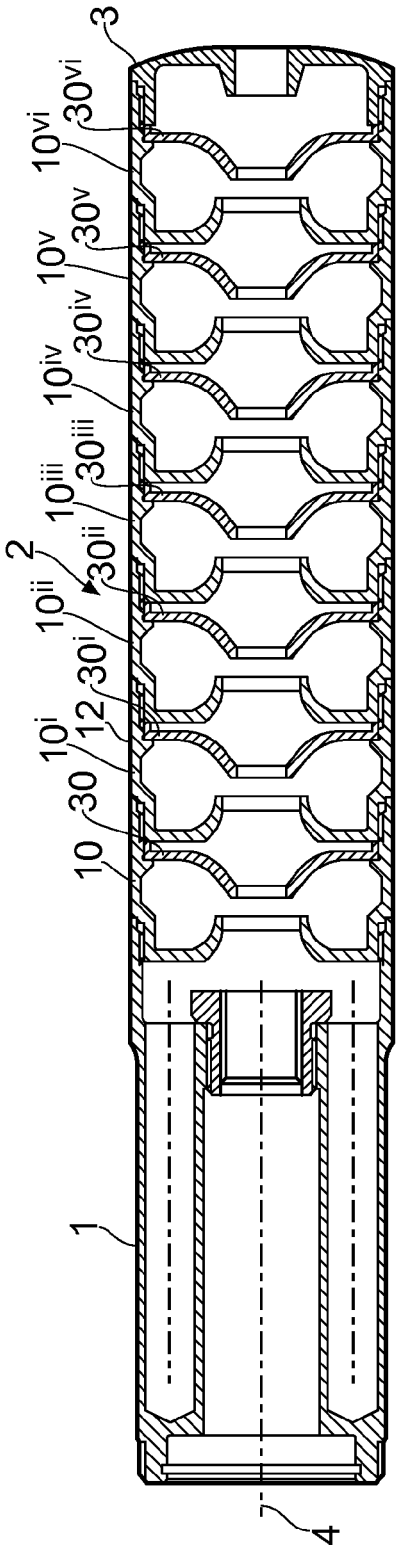
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FIG. 1a

