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(54) **NOISE REDUCING SILENCER WITH SPIRAL CHAMBERS FOR A COMPRESSOR**

(57) A noise reducing silencer (200) for a compressor, the silencer (200) including a housing (210), a spirally shaped silencer core (220) provided in the housing (210) and having an inlet (216) and an outlet (2121), a connecting element connected to the silencer core (220) to connect the outlet (2121) of the silencer core (220) to an inlet of a compressor. The silencer core (220) is provided to reduce noise during operation of the compressor, where the silencer core (220) can include two spiral chambers (222, 224) stacked on each other. The spiral chambers (222, 224) can also include hollow walls that form the spiral chambers and that are filled with sound absorbing material.

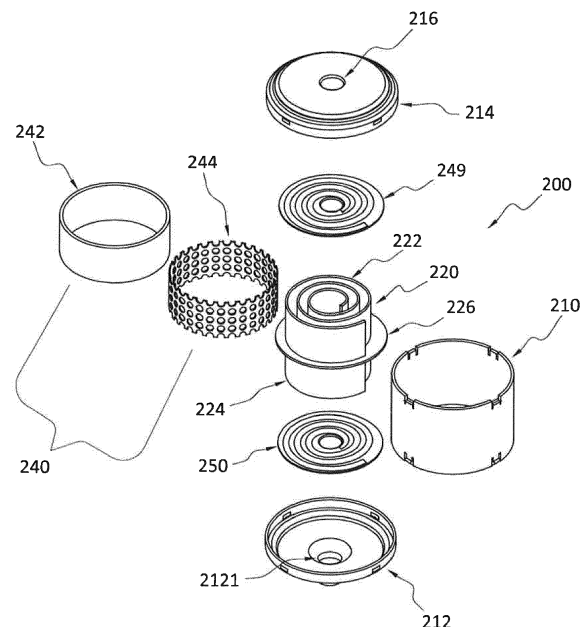


FIG. 2

Description

CROSS REFERENCE OF RELATED APPLICATIONS

[0001] This application claims priority to provisional application number 62/717,175, filed August 10, 2018, and provisional application number 62/719,726, filed August 20, 2018, which are incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention relates generally to a compressor, and more particularly to a silencer for reducing the noise emitted from certain compressors, especially reciprocating compressors or piston compressors.

BACKGROUND

[0003] Compressors typically include a motor that drives a compressor element to pressurize air. The compressor element can be a reciprocating compressor or piston compressor, a centrifugal compressor, a scroll compressor, a screw compressor having male and female compressor elements, or the like. All such compressor elements have a suction side for receiving inlet air, e.g., through an inlet air filter, and an outlet side for discharging the compressed air to a tank and/or distribution header for distributing the compressed air to a network of users. During the compression process, due to the large volume of air provided through the air inlet of the compressor, noise is generated at the air inlet or suction side.

[0004] For example, in a reciprocating compressor, which is widely used in various industrial and domestic applications, the motor is used to drive a crankshaft that moves pistons in a reciprocating manner, where gas enters the suction side, typically through an inlet manifold, is compressed via the pistons being driven in a reciprocating manner, and then discharged at high pressure into a tank.

[0005] However, during operation of the reciprocating compressor, noise is emitted from the air inlet or suction side of the reciprocating compressor when the air is drawn through the inlet manifold, e.g., due to the turbulence of the air moved through the inlet. Typically, the prior art reciprocating compressor has little to no provisions to reduce the noise it generates or employs conventional structures to reduce this noise. For example, one conventional structure draws the inlet air through a large, bulky, and remotely mounted baffling box, where such structure is costly and restricts the inlet air flow by employing a long tube that connects the suction side or air inlet of the compressor to the large baffling box, which reduces the efficiency of the compressor.

[0006] In view of such drawbacks, there is a need to provide a simpler, smaller, and more cost-effective structure for reducing the noise generated at the air inlet of

compressors that does not reduce the efficiency of the compressor.

SUMMARY OF THE INVENTION

[0007] The present invention is provided to solve the deficiencies of the prior art by providing improvements over the prior art in several ways. For example, it is an object of the present invention to provide a silencer that costs less, is much smaller, and can be attached directly to the compressor air inlet to reduce or eliminate restriction to the inlet air flow.

[0008] In order to achieve the objectives of the present invention, a noise reducing silencer is provided that is attached directly to the compressor air inlet of a compressor. The noise reducing silencer has a silencer core which reduces and/or eliminates the noise at the air inlet to provide a quieter compressor without adding significant extra costs and without significantly reducing efficiency. In one embodiment of the invention, the silencer comprises a housing, a silencer core, where the silencer core comprises two spiral chambers that are stacked on each other. In another embodiment, the two spiral chambers comprise hollow walls forming the spiral chambers, where the hollow walls comprise sound absorbing material. In order to reduce costs and size, the noise reducing silencer can be incorporated into a conventional air filter for a compressor and/or include filtering elements. The noise reducing silencer may be attached directly to the compressor intake/air inlet. The noise reducing silencer can also be attached to the air filter as a separate element.

[0009] The spiral chambers can be made of metal, plastic, a composite material, or a combination thereof or include material to dampen the noise.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The features and objects of the present invention are more clearly understood from the detailed description of preferred embodiments taken in conjunction with the accompanying drawings, in which:

Fig. 1 illustrates a perspective view of a compressor installation with a noise reducing silencer;

Fig. 2 illustrates an exploded perspective view of a noise reducing silencer according to a first embodiment of the present invention.

Fig. 3 illustrates the construction of the spiral chambers according to a first embodiment of the invention.

Fig. 4 illustrates an exploded perspective view of a noise reducing silencer according to a second embodiment of the present invention

Fig. 5A and Fig. 5B illustrate the construction of the

spiral chambers according to a second embodiment of the invention.

Fig. 6A and Fig. 6B illustrate an exploded perspective view of a noise reducing silencer according to a third embodiment of the present invention.

Fig. 7A, Fig. 7B, and Fig. 7C illustrate the construction of the spiral chambers according to a third embodiment of the invention.

Fig. 8A, Fig. 8B, and Fig. 8C illustrate the construction of the spiral chambers according to a fourth embodiment of the invention.

Fig. 9A illustrates a perspective cross-section view of a noise reducing silencer according to a fourth embodiment of the invention.

Fig. 9B illustrates a cross-section view of a noise reducing silencer according to a fourth embodiment of the invention.

[0011] In the various figures, similar elements are provided with similar reference numbers. It should be noted that the drawing figures are not necessarily drawn to scale, or proportion, but instead are drawn to provide a better understanding of the components thereof, and are not intended to be limiting in scope, but rather provide exemplary illustrations.

DETAILED DESCRIPTION OF THE INVENTION

[0012] The present invention will be described with respect to particular embodiments and with reference to certain drawings but the invention is not limited thereto and can be combined interchangeably with certain features in the different embodiments.

[0013] FIG. 1 illustrates a compressor installation, which can be a single or two stage reciprocating compressor or piston compressor, a centrifugal compressor, a scroll compressor, a screw compressor having male and female compressor elements, or the like, that includes a noise reducing silencer 200 according to the present invention. In this embodiment, the compressor element 10 is illustrated as a reciprocating compressor having a piston cylinder. Other embodiments may comprise multiple piston cylinders, for compressing air received from an air inlet 12 of the compressor element 10. The noise reducing silencer 200 is provided at the air inlet 12 for filtering the inlet air. The compressor element 10 is driven by a motor 20, e.g., a gas driven or electrically driven motor, that rotates the crankshaft to reciprocally rotate piston(s) to compress the air in the piston cylinder(s) of the compressor element 10. The compressed air is then discharged from the compressor element 10 to be stored in a tank or distributed to users.

[0014] The noise reducing silencer 200 is provided at

the air inlet 12 to reduce and/or eliminate the noise generated when the air is suctioned or drawn into the air inlet 12 of the compressor element 10. The noise reducing silencer 200 can be used to replace the standard air filters used for reciprocating air compressors by including air filter media in the noise reducing silencer, or be attached to the standard air filters, e.g., series connection.

[0015] As seen in Fig. 2, in one embodiment of the invention, the noise reducing silencer 200 includes a housing 210 that includes a base 212 and cover 214, where the cover 214 includes at least one opening 216 to allow air to be drawn into the noise reducing silencer 200. A silencer core 220 is provided within the housing 210 for guiding the air from an inlet of the housing (through opening 216) to an exit of the housing through outlet 2121 of the base 212. The outlet 2121 of the base 212 is then configured to be connected to the air inlet of a compressor, e.g., screw fittings, welding, pinned connection, cam fittings, compression fitting, etc.

