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(54) **FILTER ASSEMBLY WITH FLOATING SEAL INTERFACE**

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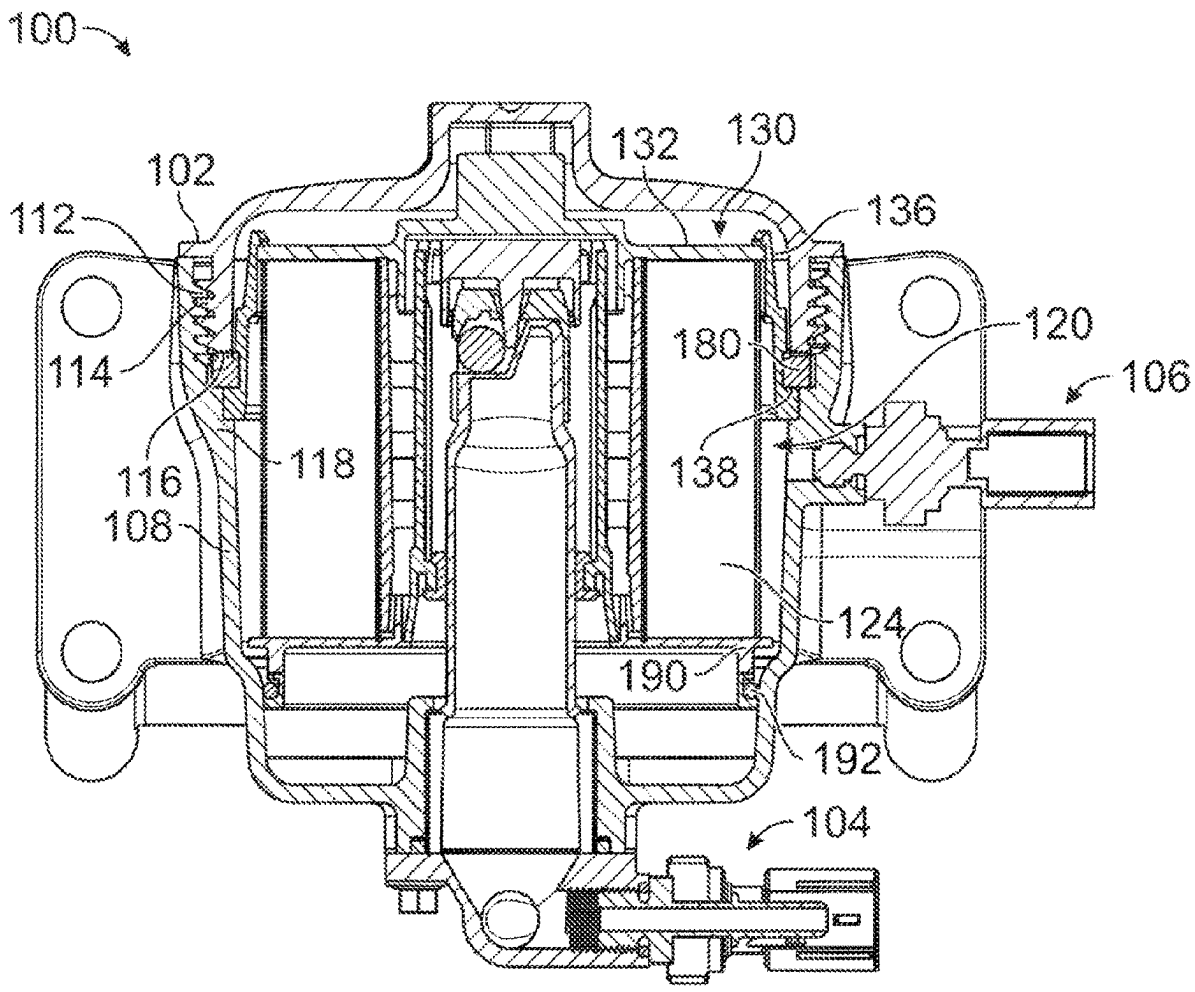
(57) **ABSTRACT**

A filtration system having a floating seal interface is provided. The filtration system includes a filter housing having a shell and a filter head. The filtration system also includes a filter element positioned within the filter housing. The filter element includes a filter media and a first endplate positioned at a filter media first end. The first endplate includes a first endplate first portion and a first endplate second portion. The first engagement structure couples the first endplate second portion to the first endplate first portion such that the first endplate first portion is movable relative to the first endplate second portion while remaining coupled to the first endplate second portion.



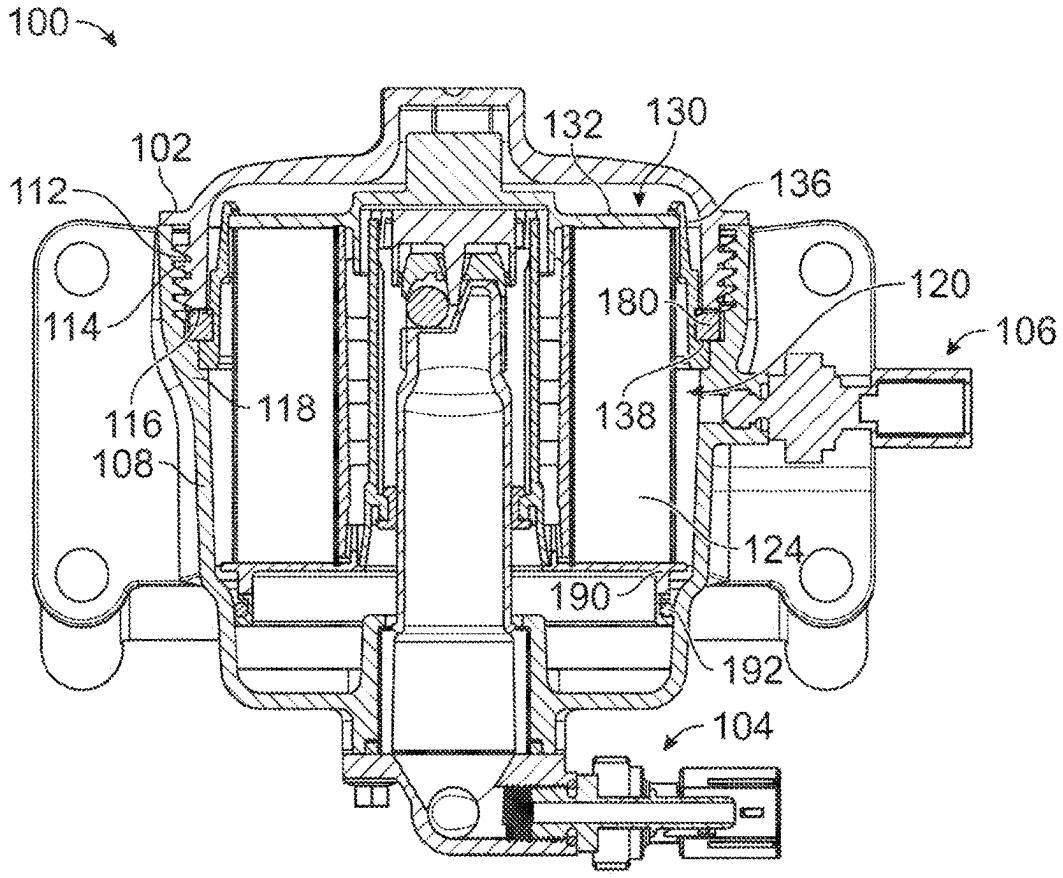

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FIG. 1

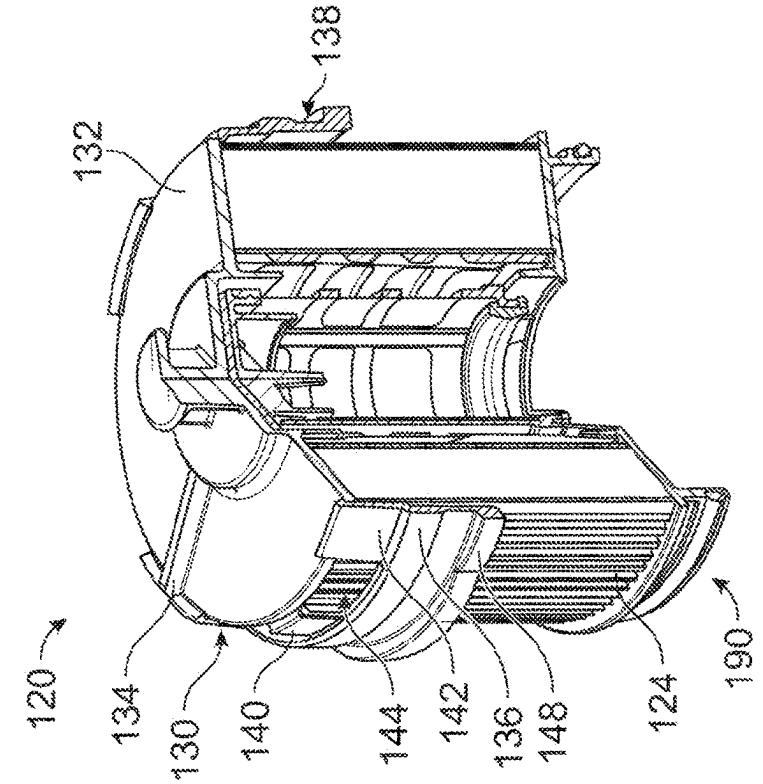
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FIG. 2B

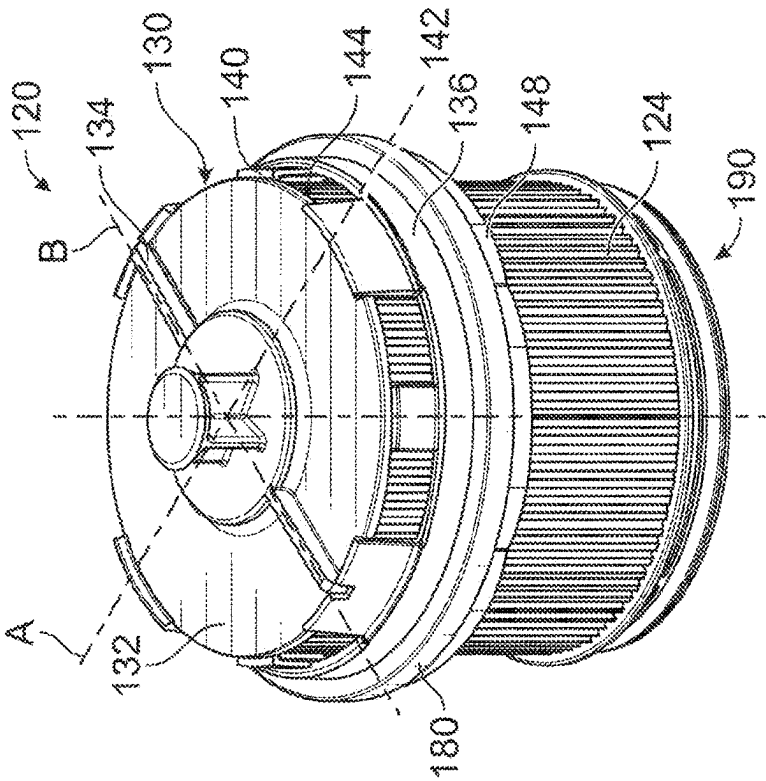
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FIG. 2A

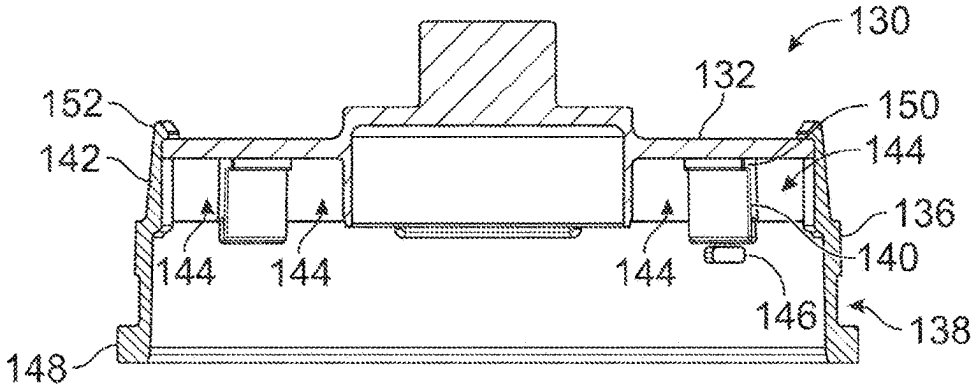
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FIG. 3A