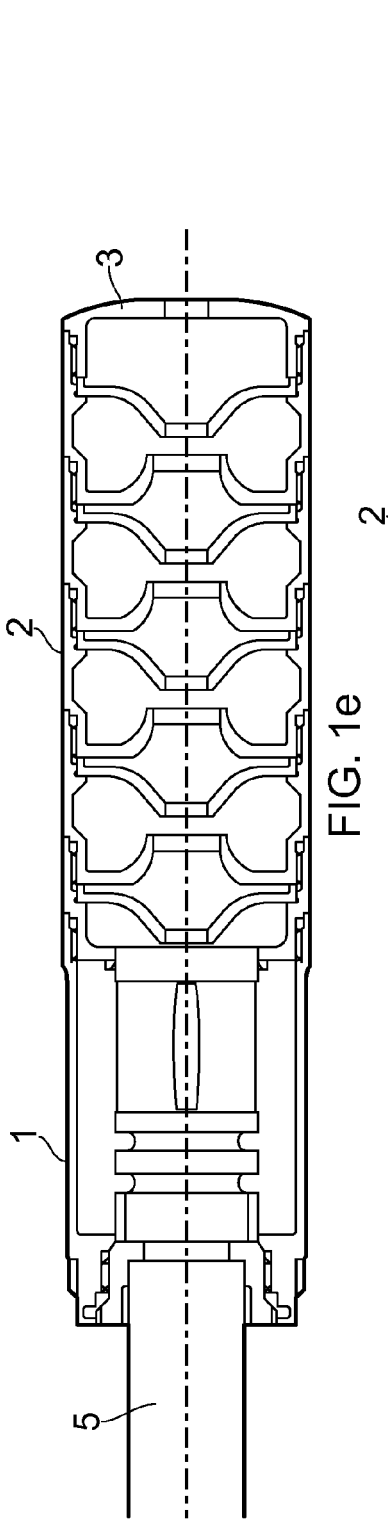

FIG. 1e

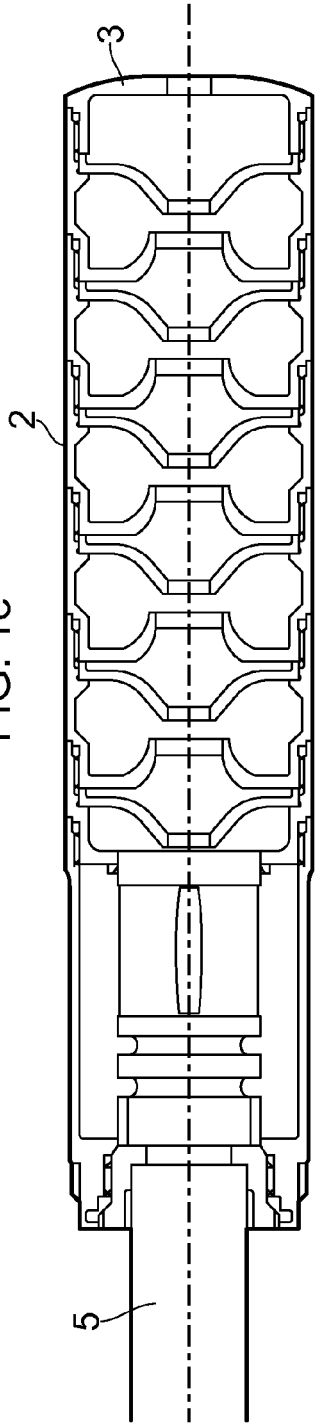

FIG. 1d

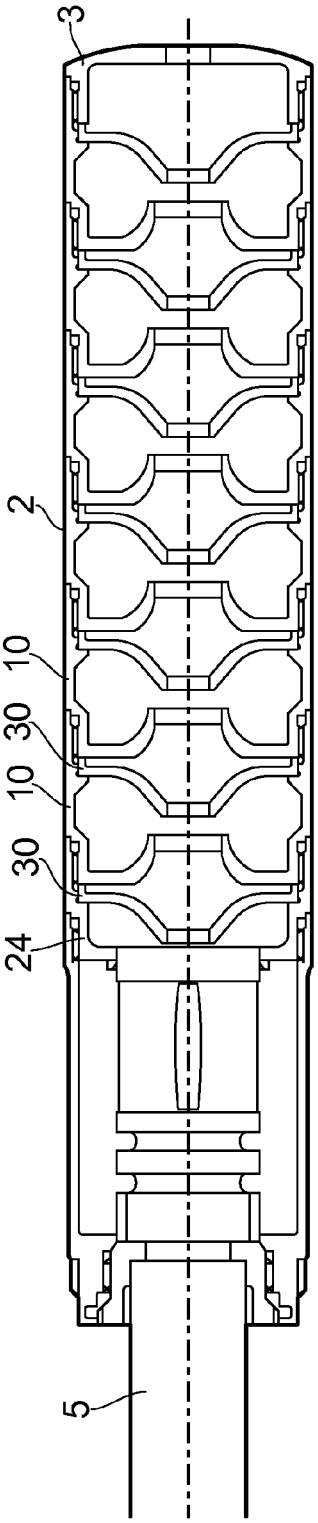

FIG. 1c

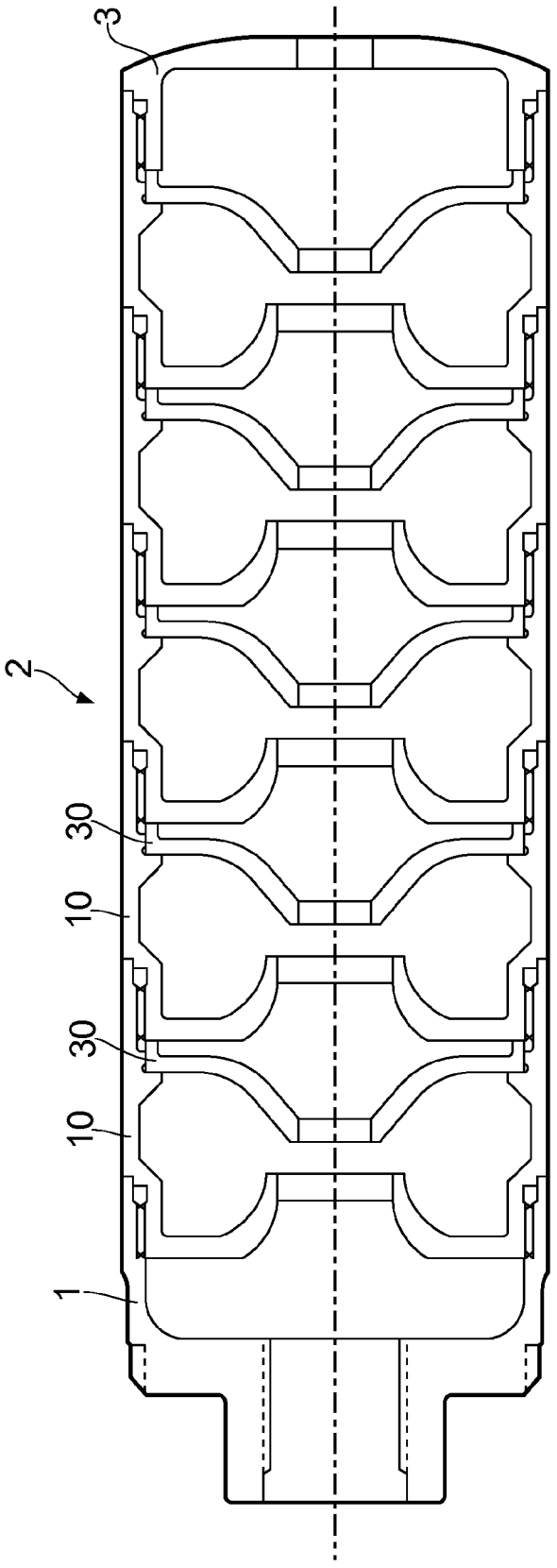

FIG. 1f