[0016] In this embodiment of the invention, the noise reducing silencer 200 includes a silencer core 220 that comprises first spiral chamber 222, and second spiral chamber 224, which are rigidly connected to and separated by support 226. Thus, spiral chambers 222 and 224 are stacked on each other to reduce noise. First end seal 249 abuts first spiral chamber 222, and guides air flow from opening 216 through the aperture in the center of first end seal 249 and into the center of first spiral chamber 222. Second end seal 250 abuts second spiral chamber 224, and guides airflow from the center of second spiral chamber 224 through the aperture in the center of second end seal 250 and into outlet 2121 in base 212. Base 212 and cover 214 may be provided with indentations to hold silencer core 220 and filtering element 240 in fixed positions. Each of the spiral chambers 222, 224 is provided with an inlet and an outlet, where the outlet of the second spiral chamber 224 can be connected to a connecting element or channel provided along an inner side of the windings of the second spiral chamber 224 for connecting to the outlet 2121 of the base 212. While two spiral chambers 222, 224 are illustrated in this embodiment, a single spiral chamber or more than two spiral chambers can be used, where the number of spiral chambers are determined based on a number of factors, including the size of the noise reducing silencer. In some embodiments, one to six spiral chambers can be used.

[0017] The end seals 249, 250 are constructed of a composite material or rubber to seal the spiral chambers and direct the air flow through the silencer core 220. Additionally, a filtering element 240 can be placed around the silencer core 220. Filtering element 240 includes a filter screen 244 to provide a supporting surface for the filter 242. The filter 242 can include a variety of filtering media for example, coalescing filters, particulate filters, and carbon filters, to remove at least solid particles, liquids, aerosols, hydrocarbon vapours, etc. The filtering element can be further configured to reduce high frequency noise, e.g., based on the material and construc-

tion of the filtering element, e.g., using noise reducing material such as composite material and firmly mounting the filter screen. The base 212 of the noise reducing silencer 200 is also configured so that it can be coupled to the air intake port, e.g., air inlet, of the compressor, for example, by being fit into the air intake port of the compressor. The size of the assembled noise reducing silencer may be closely matched to the size of the standard air filters that are typically used for reciprocating air compressors.

[0018] In the embodiment of the invention that includes the filtering element 240, the noise reducing silencer 200 is constructed in a way so that the at least two spiral chambers are provided centrally in the housing 210. The filter screen 244 is then provided along an outer side and surrounding second spiral chamber 224 of the spirally shaped silencer core 220, and the filter 242 is provided along an outer surface of the filter screen 244. The housing 210, base 212, and cover 214 enclose the elements of the noise reducing silencer 200.

[0019] The operation of the noise reducing silencer 200 is provided as follows: Air is drawn through the opening 216 in the cover 214 into the noise reducing silencer 200 centrally through the first end seal 249 and through the first spiral chamber inlet 227 (shown in Fig. 3) of the first spiral chamber 222 provided along the center of the first spiral chamber 222. After passing through the first spiral chamber 222, the air exits the outer winding. A space may be provided between the exterior surface of filter element 240 and the interior surface of housing 210, whereby air flows out of first spiral chamber 222, through the space, through filter element 240, through second spiral chamber inlet 228 (shown in Fig. 3), and into second spiral chamber 224. Filter element 240 preferably abuts support plate 226. After the air enters into the second spiral chamber 224 through second spiral chamber inlet 228, the air passes through the second spiral chamber 224, and exits the spiral chamber 224 centrally, passes through the aperture in the center of second end seal 250 and through the outlet 2121 of the base 212. That is, air is flowed in series through the first spiral chamber 222 and then through the second spiral chamber 224.

[0020] Typically, in such compressor elements, noise is generated at the air inlet due to the suction of air, however, in the present invention, the noise from the suction of air is reduced and/or eliminated by the noise reducing silencer 200. Without limiting the invention by theory, it is understood that the spiral chambers 222, 224 create an extended and indirect path for the sound to travel by forcing the air to travel through. The windings of the spiral chambers preferably include two windings. However, more or less windings are within the scope of the invention. That is, it is understood that the spiral shape of the spiral chambers prevents a straight path for the sound to travel and the sound is instead reflected from all surfaces causing noise cancelation and attenuation. For example, the spiral windings provide a sealed surface for a broad spectrum of sound frequencies that are diffused

or absorbed by the spiral chambers 220. The number of windings that are appropriate depends on the application and volume of air to be passed through the spirally shaped silencer core 220. In other words, it is appreciated that this stacked dual chamber reduces air flow restriction to the compressor by not only providing a wider inlet opening, but reduces the noise by creating an extended and indirect path for the noise generated at the air inlet of the compressor to travel.

[0021] Fig. 3 illustrates that first spiral chamber 222 is provided with first spiral inlet 227, and second spiral chamber 224 is provided with second spiral inlet 228. The dimensions of the spiral chambers 222, 224 may be kept to a minimum and with the use of two spiral chambers, the silencer core 220 may be configured to reduce noise and provide an increased amount of air flow into the noise reducing silencer 200, e.g., reduce the air flow restriction by having wider inlet openings.

[0022] Noise reduction can be further enhanced by coating the spiral chambers with a sound absorbing material, such as sound proofing paint or gel, foam, fiberglass, ceramics or the like. This concept can be stacked for increased noise reduction. The end seals 249, 250 can also be coated with the sound absorbing material for further noise reduction.

[0023] The spirally shaped silencer core 220 can be made of a composite material, such as plastic, rubber, metal, carbon, natural fibers, fiberglass, or a combination thereof, to absorb a broad spectrum of frequencies and can further include porous or corrugated tubes or foams inside the spirally wound silencer core 220 to further absorb noise.

[0024] Fig. 4 illustrates a second embodiment of the invention. Similar to the first embodiment, this second embodiment includes a silencer core 420 that comprises spiral chambers 422, 424 that are stacked on top of each other. In this embodiment, however, the spiral chambers comprise hollow walls so that the spiral chambers are constructed as double walled spiral chambers where the opening created in the hollow wall, e.g., between the double walls, is filled with a sound absorbing material to further reduce and/or eliminate the generated noise. The dimensions of the spiral chambers are also preferably kept to a minimum to aid in noise reduction and by using two chambers the restriction to the air flow is reduced by providing a larger inlet opening into the silencer core. Additionally, the divided chambers are better supported to withstand the forces of the air flow being drawn into the compressor, e.g., using support 426.

[0025] Specifically, as illustrated in Fig. 4, the noise reducing silencer 400 includes a housing 410 that includes a base 412 and cover 414, where the cover 414 includes an opening 416. The silencer core 420 is made up of first spiral chamber 422 and second spiral chamber 424 that are rigidly connected to and separated by support 426. Noise reducing silencer 400 is provided within the housing 410 for guiding the air from an inlet of the housing (through opening 416) to an exit of the housing

through outlet 4121 of the base 412. First end seal 449 abuts first spiral chamber 422, and guides air flow from opening 416 in cover 414 through the aperture in the center of first end seal 449 and into the center of first spiral chamber 422. Second end seal 450 abuts second spiral chamber 424, and guides air flow from the center of second spiral chamber 424 through the aperture in the center of second end seal 450 and into outlet 4121 in base 412. Additionally, a filtering element 440 is placed around second spiral chamber 424 of the silencer core 420 and includes a filter screen 444 to provide a supporting surface for the filter 442, where the filtering element can be further configured to reduce high frequency noise, e.g., based on the material and construction of the filtering element, e.g., using noise reducing material such as composite material and firmly mounting the filter screen. A space may be provided between the exterior surface of filter element 440 and the interior surface of housing 410, whereby air flows out of first spiral chamber 422, through the space, through filter element 440, through second spiral chamber inlet 428 (shown in Fig. 5A), and into second spiral chamber 424. Filter element 440 preferably abuts support plate 426. Base 412 and cover 414 may be provided with indentations to hold silencer core 420 and filtering element 440 in fixed positions. The base 412 of the noise reducing silencer 400 is also configured so that it can be coupled to the air inlet of the compressor, for example, by being compression fit into the air inlet of the compressor. The housing 410, base 412, and cover 414 form an enclosure for the noise reducing silencer. The size of the assembled noise reducing silencer may be closely matched to the size of the standard air filters that are typically used for reciprocating air compressors.