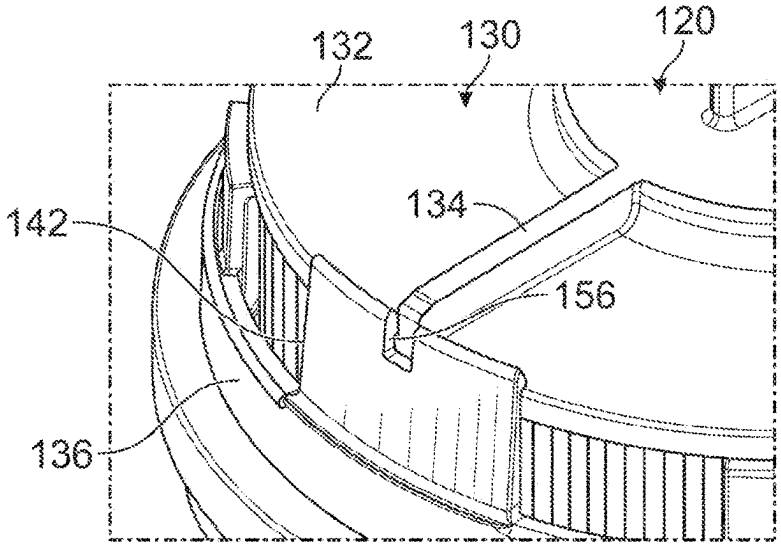
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FIG. 3B

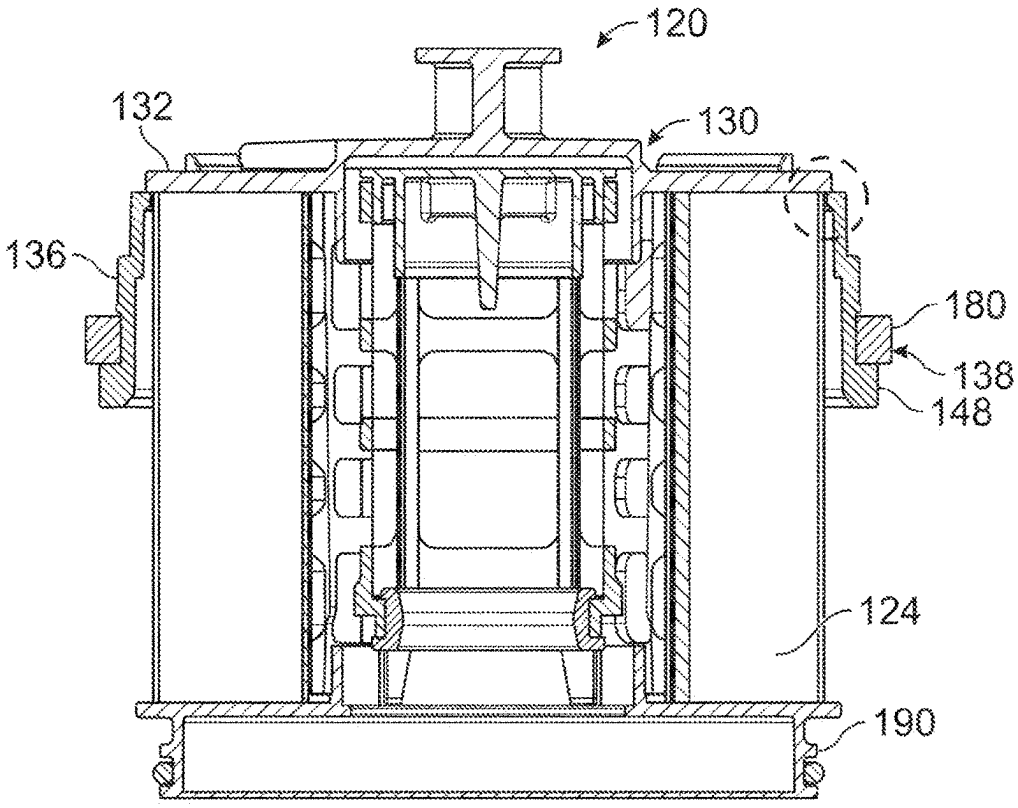


FIG. 4A

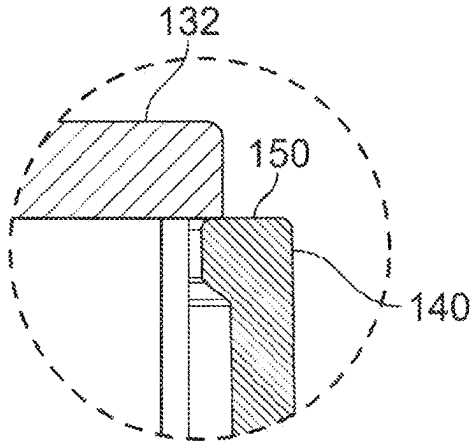


FIG. 4B

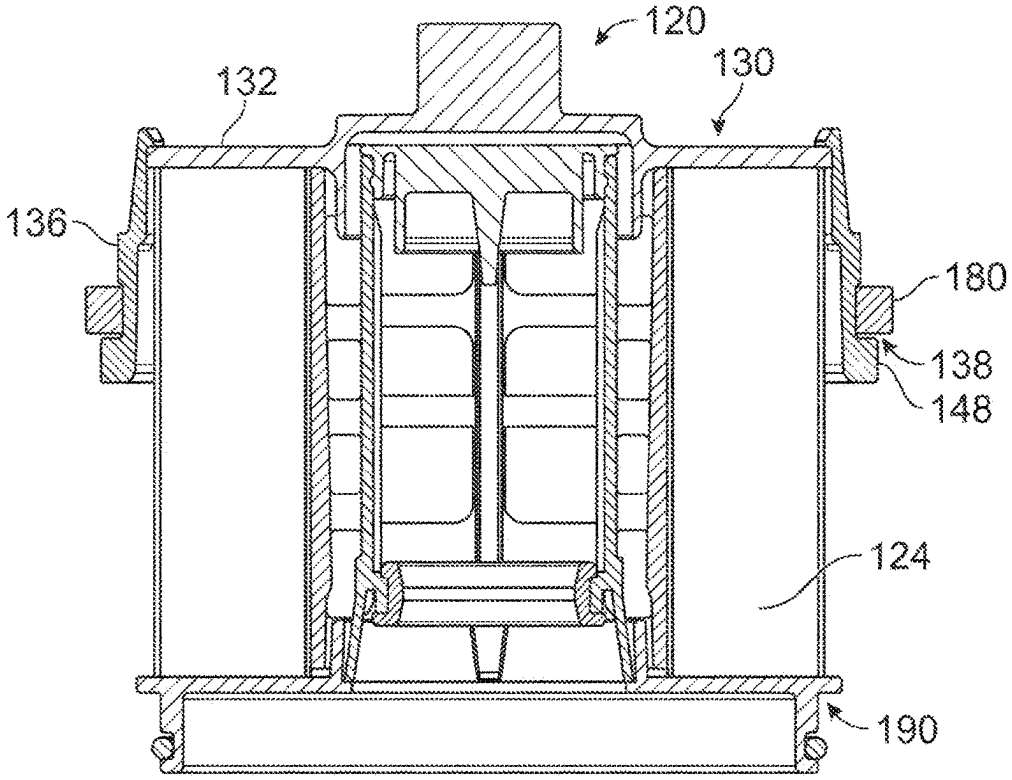


FIG. 5A

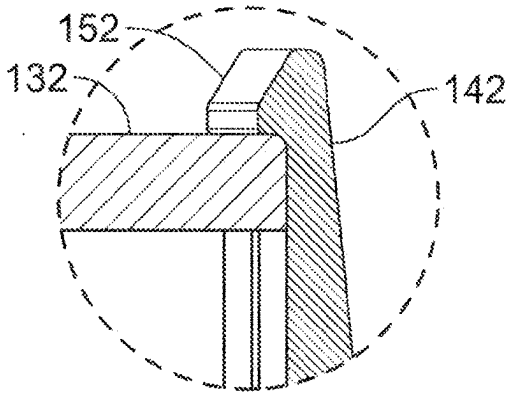


FIG. 5B

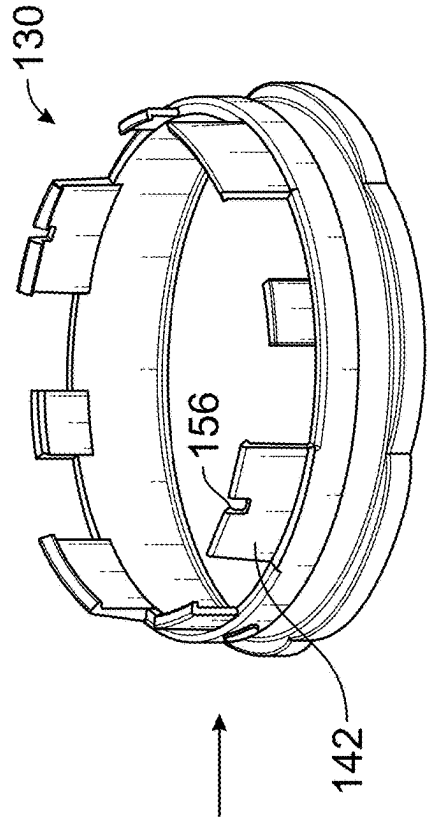


FIG. 6C

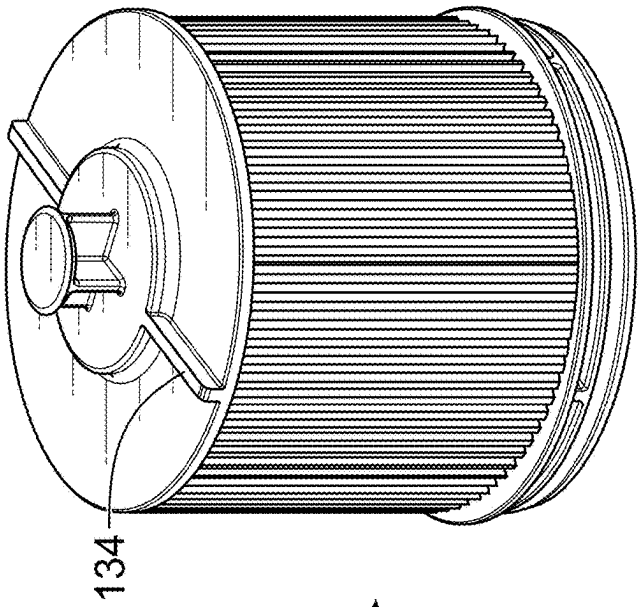


FIG. 6B

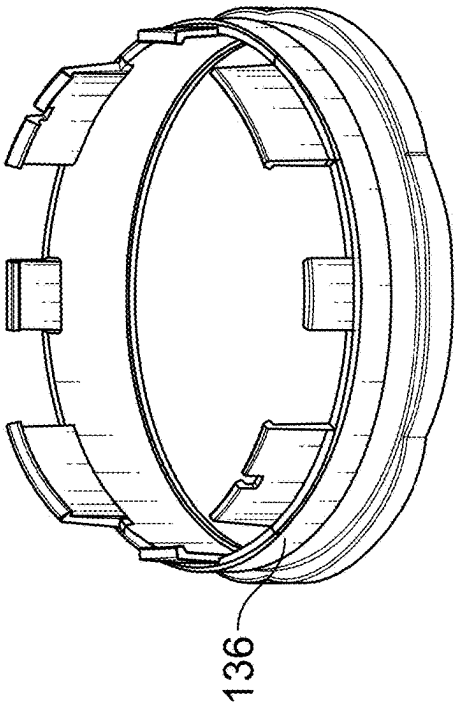
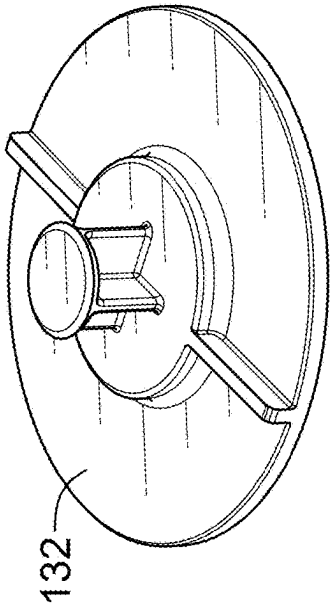