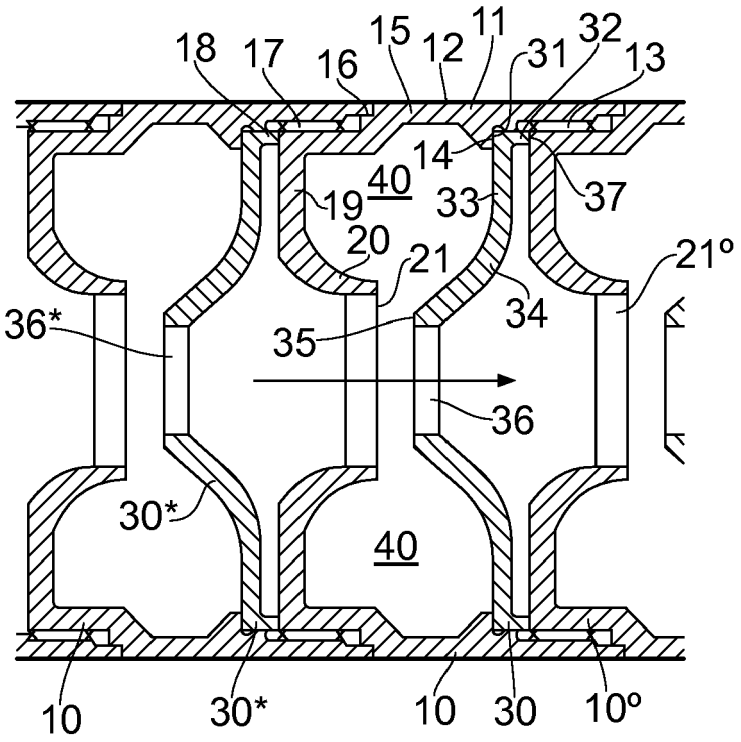
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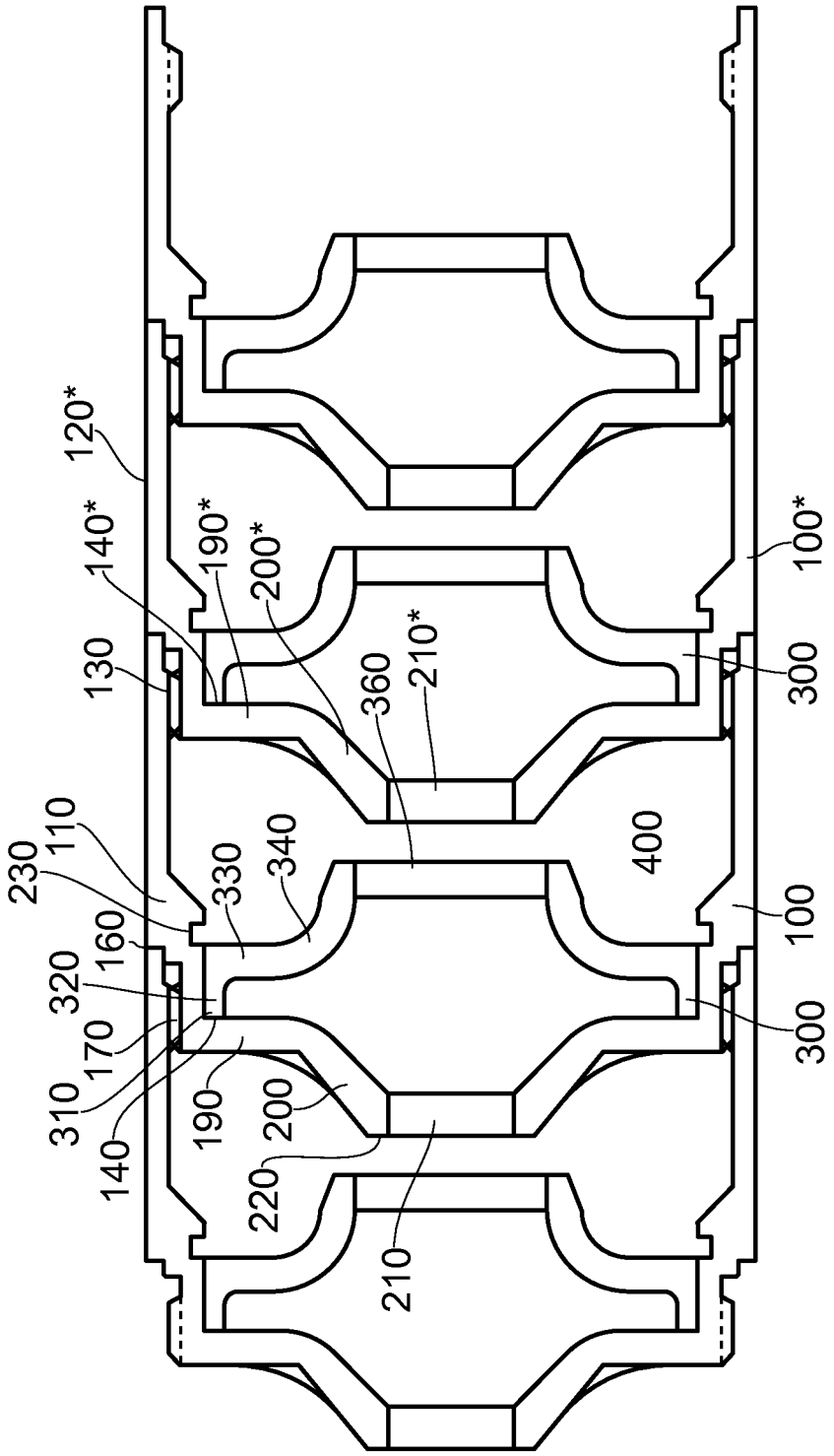
FIG. 2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310
190
200
140
220
210

FIG. 3

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

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- US 5029512 A **[0002]**
- US 4907488 A **[0002]**
- US 5679916 A **[0002]**
- NO 20093290 **[0017]**