[0026] Fig. 5A illustrates that first spiral chamber 422 is provided with first spiral inlet 427, and second spiral chamber 424 is provided with second spiral inlet 428. The dimensions of the spiral chambers 422, 424 may be kept to a minimum and with the use of at least two spiral chambers, the silencer core 420 is configured to reduce noise and provide an increased amount of air flow into the noise reducing silencer 400. Without limiting the invention by theory, similar to the first embodiment, in this second embodiment, the spiral chambers 422, 424 create an extended and indirect path for the sound to travel by forcing the air to travel through the windings of the spiral chambers. The windings preferably include two windings, and more preferably three windings as shown in Fig. 5A. However, more or less windings are within the scope of the invention. For example, as seen in Fig. 5B, the first spiral chamber 422 has a chamber inlet opening 427 and the second spiral chamber 424 has a chamber inlet opening 428 for receiving the air into the spiral chambers. The silencer core 420 has a central hollow cylinder 429 for the air to exit centrally from the second spiral chamber. Noise reduction in this embodiment is further enhanced since the spiral chambers comprise hollow walls that are constructed as double walls which are filled with sound absorbing material. Furthermore, noise re-

duction can be further reduced by coating the spiral chambers with a sound absorbing material, such as sound proofing paint or gel, foam, fiberglass, ceramics or the like. This concept can be stacked for increased noise reduction. The end seals 449, 450 can also be coated with the sound absorbing material for further noise reduction.

[0027] Figs. 6A and 6B illustrate a third embodiment of the invention, where similar to the first embodiment, the third embodiment includes a silencer core 620 that comprises spiral chambers 622, 624 that are stacked on top of each other. In this embodiment, however, the spiral chambers are not separated by the support or flange, but have the outlet of the first spiral chamber connected to the inlet of the second spiral chamber.

[0028] Specifically, as illustrated in Fig. 6A, the noise reducing silencer 600 includes a housing that includes a base 612 and cover 614, where the cover 614 includes an opening 616. The silencer core 620 is made up of first spiral chamber 622 and second spiral chamber 624 (shown in Fig. 6B) that are rigidly connected to one another. Noise reducing silencer 600 is provided within the housing for guiding the air from an inlet of the housing (through opening 616) to an exit of the housing through outlet 6121 of the base 612. First end seal 649 abuts first spiral chamber 622, and guides air flow from opening 616 in cover 614 through the aperture in the center of first end seal 649 and into the center of first spiral chamber 622. Second end seal 650 abuts second spiral chamber 624, and guides airflow from the second spiral chamber 624 to a filtering element 640 provided on an outflow or downstream side of the second spiral chamber 624 of the silencer core 620. The filtering element 640 can include a filter support or screen 644 to provide a supporting surface for the filter 642. A spacer 630 may be provided between the second end seal 650 and the filtering element 640. In this embodiment, air flows out of first spiral chamber 622 from an air outlet of the first spiral chamber 622 that is connected to a second spiral chamber inlet 628 (shown in Fig. 7B), and into the second spiral chamber 624. Filtering element 640 preferably guides the air flow from the center of second spiral chamber 624 through the aperture in the center of second end seal 650 and into outlet 6121 in base 612 (and optionally through the spacer 630). As seen in Fig. 6B, the base 612 of the noise reducing silencer 600 is also configured so that it can be coupled to the air inlet of the compressor, for example, by being compression fit or threaded into the air inlet of the compressor. The housing which includes base 612 and cover 614 forms an enclosure for the noise reducing silencer, where the base 612 and cover 614 may be connected via tabs connections or tongue and groove or other means. The size of the assembled noise reducing silencer may be closely matched to the size of the standard air filters that are typically used for reciprocating air compressors.

[0029] Fig. 7A illustrates that first spiral chamber 622 is provided with first spiral inlet 627, and second spiral

chamber 624 is provided with second spiral inlet 628, as seen in Fig. 7B. As seen in Figs. 7B and 7C, the outlet of the first spiral chamber 622 is connected to the second spiral inlet 628. The dimensions of the spiral chambers 622, 624 may be kept to a minimum and with the use of at least two spiral chambers, the silencer core 620 is configured to reduce noise and provide an increased amount of air flow into the noise reducing silencer 600. Without limiting the invention by theory, similar to the first embodiment, in this third embodiment, the spiral chambers 622, 624 create an extended and indirect path for the sound to travel by forcing the air to travel through the windings of the spiral chambers. The windings preferably include two windings, as shown in Fig. 7C. However, more or less windings are within the scope of the invention.

[0030] Figs. 8A, 8B, 8C illustrate another embodiment of the invention, which is similar to Figs. 7A-7C, but includes the spiral chambers constructed with double walls, where the enclosure between the double walls can be filled with sound-absorbing material. Specifically, the first spiral chamber 822 is provided with first spiral inlet 827, and second spiral chamber 824 is provided with second spiral inlet 828, as seen in Fig. 8A. As seen in Figs. 8A and 8C, the outlet of the first spiral chamber 822 is connected to the second spiral inlet 828. The dimensions of the spiral chambers 822, 824 may be kept to a minimum and with the use of at least two spiral chambers, the silencer core 820 is configured to reduce noise and provide an increased amount of air flow into the noise reducing silencer, as in the other embodiments. Without limiting the invention by theory, similar to the first embodiment, in this embodiment, the spiral chambers 822, 824 create an extended and indirect path for the sound to travel by forcing the air to travel through the windings of the spiral chambers. The windings preferably include two windings, as shown in Fig. 8C. However, more or less windings are within the scope of the invention.

[0031] Fig. 9A illustrates a perspective cross-section view of a noise reducing silencer 900 according to a fourth embodiment of the invention, which is provided with base 912 and cover 914. In this embodiment, air flows from opening 916 into first spiral chamber 922, and from first spiral chamber air outlet 931 into the second spiral chamber inlet 928, and from second spiral chamber 924, second end seal 950, and through filter 942, and then through outlet 9121 in base 912.

[0032] Fig. 9B illustrates a cross-section view of the noise reducing silencer according to the fourth embodiment of the invention, which is provided with base 912 and cover 914. In this embodiment, air flows through first spiral chamber 922, and through second spiral chamber 924, and through filter 942 and filter screen 944.

[0033] In view of such structure and features, the present invention solves the deficiencies of the prior art by providing a noise reducing silencer for a compressor installation which includes a silencer core that is configured to reduce and/or eliminate noise generated at an

air inlet of a compressor. This is an improvement over the prior art in several ways. These features cost less than a baffle box provided at an air inlet of a compressor. The present invention allows a smaller size silencer due to the compact arrangement of the silencer core, and may be attached directly to the compressor inlet with the air filter to reduce or eliminate restriction to the inlet air flow.

[0034] The invention discussed herein is directed to specific embodiments, but the design is not limited to the description of the exemplary invention but only by the scope of the appended claims. As a result, there are multiple embodiments that employ the beneficial characteristics of the invention, each providing a different advantage and which are combinable and/or interchangeable with various aspects of the different embodiments of the invention that do not depart from the spirit and scope of the invention.

Claims

1. A noise reducing silencer for a compressor, said silencer comprising:
 - a housing; and
 - a spirally shaped silencer core provided in the housing and having a core inlet and a core outlet, wherein the silencer core comprises two spiral chambers that are stacked on each other.
2. The silencer according to claim 1, further comprising end seals, wherein the housing comprises a base and a cover enclosing the housing and the end seals are provided to seal the spiral chambers from the base and the cover, respectively; and said silencer further comprising a connecting element configured to connect the outlet of the silencer core to an air inlet of the compressor.
3. The silencer according to claim 2, further comprising a filter element and a filter screen configured in a way to support the filter element, wherein said filter element and filter screen are provided circumferentially around an outer side of at least one of the spiral chambers within the housing.
4. The silencer according to claim 1, wherein the spiral chambers are coated with a sound absorbing material.
5. The silencer according to claim 1, wherein the spiral chambers comprise at least two windings.
6. The silencer according to claim 1, wherein the spiral chambers comprise hollow walls forming the spiral chambers which are filled with sound absorbing material.