FIG. 6A



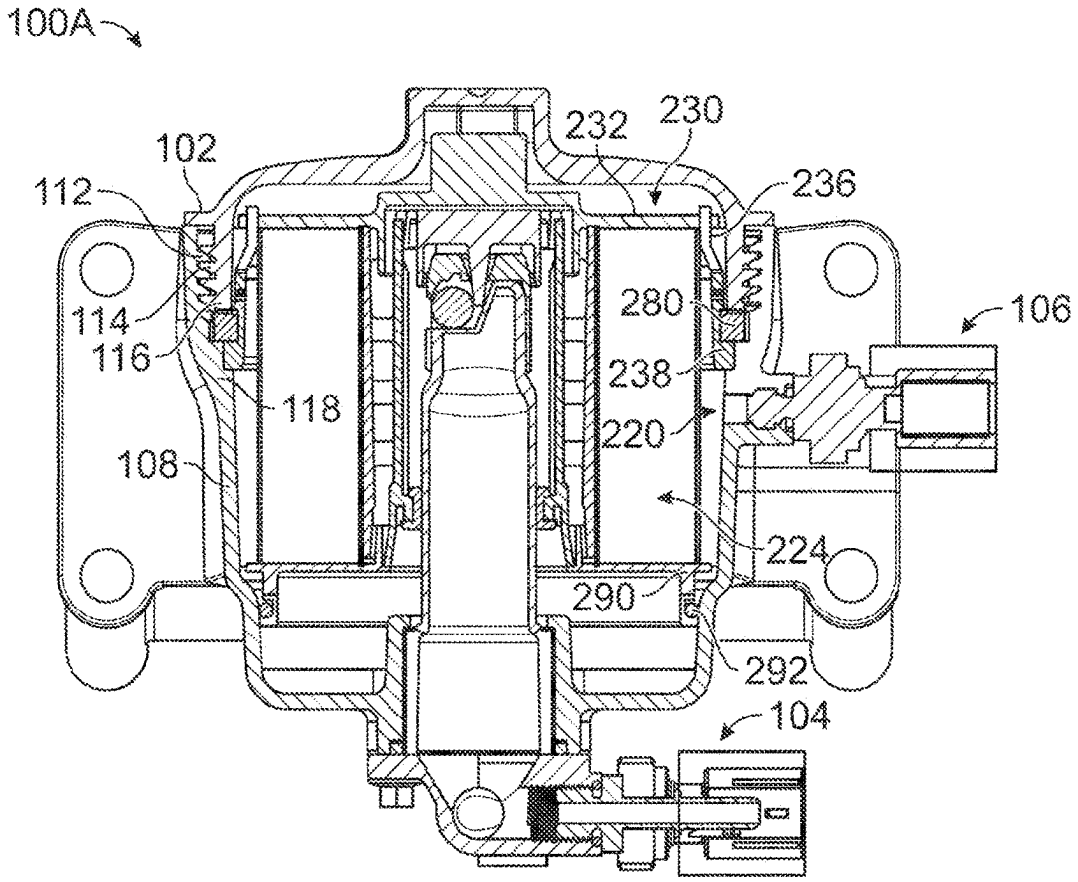

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FIG. 7

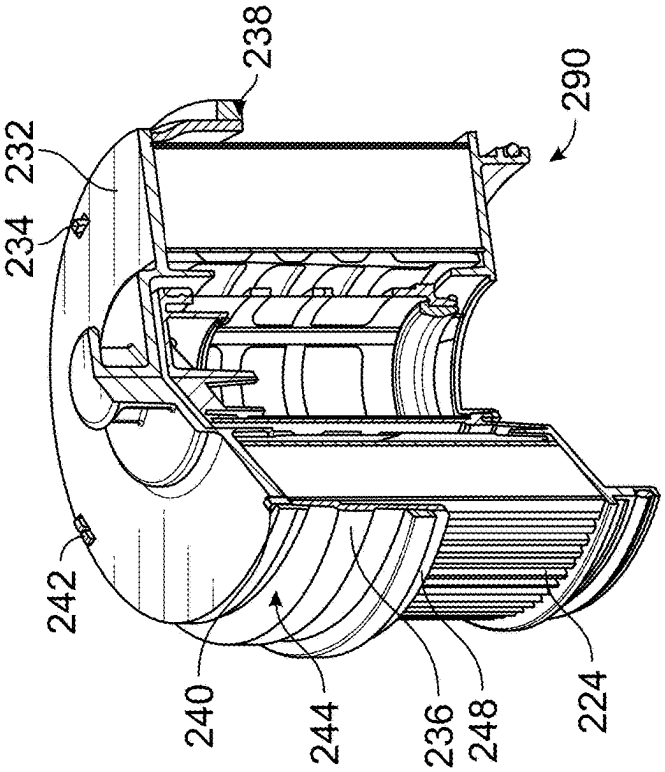

FIG. 8B

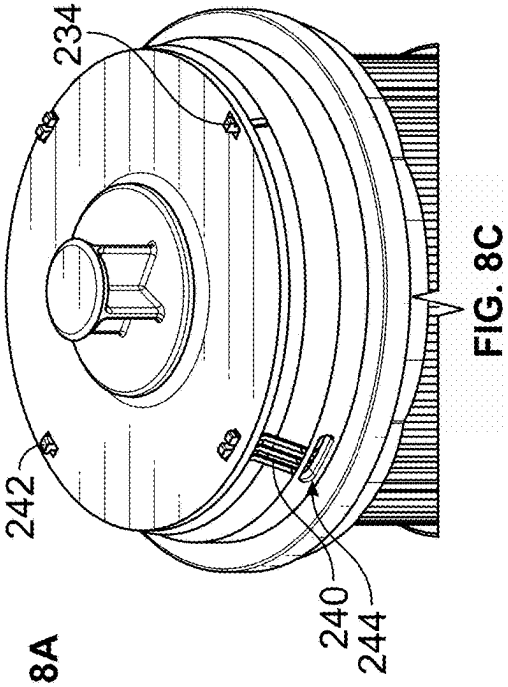

FIG. 8C

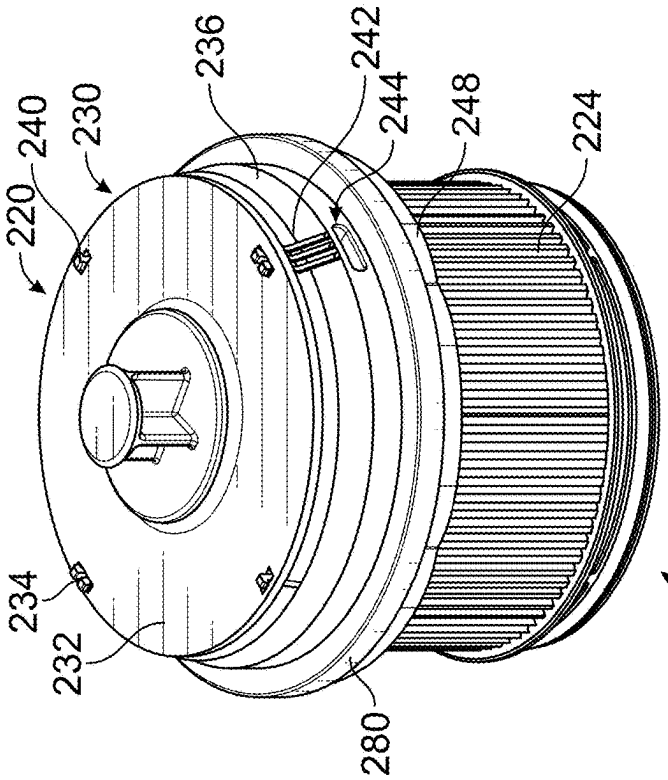

FIG. 8A

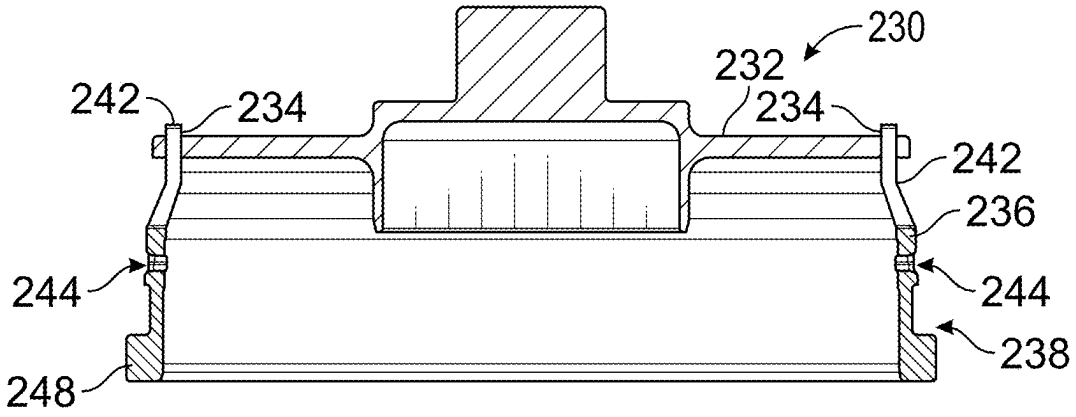
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FIG. 9A

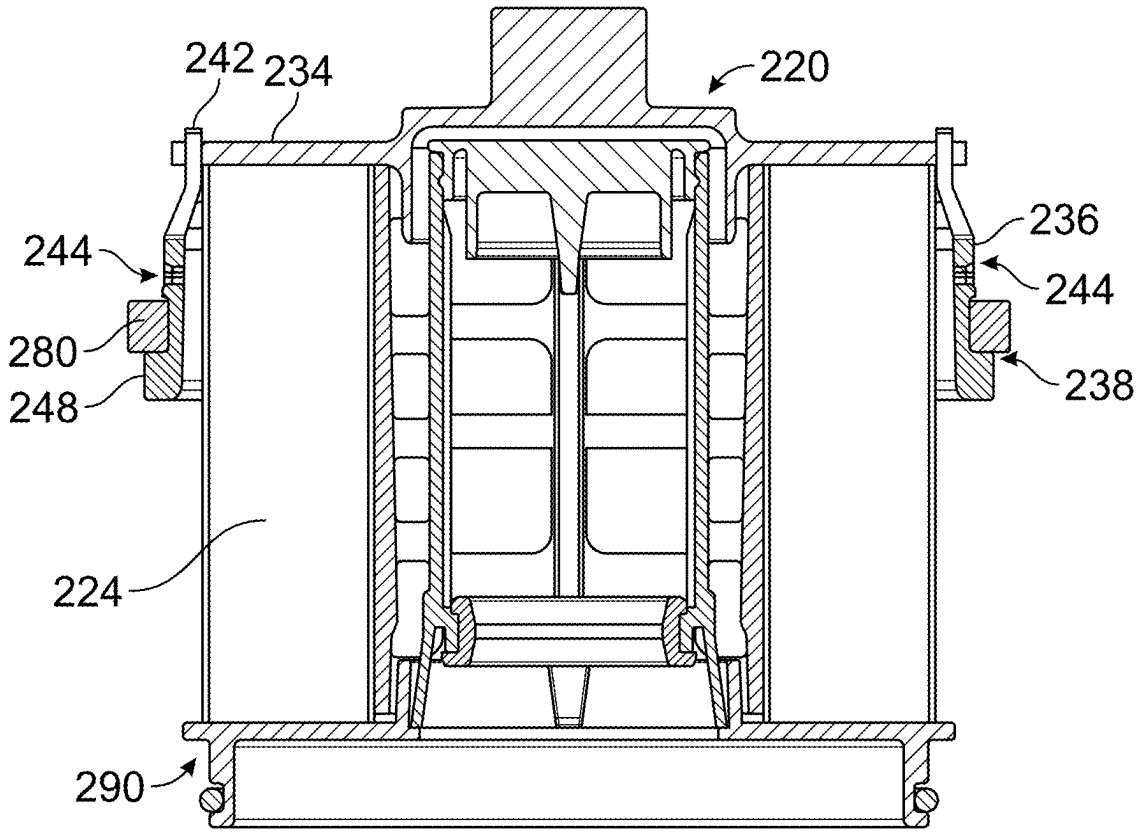
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FIG. 9B

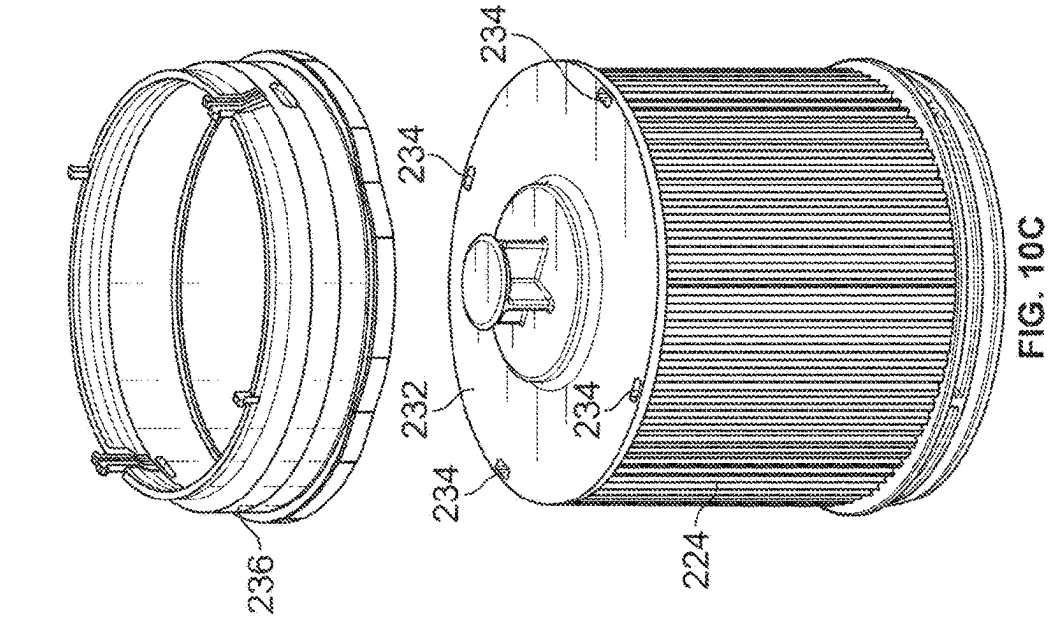

FIG. 10C

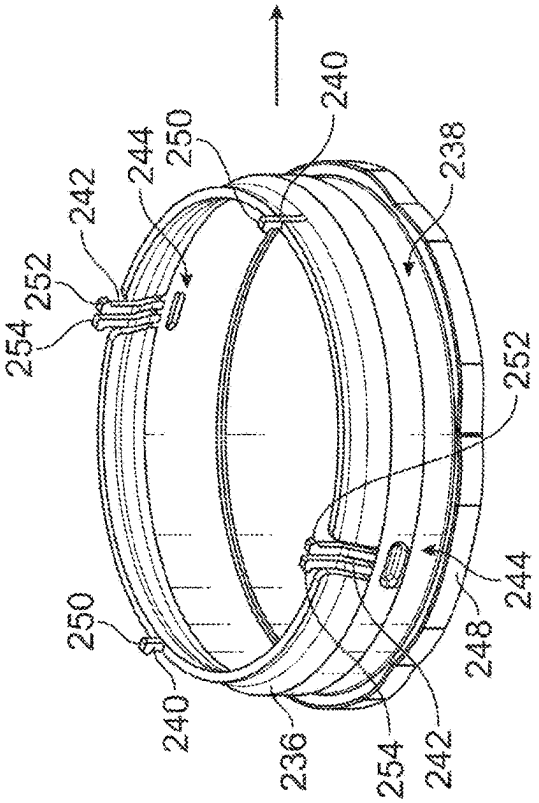

FIG. 10B

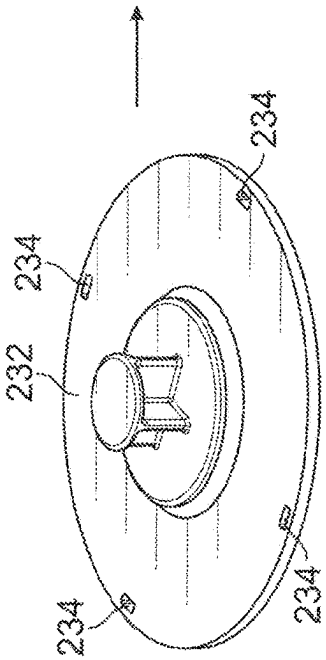

FIG. 10A

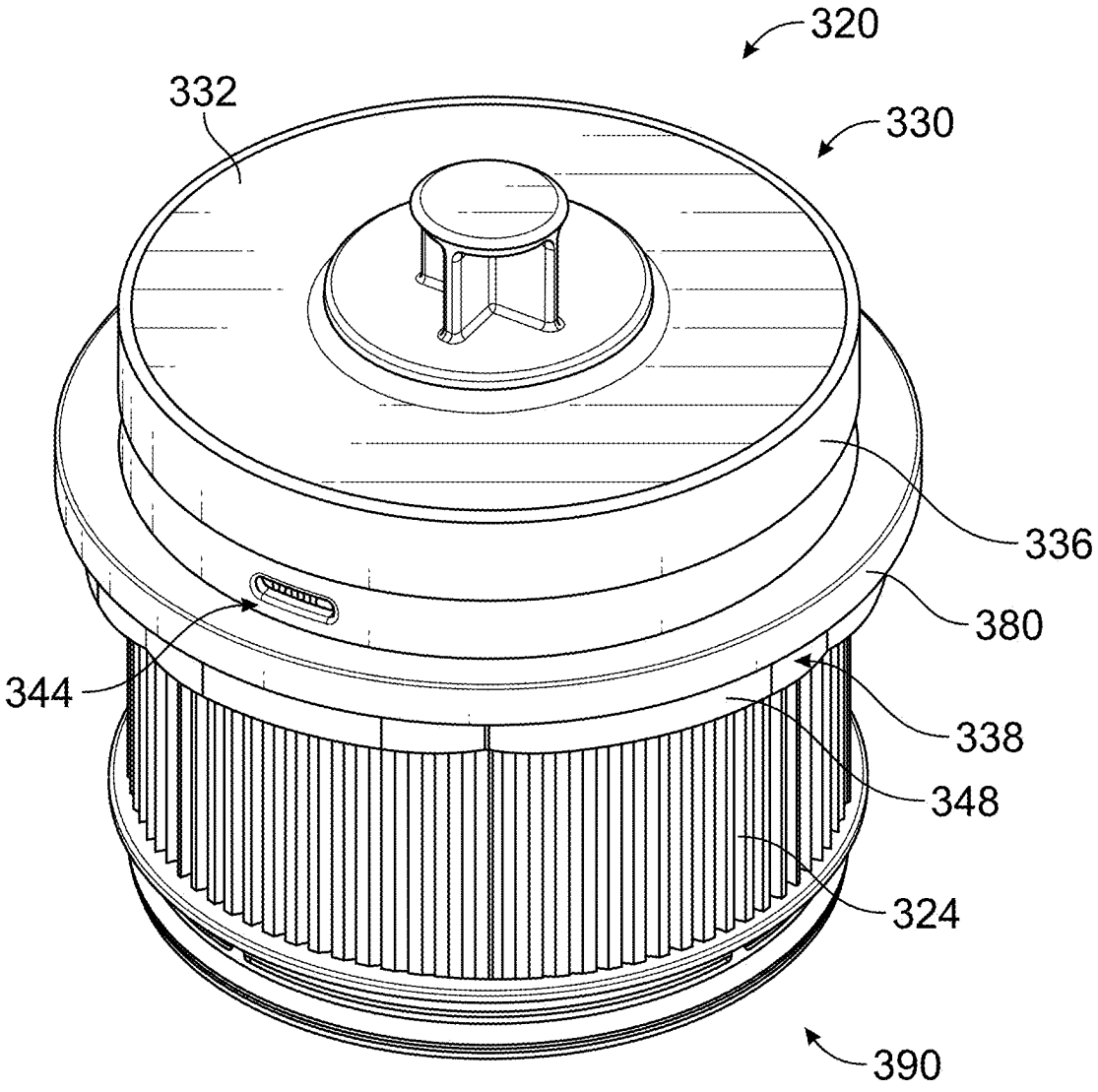

FIG. 11A

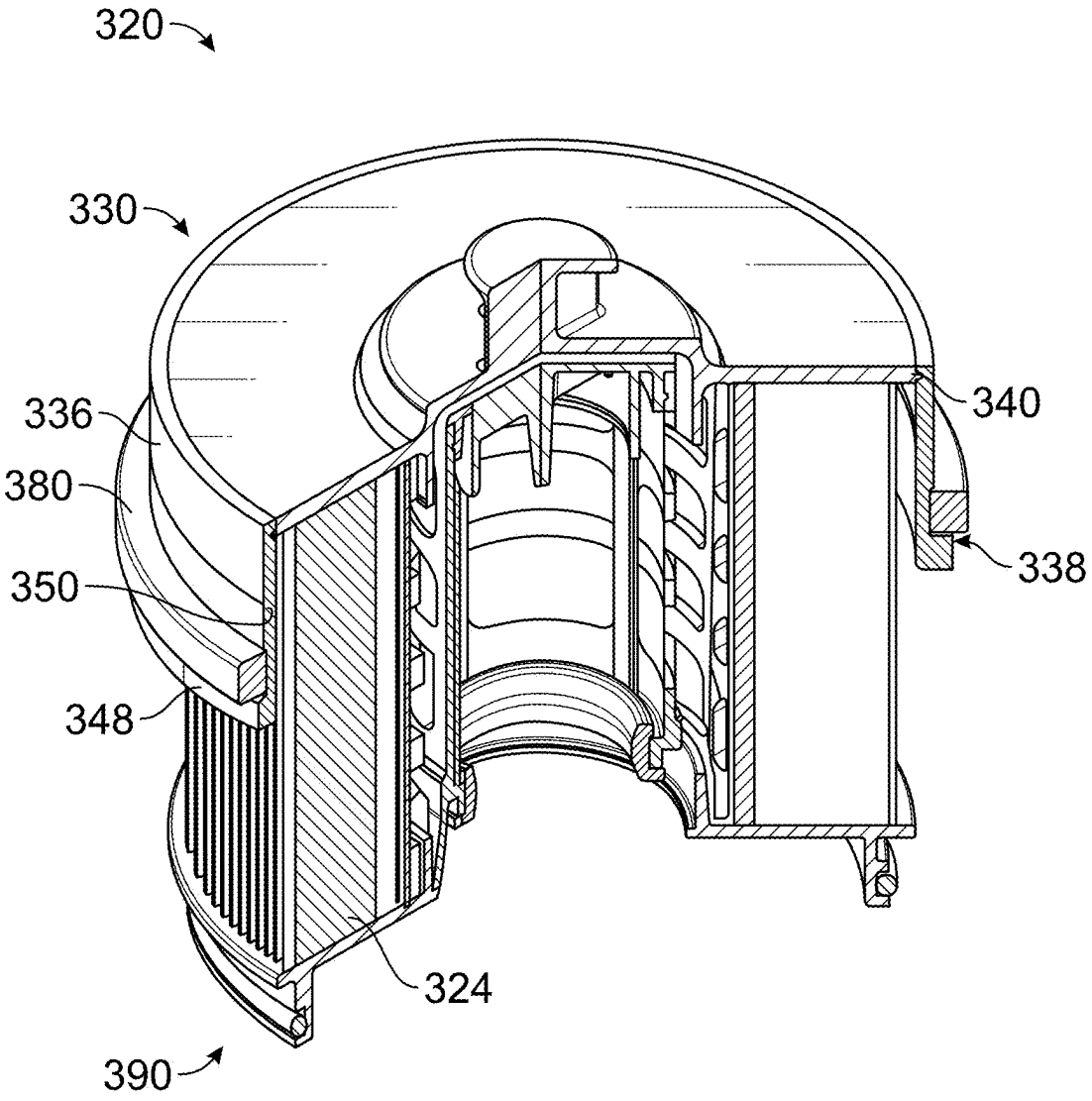

FIG. 11B