7. The silencer according to claim 1, further comprising a filter element and a filter support configured in a way to support the filter element, wherein said filter element and filter support are provided at an out flow side of the core outlet. 5
8. The silencer according to claim 1, wherein the spirally shaped silencer core comprises composite material. 10
9. The silencer according to claim 1, wherein the housing comprises a base and a cover for enclosing the housing, and wherein said housing comprises at least one opening for an inlet airflow. 15
10. The silencer according to claim 1, wherein the inlet of the silencer core is provided centrally in a first spiral chamber of the spiral chambers and wherein the outlet of the silencer core is provided centrally in a second spiral chamber of the spiral chambers. 20
11. The silencer according to claim 10, wherein an outlet of the first spiral chamber is provided as a lateral outlet along an outer surface of the first spiral chamber and an inlet of the second spiral chamber is provided as a lateral inlet along an outer surface of the second spiral chamber. 25
12. A compressor installation comprising: 30
a motor;
a compressor element;
and a noise reducing silencer connected to an air inlet of the compressor element, said silencer comprising a housing, a spirally shaped silencer core provided in the housing, and a connecting element that connects the outlet of the silencer core to the air inlet of the compressor element, said silencer core comprising spiral chambers that are stacked on each other, each having an inlet and an outlet, 35
wherein the silencer core is configured in a way to reduce noise generated from a gas entering into the compressor during operation. 40
45
13. The compressor installation according to claim 12, wherein the compressor is a reciprocating compressor, and the gas is air.
14. The compressor according to claim 12, wherein the spiral chambers comprise hollow walls filled with sound absorbing material. 50
15. A noise reducer for a compressor, said noise reducer comprising: 55
a housing;
a noise reducer core provided in the housing,
- said reducer core comprising a first spiral chamber configured to guide an air flow from the interior of the first spiral chamber to the exterior of the first spiral chamber.
16. The noise reducer according to claim 15, wherein said reducer core further comprises a second spiral chamber configured to guide an air flow from the exterior of the second spiral chamber to the interior of the second spiral chamber.
17. The noise reducer according to claim 16, further comprising a filtering element and said reducer configured to guide an air flow through said filtering element.
18. The noise reducer according to claim 17, further comprising a support that abuts said first spiral chamber, said second spiral chamber, and said filtering element within said housing.