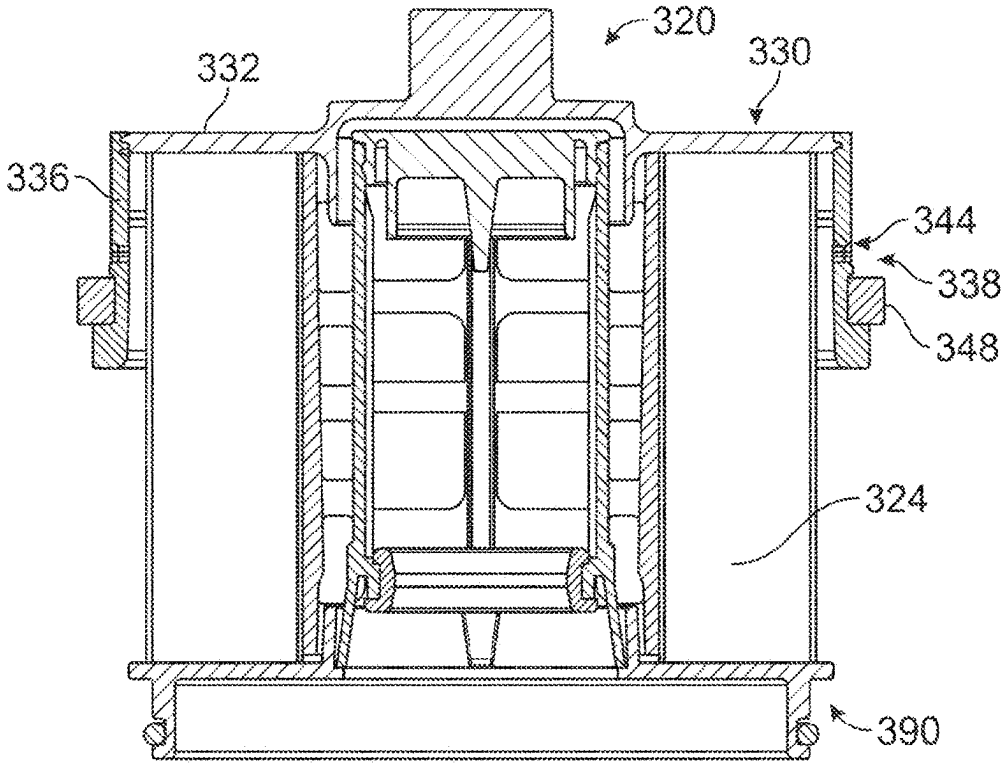

FIG. 12A

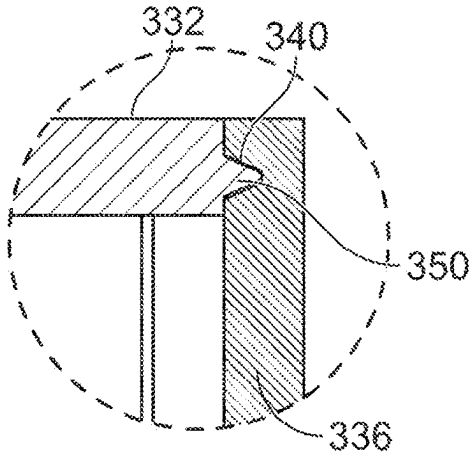

FIG. 12B

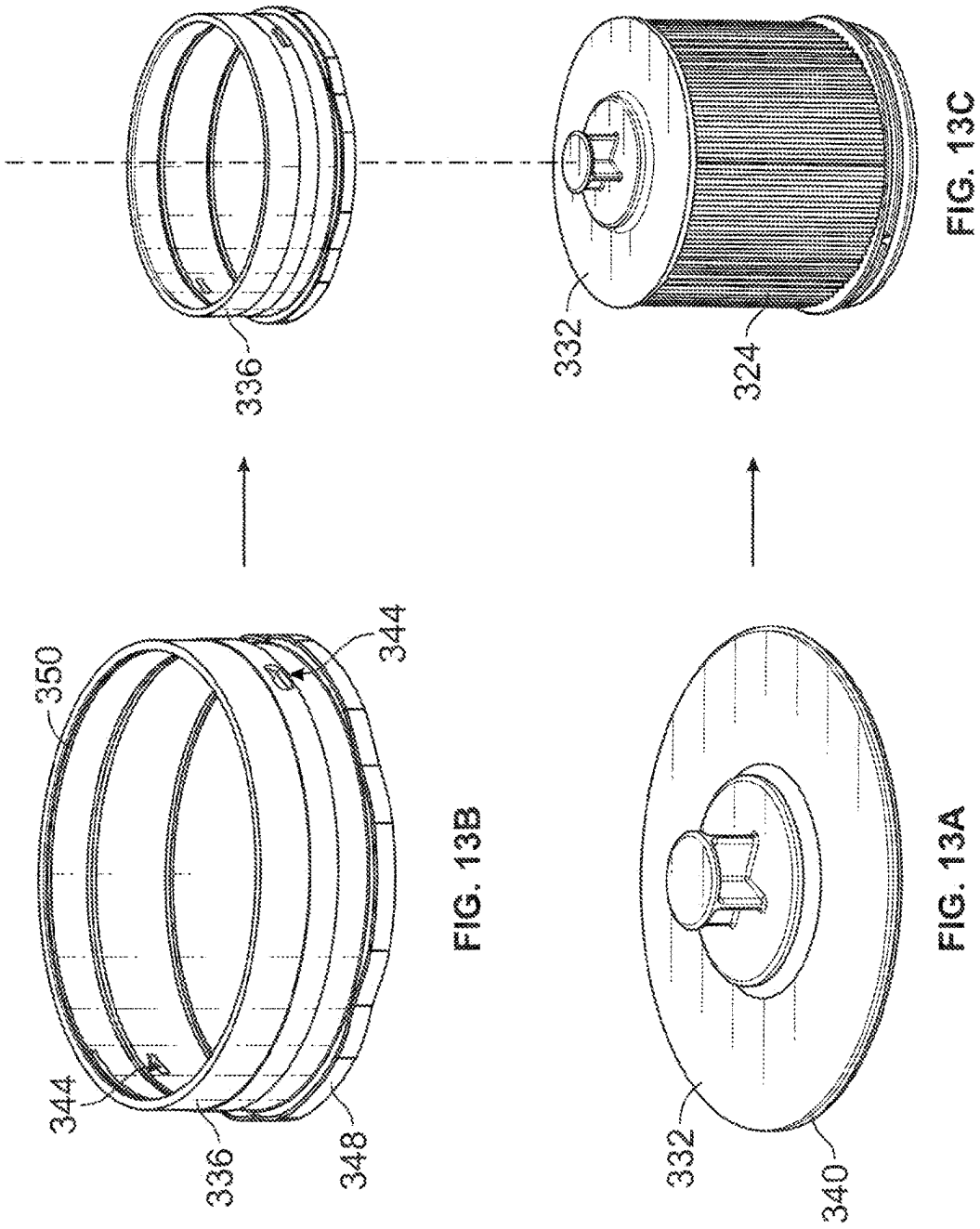

FIG. 13C

FIG. 13B

FIG. 13A

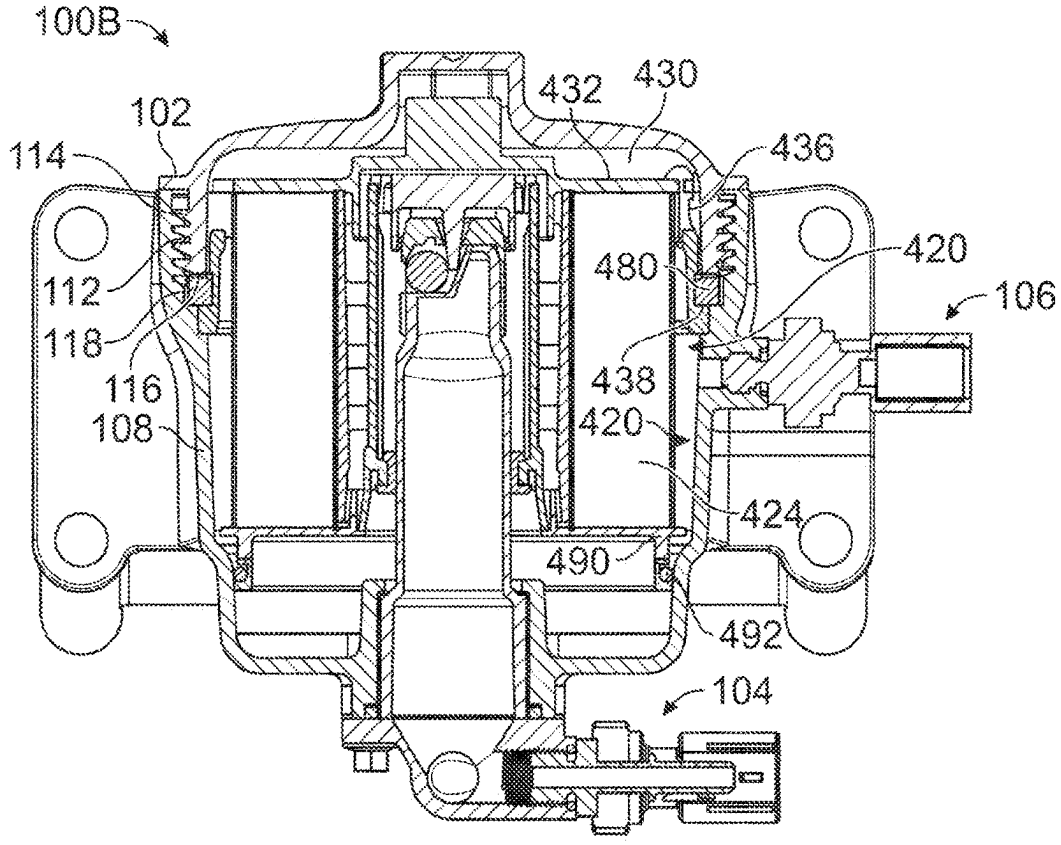
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FIG. 14

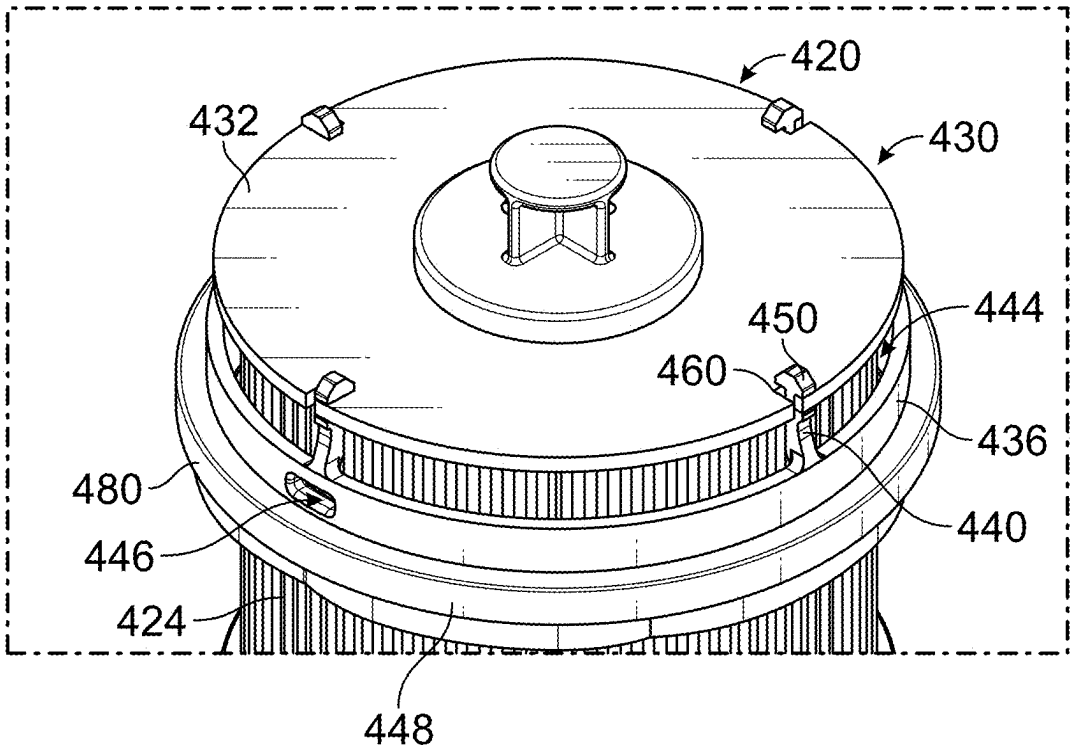

FIG. 15A

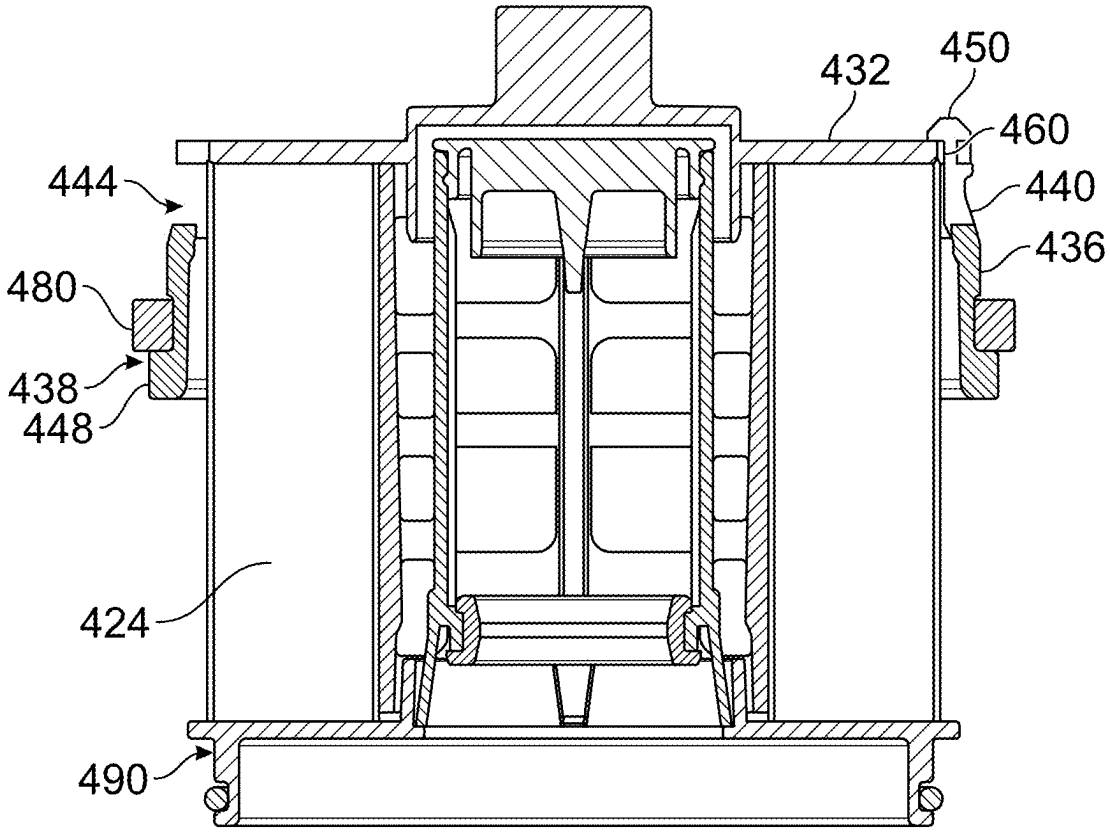

FIG. 15B

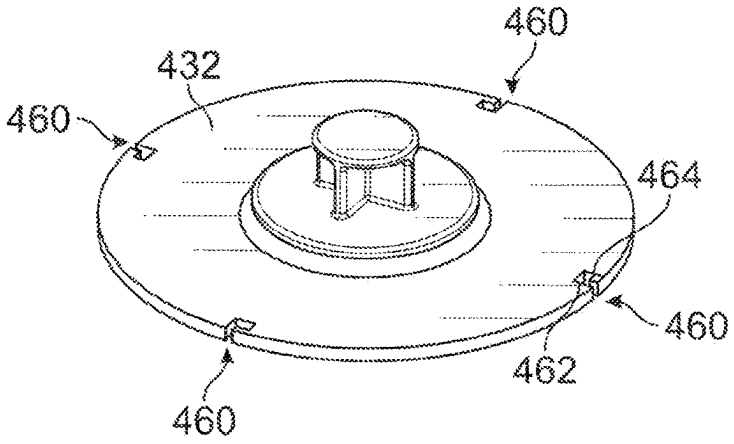

FIG. 16A

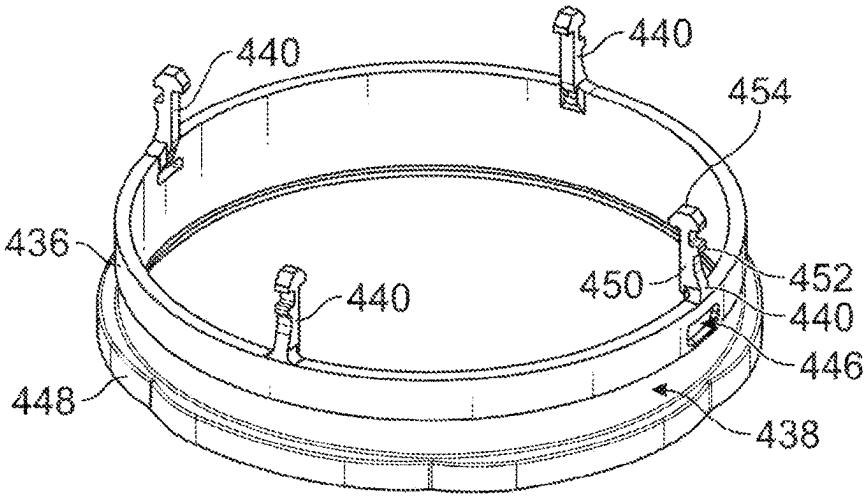

FIG. 16B

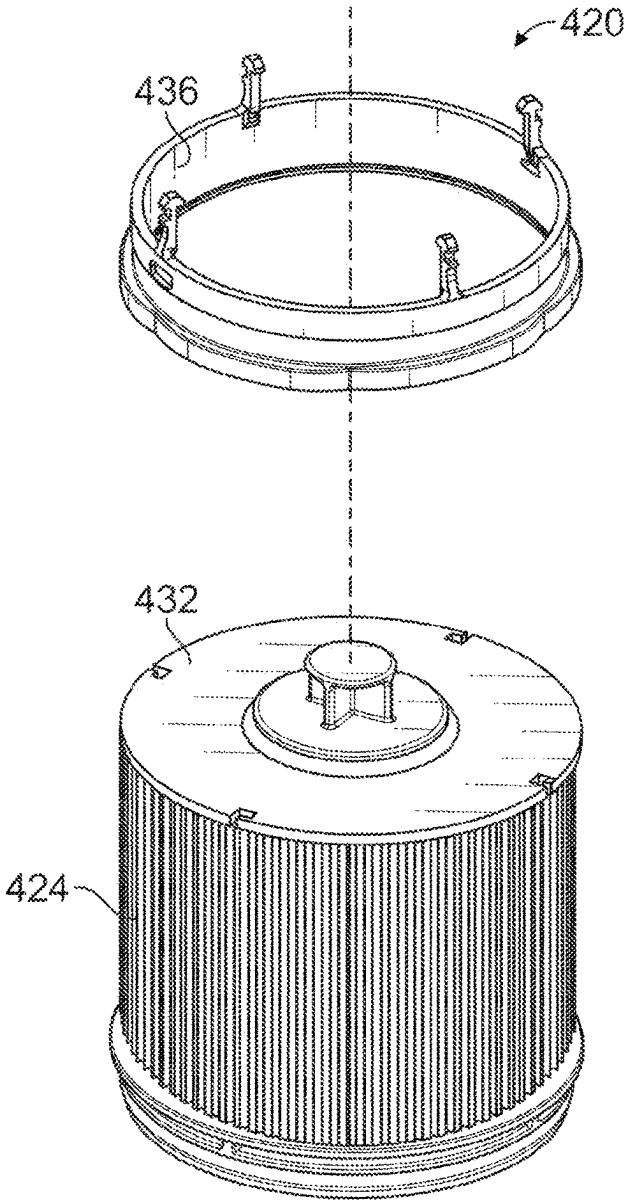

FIG. 16C

FILTER ASSEMBLY WITH FLOATING SEAL INTERFACE

CROSS-REFERENCE TO RELATED CASES

[0001] This application is a National Phase Application based on PCT Application No. PCT/US2023/018118, filed Apr. 11, 2023, which claims the benefit of Indian Patent Application number 202241023156, filed on Apr. 20, 2022, entitled FILTER ASSEMBLY WITH FLOATING SEAL INTERFACE. The contents of these applications are incorporated herein by reference in their entirety.

TECHNICAL FIELD

[0002] The present invention generally relates to the field of filtration systems.

BACKGROUND

[0003] Internal combustion engines generally combust a mixture of fuel (e.g., gasoline, diesel, natural gas, etc.) and air. Lubrication oil is also supplied to the engine to lubricate the various moving components of the engine. Either prior to entering the engine or during engine operation, the intake air, fuel, lubrication oil, and/or other fluids are typically passed through filtration systems to remove contaminants (e.g., dust, water, oil, etc.) from the fluids. The filtration systems include filter elements having filter media. As the fluid passes through the filter media, the filter media removes at least a portion of the contaminants in the fluid. One or more sealing members (e.g., gaskets, O-rings, etc.) may be used to separate the filtered fluid from the un-filtered fluid.

SUMMARY

[0004] An example embodiment relates to a filtration system. The filtration system includes a filter housing having a shell and a filter head. The filtration system also includes a filter element positioned within the filter housing. The filter element includes a filter media and a first endplate positioned at a filter media first end. The first endplate includes a first endplate first portion and a first endplate second portion. The first endplate second portion includes a first engagement structure that couples the first endplate second portion to the first endplate first portion such that the first endplate first portion is movable relative to the first endplate second portion while remaining coupled to the first endplate second portion.

[0005] Another example embodiment relates to a filter element. The filter element includes a filter media and a first endplate positioned at a filter media first end. The first endplate includes a first endplate first portion and a first endplate second portion. The first endplate second portion includes a first engagement structure that couples the first endplate second portion to the first endplate first portion such that the first endplate first portion is moveable relative to the first endplate second portion while remaining coupled to the first endplate second portion.

[0006] Still another example embodiment relates to an endplate for a filter element. The endplate comprises an endplate first portion comprising a rib that extends radially from a center of the endplate first portion to an edge of the endplate first portion. The endplate further comprises an endplate second portion. The endplate second portion comprises a first wall extending away from a top surface of the endplate second portion and towards a bottom surface of the endplate first portion, and a second wall extending away from the top surface of the endplate second portion and above the endplate first portion. The second wall has a groove that is sized to receive a portion of the rib such that the endplate first portion is coupled to the endplate second portion and the endplate first portion is movable relative to the endplate second portion while remaining coupled to the endplate second portion.

[0007] These and other features, together with the organization and manner of operation thereof, will become apparent from the following detailed description when taken in conjunction with the accompanying drawings, wherein like elements have like numerals throughout the several drawings described below.

BRIEF DESCRIPTION OF THE FIGURES

[0008] FIG. **1** is a sectional view of a filtration system, according to an example embodiment.

[0009] FIG. **2**A is a perspective view of a filter element for use in the filtration system of FIG. **1**, according to an example embodiment.

[0010] FIG. **2**B is a cutaway perspective view of the filter element of FIG. **2**A.

[0011] FIG. **3**A is a sectional view of a first endplate for use with the filter element of FIG. **2**A.

[0012] FIG. **3**B is a detailed perspective view of the filter element of FIG. **2**A showing the first endplate.

[0013] FIG. **4**A is a first sectional view of the filter element of FIG. **2**A.

[0014] FIG. **4**B is a first detailed sectional view of the filter element of FIG. **2**A showing a first engagement feature.

[0015] FIG. **5**A is a second sectional view of the filter element of FIG. **2**A.

[0016] FIG. **5**B is a second detailed sectional view of the filter element of FIG. **2**A showing a first engagement feature.

[0017] FIG. **6**A is a perspective view of a first portion of the first endplate of FIG. **3**A.

[0018] FIG. **6**B is a perspective view of a second portion of the first endplate of FIG. **3**A.

[0019] FIG. **6**C is a perspective view of the filter element of FIG. **2**A shown in a disassembled state.

[0020] FIG. **7** is a sectional view of a filtration system, according to another example embodiment.

[0021] FIG. **8**A is a perspective view of a filter element for use with the filtration system of FIG. **7**, according to an example embodiment.

[0022] FIG. **8**B is a cutaway perspective view of the filter element of FIG. **8**A.

[0023] FIG. **8**C is a detailed perspective view of the filter element of FIG. **8**A, showing a first endplate.

[0024] FIG. **9**A is a sectional view of a first endplate for use with the filter element of FIG. **7**.

[0025] FIG. **9**B is a sectional view of the filter element of FIG. **8**A.

[0026] FIG. **10**A is a perspective view of a first portion of the first endplate of FIG. **9**A.

[0027] FIG. **10**B is a perspective view of a second portion of the first endplate of FIG. **9**A.

[0028] FIG. **10**C is a perspective view of the filter element of FIG. **8**A shown in a disassembled state.

[0029] FIG. **11**A is a perspective view of a filter element, according to still another example embodiment.

[0030] FIG. **11**B is a cutaway perspective view of the filter element of FIG. **11**A.

[0031] FIG. **12**A is a sectional view of the filter element of FIG. **11**A.

[0032] FIG. **12**B is a detailed sectional view of the filter element of FIG. **11**A showing a first engagement feature.

[0033] FIG. **13**A is a perspective view of a first portion of a first endplate for use with the filter element of FIG. **11**A.

[0034] FIG. **13**B is a perspective view of a second portion of the first endplate for use with the filter element of FIG. **11**A.

[0035] FIG. **13**C is a perspective view of the filter element of FIG. **11**A shown in a disassembled state.

[0036] FIG. **14** is a sectional view of a filtration system, according to yet another example embodiment.

[0037] FIG. **15**A is a detailed perspective view of a filter element for use with the filtration system of FIG. **14**, according to an example embodiment.

[0038] FIG. **15**B is a sectional view of the filter element of FIG. **15**A.

[0039] FIG. **16**A is a perspective view of a first portion of a first endplate for use with the filter element of FIG. **15**A.

[0040] FIG. **16**B is a perspective view of a second portion of the first endplate for use with the filter element of FIG. **15**A.

[0041] FIG. **16**C is a perspective view of the filter element of FIG. **15**A shown in a disassembled state.

DETAILED DESCRIPTION

[0042] Referring to the figures generally, a filtration system having a floating seal interface is described. In the filtration system, a sealing member forms a seal between filter housing components (e.g., a shell housing, a filter mounting head, etc.). A filter element is positioned within the filter housing components. The filter element includes an endplate that at least partially positions the sealing member within the filter housing components such that the seal is formed therebetween. The endplate of the filter element advantageously enables the seal member to be axially unaligned with the other components of the filter element, such that the seal member is axially aligned with the filter housing components, even if the filter element is not axially aligned with the filter housing components.

[0043] In some arrangements, the filter element includes an interlocking interface for positioning the filter element within the filter housing components. As will be appreciated, if a non-authorized filter element lacking the matching interlocking interface pattern is attempted to be installed in or on the filter housing component, the non-authorized filter element may not fit against the filter housing component. Accordingly, the interlocking interface prevents non-authorized filter elements from being installed in the filtration system. Additionally, the interlocking interface may prevent the filter element from freely rotating with respect to the filter housing component of the filtration system.