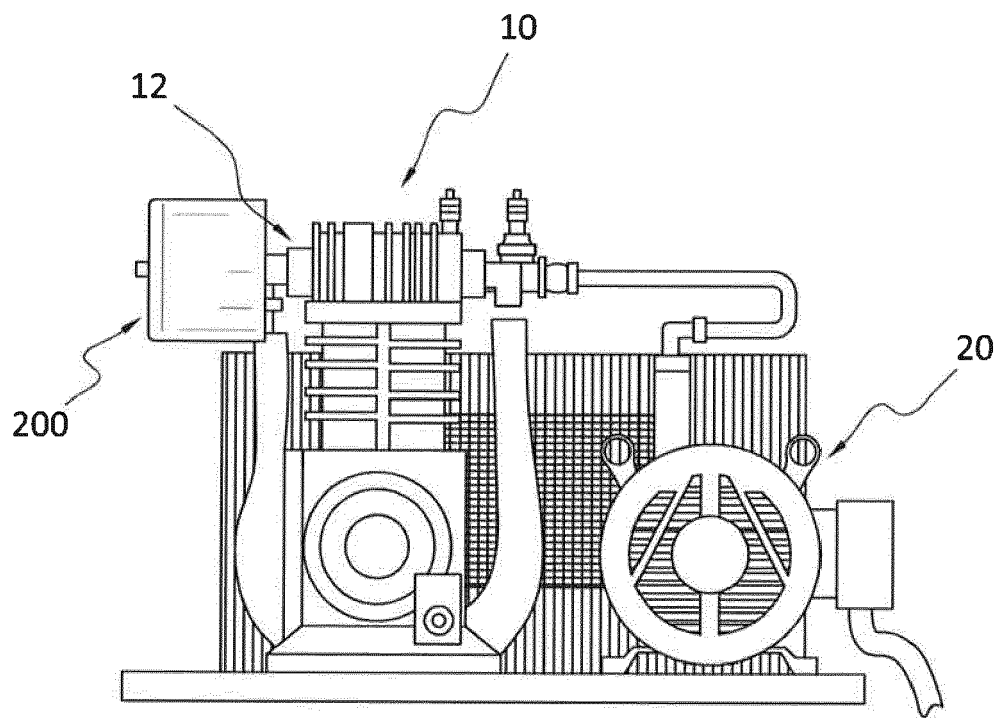


FIG. 1

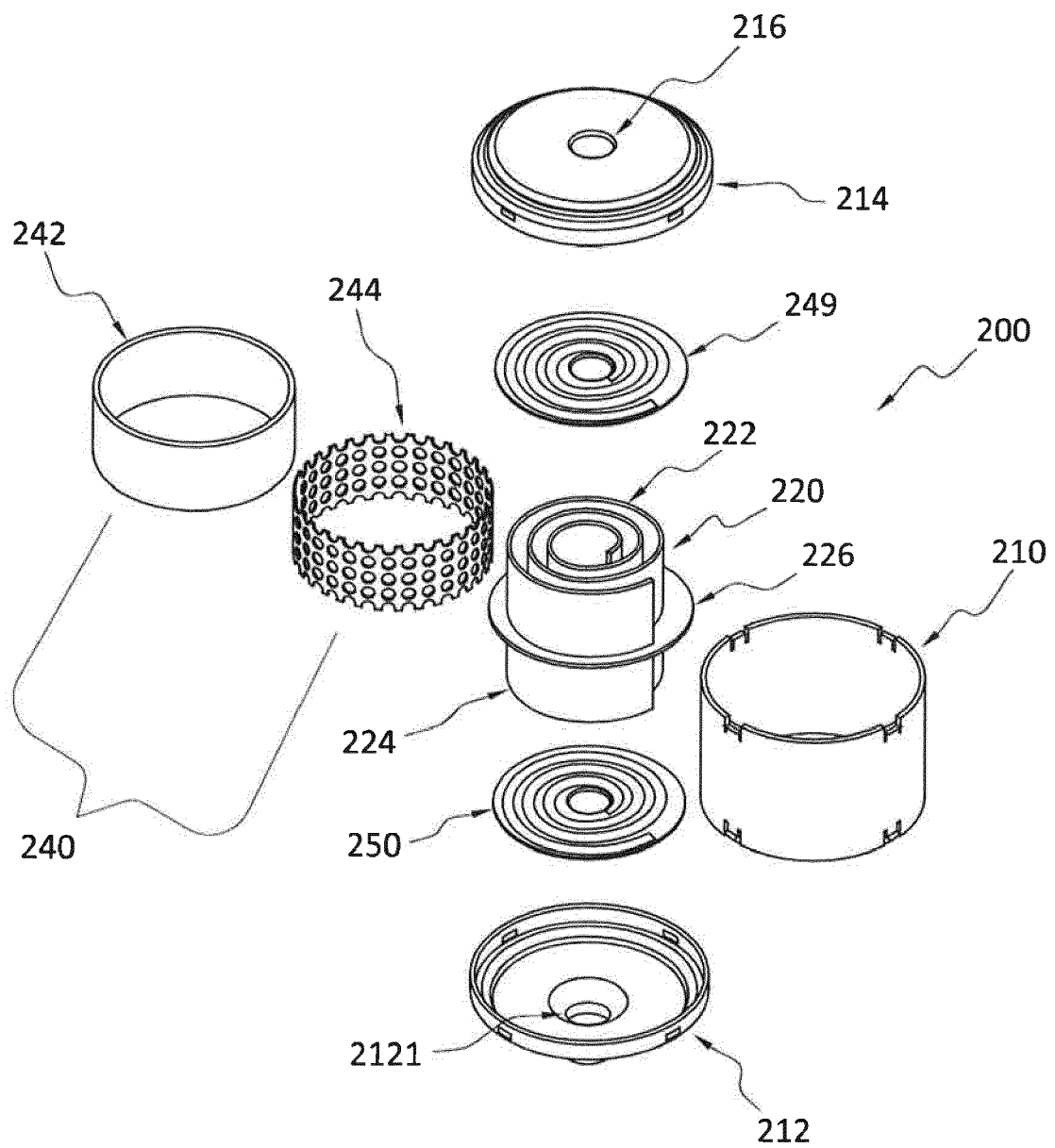


FIG. 2

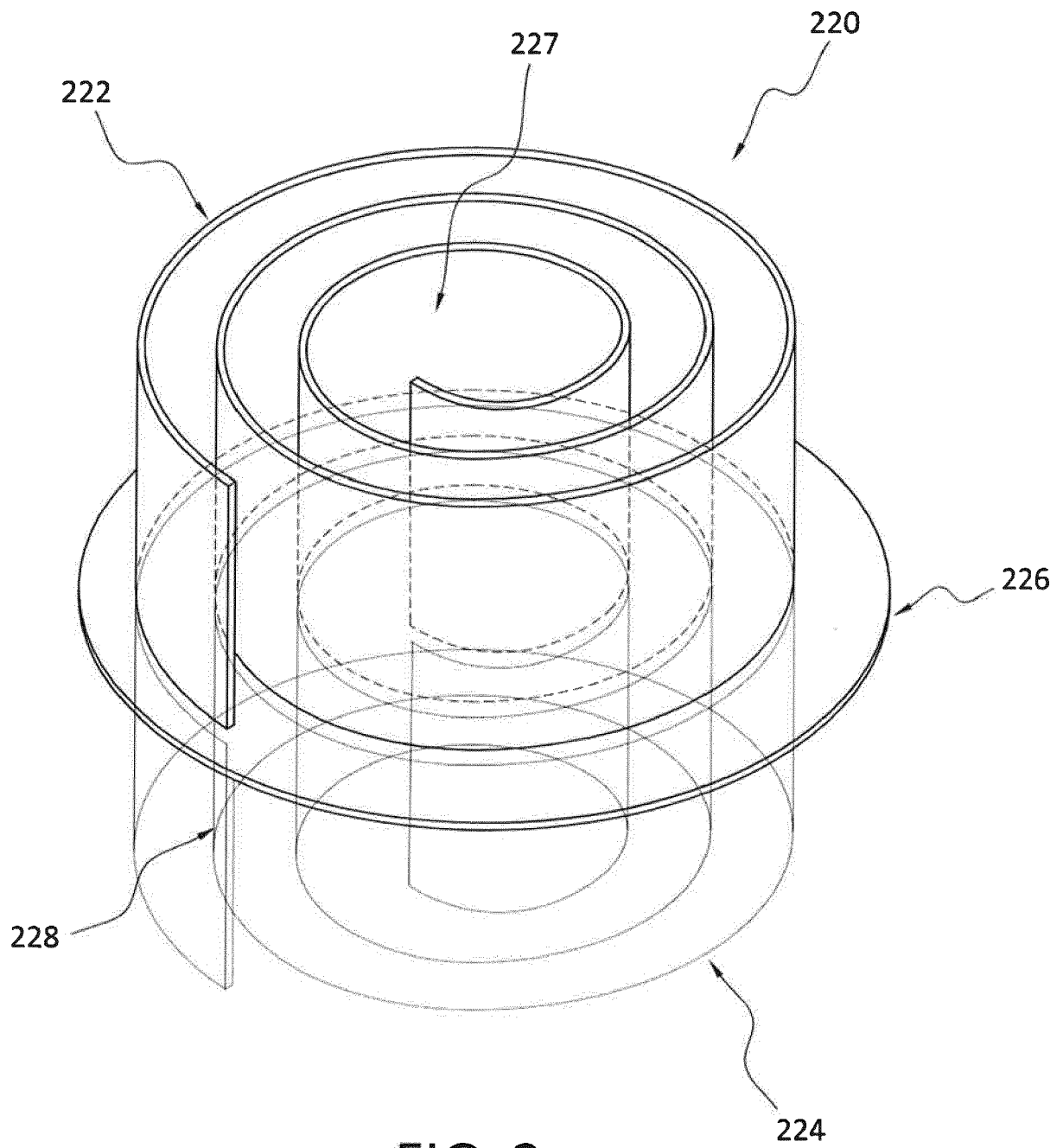


FIG. 3

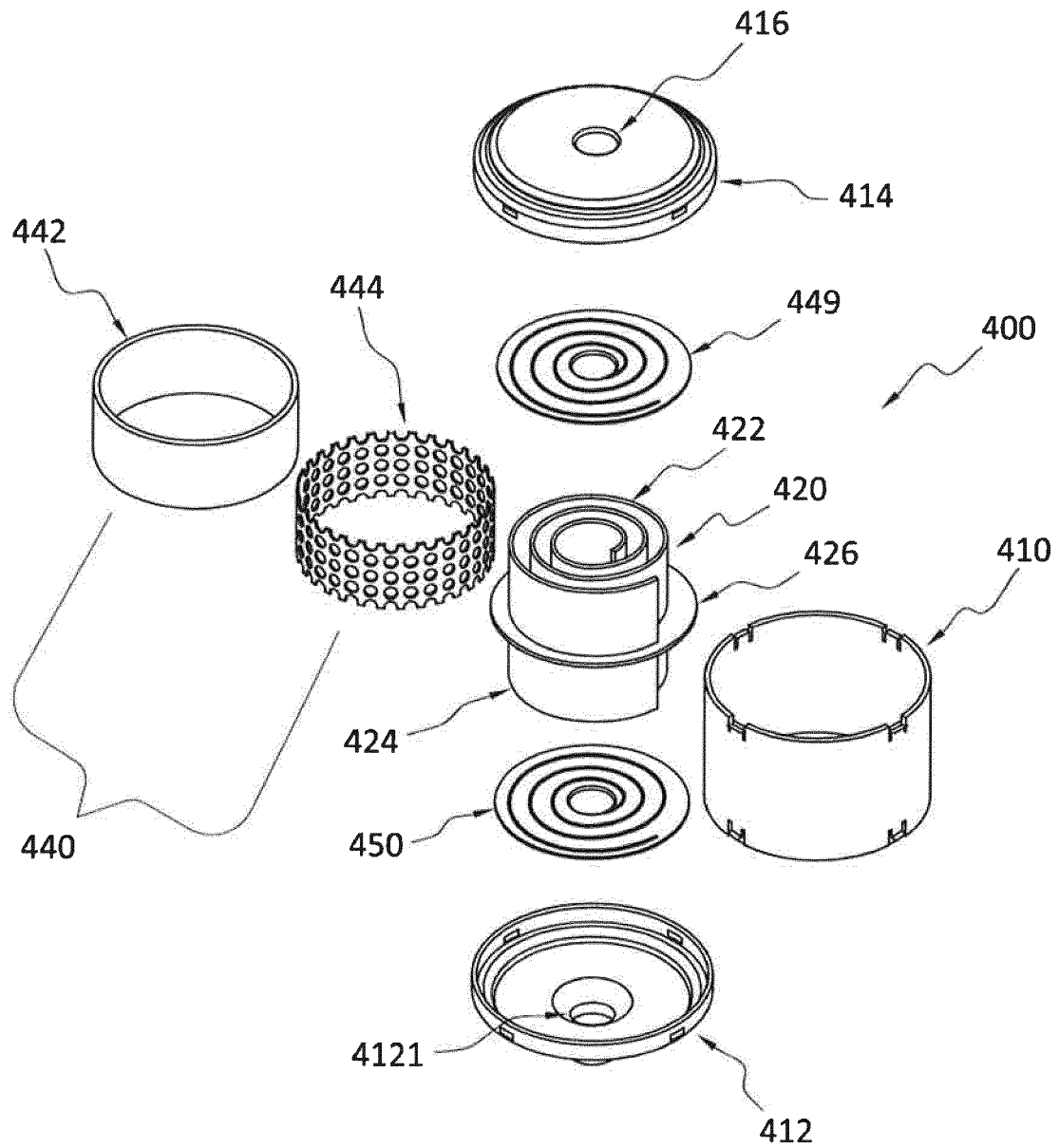


FIG. 4

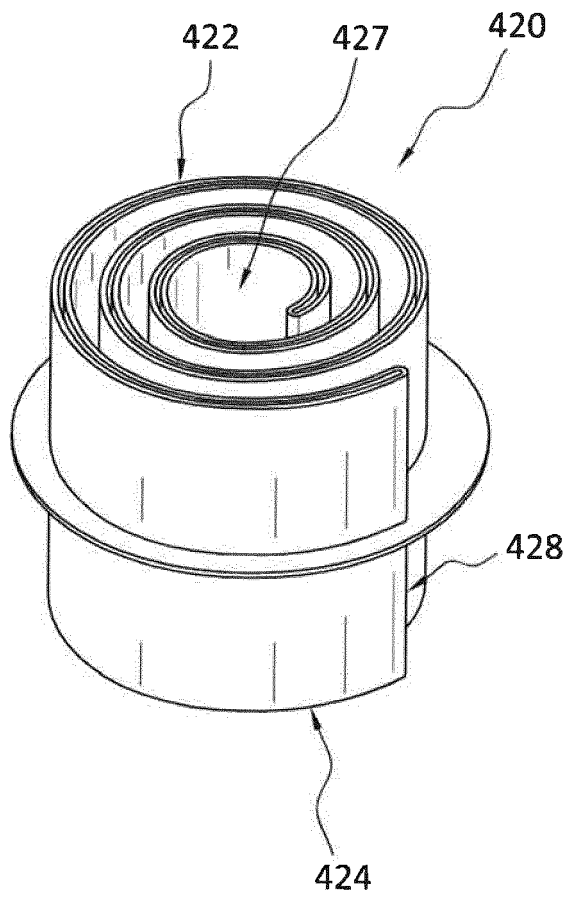


FIG. 5A

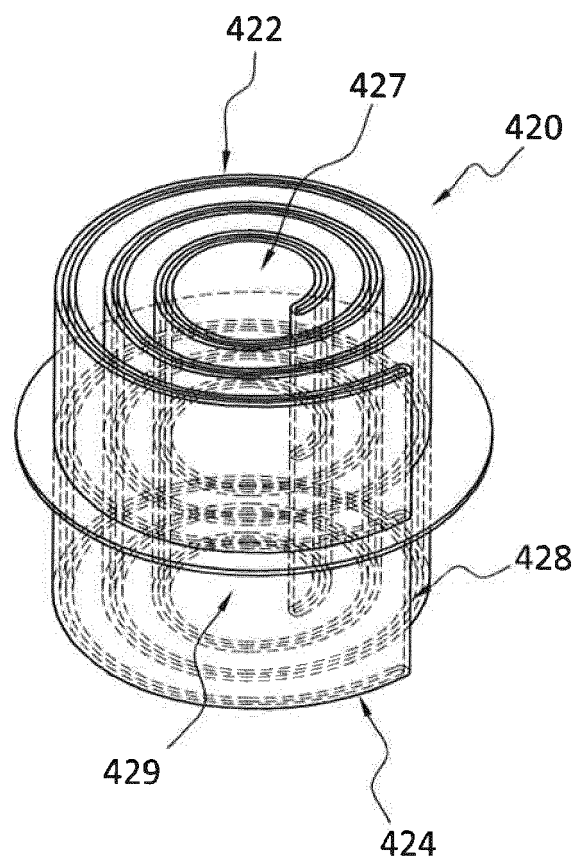


FIG. 5B

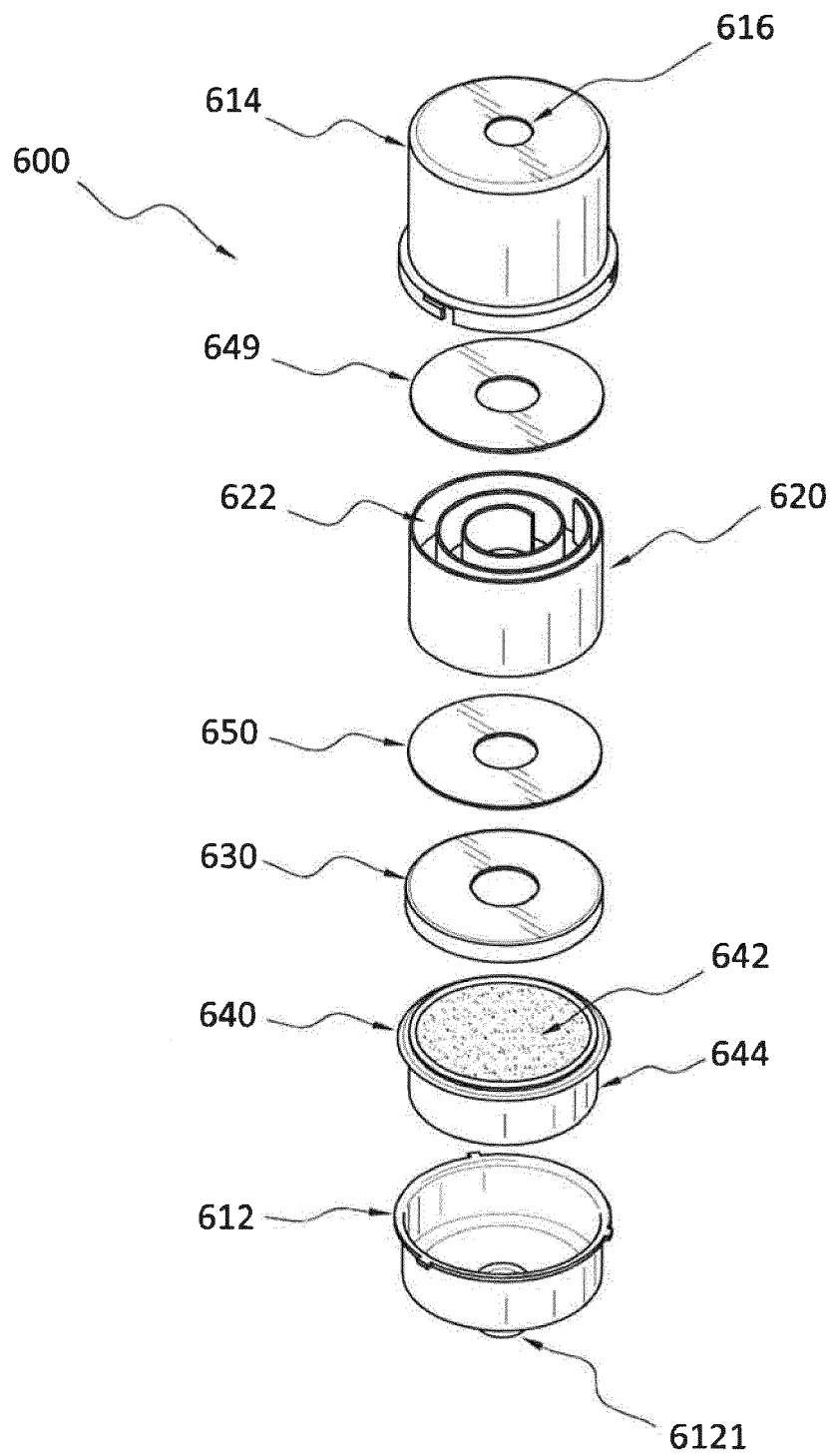