[0044] The embodiments shown and described in further detail herein below relate to an inside-out flow design for a filtration system. It should be understood that the embodiments described herein may be utilized in other filtration systems. For example, the embodiments described herein may be utilized in an outside-in flow design and/or any other type of filtration system. Additionally, the filtration system, including the filter element, may include more or fewer components than as shown in the Figures. Accordingly, references to various components being within, downstream, exterior, upstream, and the like are relative to the embodiments shown in Figures, and it should be understood that other embodiments, such as an outside-in flow design for a filtration system, may have the same or similar components provided in a different arrangement.

Filtration System

[0045] FIG. **1** is a sectional view of a filtration system **100**, according to an example embodiment. The filtration system **100** is configured to provide a filtered fluid to a downstream device such as an engine. As shown, the filtration system includes one or more filter housing components including a cover or filter head **102** and a shell **108**. The filtration system **100** also includes a filter element **120**. It should be understood that the filtration system **100** may include more or fewer components than as shown in FIG. **1**.

[0046] The filter head **102** is coupled to the shell **108**. As shown, the filter head **102** includes one or more filter head threads **112** that threadably couple to one or more shell threads **114** of the shell **108**. The filter head **102** includes a filter head sealing surface **116**, and the shell **108** includes a shell sealing surface **118**. The filter head sealing surface **116** and the shell sealing surface **118** at least partially define a cavity for a seal member **180**. The seal member presses against the filter head sealing surface **116** and the shell sealing surface **118** forming a seal therebetween, substantially preventing a fluid from flowing between the filter head **102** and the shell **108**.

[0047] The filtration system **100** may include one or more ports shown as a first port **104** and a second port **106**. One of the first port **104** and the second port **106** may be an inlet port in fluid receiving communication with an upstream component and fluid providing communication with the filter element **120**. The other of the first port **104** and the second port may be an outlet port in fluid receiving communication with the filter element **120** and in fluid providing communication with a downstream component, such as an engine. For example, the first port **104** may be the inlet port and the second port **106** may be the outlet port, or vice versa.

Snap Fit Feature

[0048] Still referring to FIG. **1**, the filter element **120** is configured to filter a fluid (e.g., by removing contaminants). In some embodiments, the filter element **120** is removably coupled to the shell **108**. In other embodiments, the filter element **120** is permanently secured within the shell **108** such that the filter element **120** cannot be removed from the shell **108** without causing damage to the filter element **120** and/or the shell **108**. The filter element **120** is at least partially contained within the shell **108** and/or the filter head **102**.

[0049] As shown, the filter element **120** includes a filter media **124**, a first endplate **130**, and a second endplate **190**. The filter media **124** may be fitted between the first endplate **130** and the second endplate **190**. In an example arrangement, the filter media **124** is embedded to the first endplate **130** by an embedding process described herein with respect to FIG. **6**B. The filter media **124** may be similarly embedded to the second endplate **190**. In various embodiments, the filter media **124** may be formed in a cylindrical or annular configuration. The filter media **124** may be pleated to increase surface area. The filter media **124** may be a single-

layer media or a multi-layer media. The filter media **124** may be made from at least one of a woven fiber, a non-woven material, a wet laid material, a polymeric material, a glass material, a cellulose material, and/or other suitable material. The filter media **124** is structured to allow the unfiltered fluid to be filtered by flowing through the filter media **124**. For example, the unfiltered fluid flows through the filter media **124**, and the filter media **124** removes impurities such as particulates, organic matter, and the like, from the unfiltered fluid as the unfiltered fluid passes through the filter media **124**. The impurities are trapped by the filter media **124**. The filter media **124** may also at least partially separate different types of fluid (e.g., separating water from fuel). It should be understood that the filter element **120** may include additional or different filter media than shown in FIG. **1**. For example, the filter element **120** may include a second filter media, a coalescing media for coalescing water, and/or other filter media.

[0050] The first endplate **130** is positioned at a first end of the filter media **124**. The first endplate **130** is shown to include a first endplate first portion **132** and a first endplate second portion **136**. As described in more detail below, the first endplate first portion **132** is removably coupled to the first endplate second portion **136**. The first endplate second portion **136** includes a first endplate sealing surface **138** that at least partially defines a cavity for the seal member **180**. In some embodiments, the seal member **180** may press against the endplate sealing surface **138** and form a seal between the first endplate **130** and the filter head **102** and/or the shell **108**. The second endplate **190** is positioned at a second end of the filter media **124**, opposite the first end of the filter media **124**. The second endplate **190** may include a second seal member **192** that forms a radial seal between the second endplate **190** and the shell **108**.

[0051] Now referring to FIGS. **2**A and **2**B, a perspective view and a cutaway perspective view of the filter element **120** are shown according to an example embodiment. As briefly described above, the filter element **120** includes a filter media **124**, a first endplate **130**, and a second endplate **190**. The first endplate **130** includes the first endplate first portion **132** and the first endplate second portion **136**.

[0052] In the embodiment shown, the first endplate first portion **132** includes one or more ribs **134** that extend radially from a center of the first endplate first portion **132** to an edge of the first endplate first portion **132**. The one or more ribs **134** are part of an anti-rotation feature described herein with respect to FIG. **3**B.

[0053] The first endplate second portion **136** includes one or more first engagement structures **140** and one or more second engagement structures **142**. The one or more first engagement structures **140** and the one or more second engagement structures **142** extend axially away from the first endplate second portion **136** towards the first endplate first portion **132**. The one or more first engagement structures **140** and the one or more second engagement structures **142** are circumferentially spaced from each other by such that a gap **144** is defined between the one or more first engagement structures **140** and the one or more second engagement structures **142**. The fluid may flow through the gaps **144** between the one or more first engagement structures **140** and one or more second engagement structures **142**. The one or more first engagement structures **140** and the one or more second engagement structures **142** couple the first endplate second portion **136** to the first endplate first portion **132** in a snap fit arrangement. As described herein, the one or more first engagement structures **140** and the one or more second engagement structures **142** couple the first endplate second portion **136** to the first endplate first portion **132** such that the first endplate first portion **132** may move relative to the first endplate second portion **136**. The one or more first engagement structures **140** and one or more second engagement structures **142** are described in more detail herein below with respect to FIGS. **4**B and **5**B.

[0054] In the embodiment shown, the first endplate second portion **136** also includes an interlocking interface **148** for positioning the filter element within the filter head **102** and/or the shell **108**. The interlocking interface **148** extends radially away from the first endplate second portion **136**. The interlocking interface **148** includes an outer wall that extends around the circumference of the first endplate second portion **136**. The outer wall includes a top surface, a bottom surface, and an outer surface. The top surface and the bottom surface are substantially parallel to each other and extend in a radial direction, away from the first endplate second portion **136**. The outer surface is substantially perpendicular to the top surface and the bottom surface. The outer surface may have an undulating or repeating pattern that matches a complementary pattern of an inner surface of the shell **108** such that the interlocking interface **148** aligns the filter element **120** within the shell **108**. The interlocking interface **148** further prevents non-authorized filter elements from being installed in the filtration system, for example, by preventing a non-matching pattern from fitting within the shell **108**. Additionally, the undulating pattern of the interlocking interface **148** may prevent the filter element **120** from freely rotating with respect to the shell **108**. In other embodiments, the first endplate second portion **136** of the interlocking interface **148** may be substantially circular or annular in shape. In these embodiments, the interlocking interface **148** does not prevent the filter element **120** from rotating relative to the shell **108**.

[0055] In any of the above described embodiments, the interlocking interface **148** at least partially defines the endplate sealing surface **138**. The endplate sealing surface **138** extends around a circumference of the first endplate second portion **136**, above the interlocking interface **148**. As briefly described above, the endplate sealing surface **138** may support the seal member **180**, such that the seal member **180** moves with the first endplate second portion **136**.

[0056] FIG. **3**A is a sectional view of the first endplate **130**. As described above, the first endplate **130** includes the first endplate first portion **132** and the first endplate second portion **136**. The first endplate second portion **136** includes the one or more first engagement structures **140**, the one or more second engagement structures **142**, the endplate sealing surface **138**, and the interlocking interface **148**.

[0057] The one or more first engagement structures **140** each include a first engagement structure first end **150** that is disposed at a bottom surface of the first endplate first portion **132**. The first engagement structure first end **150** also extends in a radially inward direction. The one or more second engagement structures **142** each include a second engagement structure first end **152** that extends axially above the first endplate first portion **132**. The second engagement structure first end **152** also extends in a radially inward direction. The first endplate first portion **132** is at least partially retained between the one or more first engagement structures **140** and the one or more second engagement

structures **142**. More specifically, the first endplate first portion **132** is at least partially retained between the first engagement structure first end **150** of the one or more first engagement structures **140** and the second engagement structure first end **152** of the one or more second engagement structures **142**. According to an example embodiment, the first endplate first portion **132** is loosely retained between the one or more first engagement structures **140** and the one or more second engagement structures **142** such that the first endplate first portion **132** and the first endplate second portion **136** may move relative to each other. The relative movement of the first endplate first portion **132** and the first endplate second portion **136** may be limited in the axial direction by the radially inward portions of the first engagement structure first end **150** and the second engagement structure first end **152**. The relative movement of the first endplate first portion **132** and the first endplate second portion **136** may be limited in the radial direction by the axial portions of the first engagement structure **140** and the second engagement structure **142**.

[0058] In some embodiments, the first endplate second portion **136** is substantially stationary during operation of the filtration system **100**. For example, the first endplate second portion **136** may be held in place by the interaction between the filter head **102**, the shell **108**, and the seal member **180** with the endplate sealing surface **138**. Accordingly, the first endplate first portion **132** may move relative to the first endplate second portion **136**. For example, during operation of the filtration system **100**, fluid pressure may impart a force on the first endplate first portion **132** or a component of the filtration system **100** fixed to the first endplate first portion **132**, such as the filter media **124**. The force imparted by the fluid pressure may cause the first endplate first portion **132** to move relative to the filter head **102** and the shell **108**. The loose coupling of the first endplate first portion **132** and the first endplate second portion **136** enables the first endplate second portion **136** to remain stationary relative to the filter head **102** and the shell **108**, advantageously reducing stress on the seal member **180**.

[0059] In the embodiment shown in FIG. **3**A, the first endplate second portion **136** also includes a fluid port **146**. The fluid port **146** allows a fluid to flow between an outside of the first endplate second portion **136** and an inside of the first endplate second portion **136**. In other embodiments, the first endplate second portion **136** does not include the fluid port **146**.

[0060] FIG. **3**B is a detailed perspective view of the filter element **120** of FIG. **2**A showing a portion of the first endplate **130**. As shown, the rib **134** extends to a radial edge of the first endplate first portion **132**. At least one of the one or more second engagement structures **142** includes a groove **156** that extends radially through the one or more second engagement structures **142**. The groove **156** is sized to receive at least a portion of the rib **134**. The rib **134** is radially aligned with the groove **156** such that the groove **156** receives at least a portion of the rib **134**. When the rib **134** is received by the groove **156**, the first endplate first portion **132** is substantially prevented from rotating in the circumferential direction, relative to the first endplate second portion **136**. Accordingly, the rib **134** and the groove **156** define an anti-rotation feature. As shown in FIG. **3**B, the first endplate **130** includes two ribs **134** and two grooves **156**. It should be understood that the first endplate **130** may include more or fewer (e.g., at least one) ribs **134** and grooves **156**. In some embodiments, the rib **134** fits loosely within the groove **156** such that the first endplate first portion **132** may partially rotate in the circumferential direction, bounded by the difference between size of the groove **156** and the size of the rib **134**. In other embodiments, the first endplate **130** does not include the rib **134** and the groove **156**.

[0061] FIG. **4**A is a first sectional view of the filter element **120** cut along line A-A in FIG. **2**A. FIG. **4**B is a first detailed sectional view of the sectional view shown in FIG. **4**A, showing the first engagement structure **140**. As briefly described above, the first engagement structure **140** extends axially away from the first endplate second portion **136** and towards the first endplate first portion **132**. More specifically, the first engagement structure **140** includes a first axial wall that extends axially away from a top surface of the first endplate second portion **136** and towards a bottom surface of the first endplate first portion **132**. The first axial wall of the first engagement structure **140** may at least partially extend radially inward from the first endplate second portion **136**. An outer surface of the first axial wall may be curved to match the curvature of the first endplate second portion **136**.

[0062] The first engagement structure first end **150** extends radially inward from a top portion of the first axial wall such that the first engagement structure first end **150** loosely contacts the bottom surface of the first endplate first portion **132**. More specifically, the first engagement structure first end **150** includes a radial wall that extends radially inward from the first axial wall and axially below the bottom surface of the first endplate first portion **132**. The radial wall is substantially perpendicular to the first axial wall. At least a portion of a top surface of the radial wall loosely contacts the bottom surface of the first endplate first portion **132**. For example, a radially outward portion of the first engagement structure first end **150** may not contact the first endplate first portion **132** and a radially inward portion of the first engagement structure first end **150** may contact the first endplate first portion **132**.