FIG. 6A

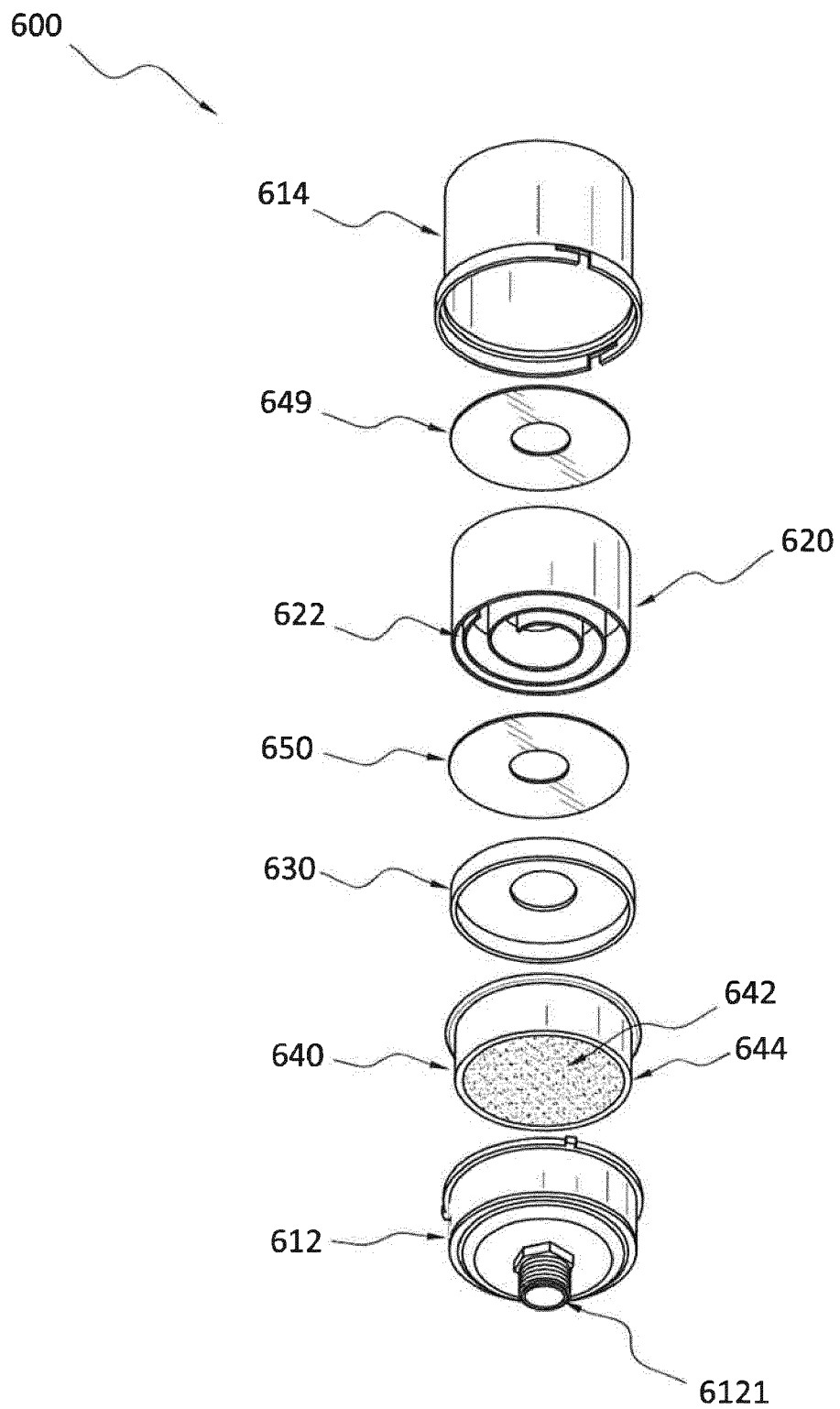
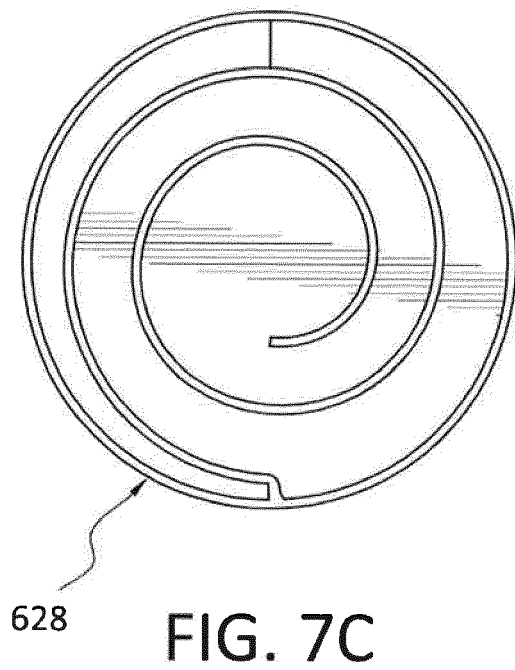
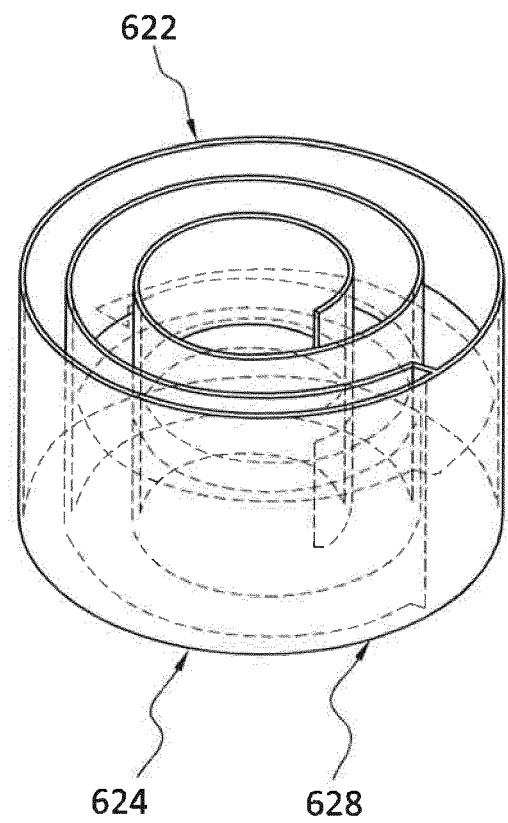
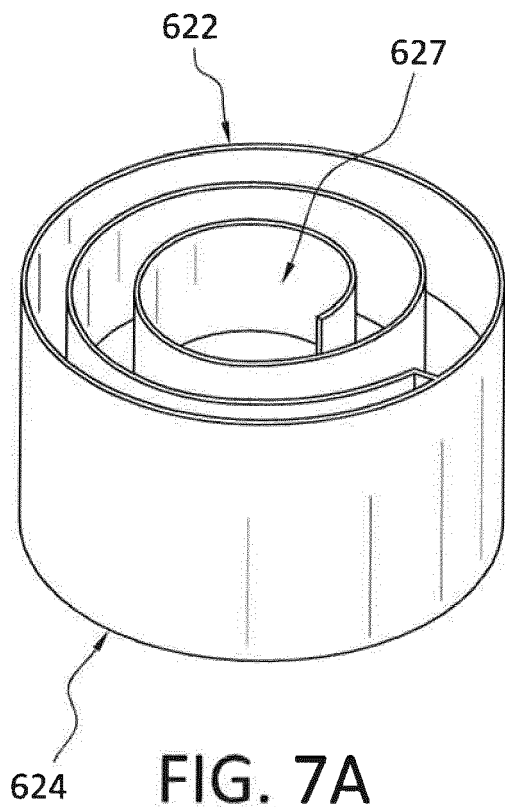


FIG. 6B



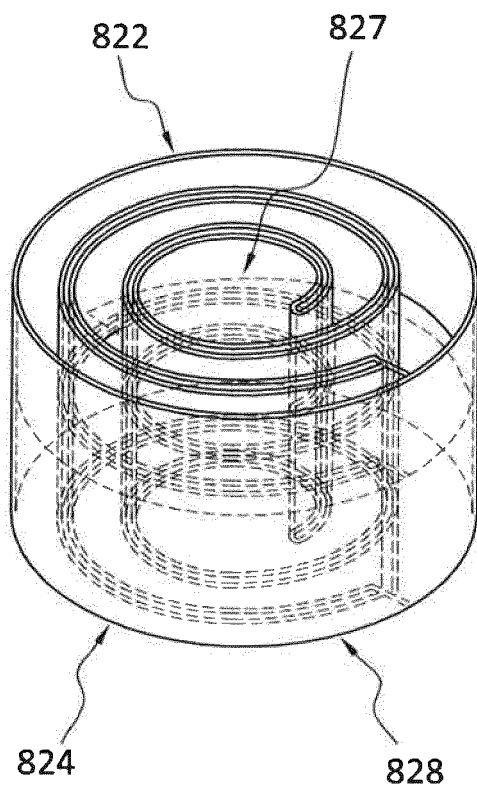


FIG. 8A

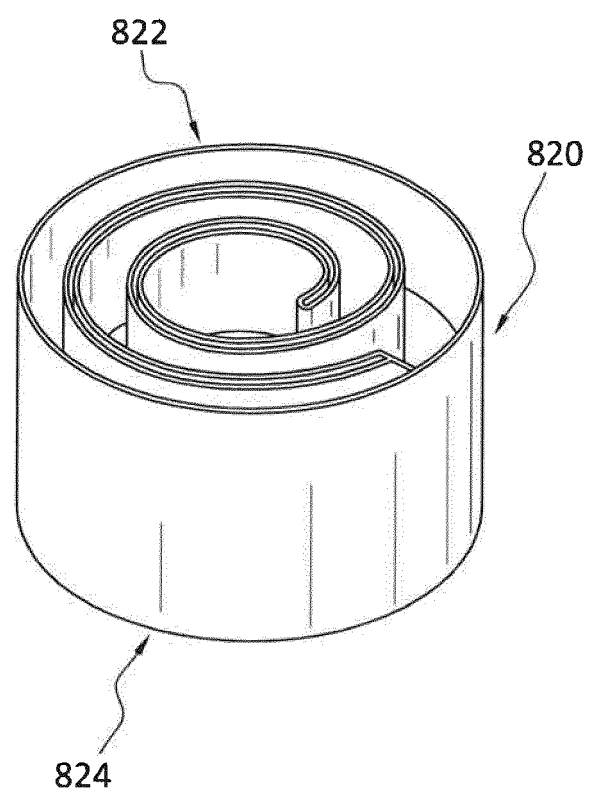


FIG. 8B

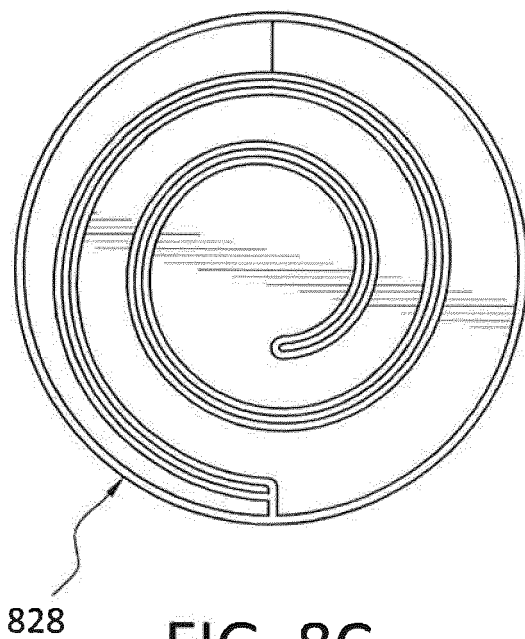


FIG. 8C

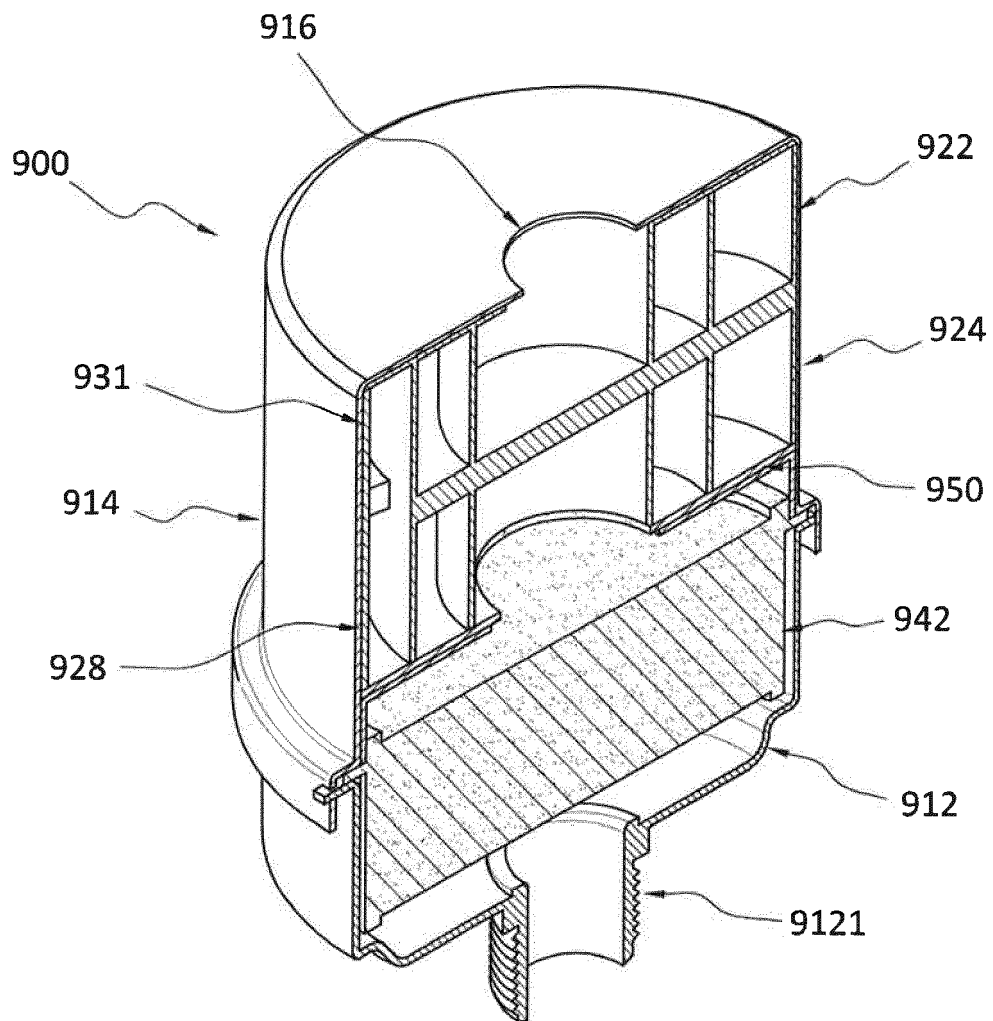


FIG. 9A

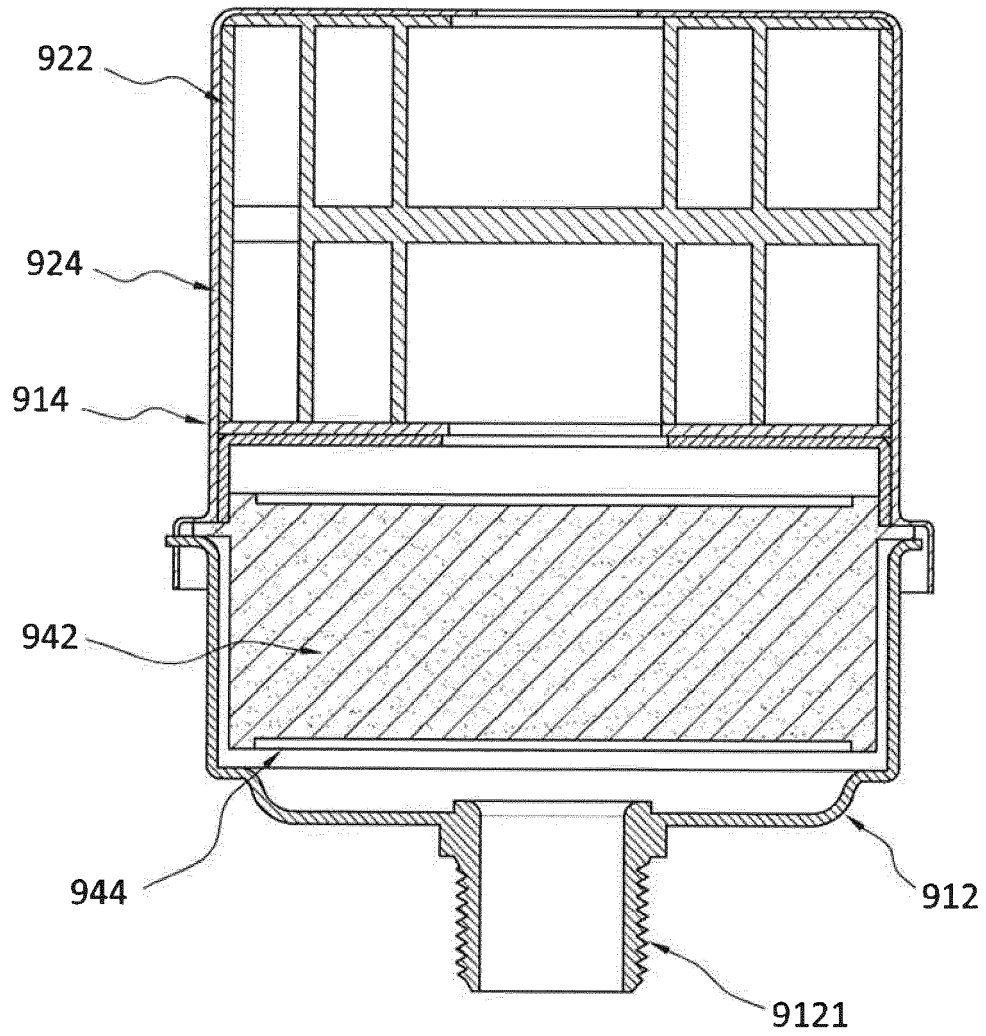


FIG. 9B



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