[0063] FIG. **5**A is a second sectional view of the filter element **120** cut along line B-B in FIG. **2**A. FIG. **5**B is a second detailed sectional view the sectional view shown in FIG. **5**A, showing the second engagement structure **142**. As briefly described above, the second engagement structure **142** extends axially away from the first endplate second portion **136** and above the first endplate first portion **132**. More specifically, second engagement structure **142** includes a second axial wall that extends axially away from a top portion of the first endplate second portion **136** and above a top surface of the first endplate first portion **132** and radially outward from the first endplate first portion **132**.

[0064] The second engagement structure first end **152** extends radially inward from a top portion of the second axial wall such that the second engagement structure first end **152** loosely contacts a top surface of the first endplate first portion **132**. More specifically, the second engagement structure first end **152** includes a tab that extends radially inward from the second axial wall of the second engagement structure **142** and axially above the first endplate first portion **132**, such that the tab is substantially above a top surface of the first endplate first portion **132**. At least a portion of a bottom surface of the tab loosely contacts the top surface of the first endplate first portion **132**. When the first endplate first portion **132** is coupled to the first endplate second

portion **136**, the second engagement structure may deflect away from the first endplate first portion **132** and "snap" back to the original position (e.g., a cantilever snap-fit).

[0065] Now referring to FIGS. **6**A-**6**C, additional views of the components of the filter element **120** are shown. Specifically, FIG. **6**A is a perspective view of the first endplate first portion **132**. As described herein, the first endplate first portion **132** may be fixed to the filter media **124** by an embedding processes. The embedding processes may include providing an adhesive or epoxy to the filter media **124** and/or the first endplate **130**, coupling the filter media **124** to the first endplate **130**, and providing an embedding flame to the first endplate **130** such that the epoxy cures and fixes the filter media **124** to the first endplate **130**. The first endplate first portion **132** has a reduced wall thickness enabling the embedding flame to properly cure the epoxy. FIG. **6**B is a perspective view of the first endplate second portion **136**. FIG. **6**C is a perspective view of the filter element **120** shown in a disassembled state. When the first endplate second portion **136** is coupled to the first endplate first portion **132**, the one or more grooves **156** may be aligned with the one or more ribs **134**.

Press Fit Feature

[0066] Referring generally to FIGS. **7**-**10**C, various views of a filtration system **100**A and components thereof are shown, according to various example embodiments. Referring first to FIG. **7**, a sectional view of the filtration system **100**A is shown, according to an example embodiment. The filtration system **100**A shown in FIG. **7** is similar to the filtration system **100** of FIG. **1**, except that the filtration system **100**A of FIG. **7** includes a different filter element shown as filter element **220**. For example, the filtration system **100**A includes the filter head **102** and the shell **108**. The filter head **102** and the shell **108** are described herein with respect to FIG. **1**. The filtration system **100**A also includes a filter element **220**. It should be understood that the filtration system **100**A may include more or fewer components than as shown in FIG. **7**.

[0067] The filter element **220** is configured to filter a fluid (e.g., by removing contaminants). In some embodiments, the filter element **220** is removably coupled to the shell **108**. In other embodiments, the filter element **220** is permanently secured within the shell **108** such that the filter element **220** cannot be removed from the shell **108** without causing damage to the filter element **220** and/or the shell **108**. The filter element **220** is at least partially contained within the shell **108** and/or the filter head **102**.

[0068] As shown, the filter element **220** includes a filter media **224**, a first endplate **230**, and a second endplate **290**. The filter media **224** may be fitted between the first endplate **230** and the second endplate **290**. In an example arrangement, the filter media **224** is embedded to the first endplate **230** by an embedding processes, such as the embedding processes described herein with respect to FIG. **6**B. The filter media **224** may be similarly embedded to the second endplate **290**. The filter media **224** may substantially similar to the filter media **124**, described herein with respect to FIG. **1**. For example, the filter media **224** may at least partially separate different types of fluid (e.g., separating water from fuel). It should be understood that the filter element **220** may include additional or different filter media than shown in FIG. **7**. For example, the filter element **220** may include a second filter media, a coalescing media for coalescing water, and/or other filter media.

[0069] The first endplate **230** is positioned at a first end of the filter media **224**. The first endplate **230** is shown to include a first endplate first portion **232** and a first endplate second portion **236**. As described in more detail below, the first endplate first portion **232** is removably coupled to the first endplate second portion **236**. The first endplate second portion **236** includes a first endplate sealing surface **238** that at least partially defines a cavity for a seal member **280**. In some embodiments, the seal member **280** may press against the endplate sealing surface **238** and form a seal between the first endplate **230** and the filter head **102** and/or the shell **108**. The second endplate **290** is positioned at a second end of the filter media **224**, opposite the first end of the filter media **224**. The second endplate **290** may include a second seal member **292** that forms a radial seal between the second endplate **290** and the shell **108**.

[0070] Now referring to FIGS. **8**A-**8**C, various views of the filter element **220** are show, according to an example embodiment. As briefly described above, the filter element **220** includes a filter media **224**, a first endplate **230**, and a second endplate **290**. The first endplate **230** includes the first endplate first portion **232** and the first endplate second portion **236**.

[0071] In the embodiment shown, the first endplate first portion **232** includes openings **234** formed through the first endplate first portion **232**. The openings **234** are positioned proximal a radial edge of the first endplate first portion **232**. The openings **234** are circumferentially spaced from each other. The openings **234** are configured to receive at least one of a first engagement structure **240** and a second engagement structure **242**.

[0072] The first endplate second portion **236** includes one or more first engagement structures **240** and one or more second engagement structures **242**. The one or more first engagement structures **240** and the one or more second engagement structures **242** extend axially away from the first endplate second portion **236** towards the first endplate first portion **232**. The one or more first engagement structures **240** and the one or more second engagement structures **242** are circumferentially spaced from each other by such that the one or more first engagement structures **240** and the one or more second engagement structures **242** each align with a corresponding opening **234** of the first endplate first portion **232**. The one or more first engagement structures **240** and the one or more second engagement structures **242** couple the first endplate second portion **236** to the first endplate first portion **232** in a press fit arrangement. As described herein, the one or more first engagement structures **240** and the one or more second engagement structures **242** couple the first endplate second portion **236** to the first endplate first portion **232** such that the first endplate first portion **232** may move relative to the first endplate second portion **236**. Each of the one or more first engagement structures **240** and each of the one or more second engagement structures **242** extend through a corresponding opening **234** of the first endplate first portion **232**. The one or more first engagement structures **240** and one or more second engagement structures **242** are described in more detail herein below with respect to FIGS. **10**A-**10**B.

[0073] The first endplate second portion **236** may also include one or more fluid ports **244**. The fluid port **244**

allows a fluid to flow between an outside of the first endplate second portion **236** and an inside of the first endplate second portion **236**. In other embodiments, the first endplate second portion **236** does not include the fluid port **244**.

[0074] In the embodiment shown, the first endplate second portion **236** also includes an interlocking interface **248** for positioning the filter element within the filter head **102** and/or the shell **108**. The interlocking interface **248** is substantially similar to the interlocking interface **148**, described herein, with respect to FIGS. **2**A and **2**B. The interlocking interface **248** at least partially defines the endplate sealing surface **238**. The endplate sealing surface **238** supports the seal member **280**, such that the seal member **280** moves with the first endplate second portion **236**.

[0075] FIG. **9**A is a sectional view of the first endplate **230** for use with the filter element **220** of FIG. **7**. As described above, the first endplate **230** includes the first endplate first portion **232** and the first endplate second portion **236**. The first endplate second portion **236** includes the one or more first engagement structures **240**, the one or more second engagement structures **242**, the endplate sealing surface **238**, and the interlocking interface **248**. FIG. **9**B is a sectional view of the filter element **120** of FIG. **8**A. As shown in FIGS. **9**A and **9**B, the second engagement structures **242** include an oblique member that extends away from the first endplate second portion **236** in an oblique direction, axially upward and radially inwards. The oblique member of the second engagement structures **242** does not align with the openings **234** such that the oblique member of the second engagement structures **242** prevents the first endplate first portion **232** from moving in an axially downward direction. Although not shown in FIGS. **9**A and **9**B, the first engagement structures **240** may include a similar oblique member that similarly extend in an oblique direction (e.g., axially upward and radially inwards), such that the oblique member of the first engagement structures **240** prevents the first endplate first portion **232** from moving in an axially downward direction.

[0076] Now referring to FIGS. **10**A-**10**C, additional views of the components of the filter element **220** are shown. Specifically, FIG. **10**A is a perspective view of the first endplate first portion **232**. As briefly described above, the first endplate first portion **232** includes openings **234** for receiving the first engagement structures **240** and/or the second engagement structures **242**. As shown the first endplate first portion **232** includes four openings **234**. In other embodiments, the first endplate first portion **232** may include more or fewer openings **234** (e.g., at least one opening **234**).

[0077] Now referring to FIG. **10**B, a perspective view of the first endplate second portion **236** is shown. As described above, the first endplate second portion **236** includes the first engagement structures **240** and the second engagement structures **242**. As shown the first endplate second portion **236** includes two first engagement structures **240** and two second engagement structures **242**. In other embodiments, the first endplate second portion **236** may include more or fewer first engagement structures **240** and second engagement structures **242** (e.g., at least one first engagement structure **240** and at least one second engagement structure **242**). In yet other embodiments, the first endplate second portion **236** may include only the first engagement structures **240** (e.g., at least one first engagement structure **240**) or only the second engagement structures **242** (e.g., at least one second engagement structure **242**). All such variations are intended to fall within the scope of this disclosure.

[0078] The one or more first engagement structures **240** each include an elongated member and a first engagement structure first end **250**. The elongated member extends axially away from the first endplate second portion **236**. When the first endplate second portion **236** is coupled to the first endplate first portion **232**, the elongated member extends through a corresponding opening **234**. The first engagement structure first end **250** is disposed at an axial end of the elongated member, axially away from the first endplate second portion **236**, such that, when the first endplate second portion **236** is coupled to the first endplate first portion **232**, the first engagement structure first end **250** is disposed above the first endplate first portion **232**. The first engagement structure first end **250** includes a radial lip that extends in a radial direction. As shown in FIG. **10**B, the radial lip of the first engagement structure first end **250** extends in a radially outward direction. In other embodiments, the radial lip of the first engagement structure first end **250** may extend in a radially inward direction. As described in more detail herein, the first engagement structure first end **250** retains the first endplate first portion **232**. More specifically, the radial lip of the first engagement structure first end **250** retains the first endplate first portion **232** by preventing the first endplate first portion **232** from moving in an axially upward direction (e.g., away from the first endplate second portion **236**). For example, the lip of the first engagement structure first end **250** may loosely contact a top surface of the first endplate first portion **232** by preventing the first endplate first portion **232** from moving in the axially upward direction.

[0079] The one or more second engagement structures **242** each include an oblique member, an example of which is described above with respect to FIGS. **9**A and **9**B, a second engagement structure first portion **252**, and a second engagement structure second portion **254**. As described above, the oblique member is not aligned with the openings **234** such that the oblique member prevents the first endplate first portion from moving axially downward (e.g., towards the first endplate second portion **236**). The second engagement structure first portion **252** includes a first prong and the second engagement structure second portion **254** includes a second prong. The first prong and the second prong extend axially away from the first endplate second portion **236**, such that, when the first endplate second portion **236** is coupled to the first endplate first portion **232**, the first elongated member and the second elongated member extend through a corresponding opening **234** of the first endplate first portion **232**. The second engagement structure first portion **252** also includes a first tangential lip, and the second engagement structure second portion **254** also includes a second tangential lip. The first tangential lip and the second tangential lip extend in a circumferential or tangential direction. As shown in FIG. **10**B, the first tangential lip of the second engagement structure first portion **252** extends in a first tangential direction, and the second tangential lip of the second engagement structure second portion **254** extends in a second tangential direction, opposite the first tangential direction.

[0080] The first endplate first portion **232** is at least partially retained by the first engagement structures **240** and the second engagement structures **242**. More specifically, the first endplate first portion **232** is at least partially retained by

the first engagement structure first end **250** of the one or more first engagement structures **240** and the second engagement structure first portion **252** and the second engagement structure second portion **254** of the one or more second engagement structures **242**. According to an example embodiment, the first endplate first portion **232** is loosely retained by the one or more first engagement structures **240** and the one or more second engagement structures **242** such that the first endplate first portion **232** and the first endplate second portion **236** may move relative to each other.

[0081] The relative movement of the first endplate first portion **232** and the first endplate second portion **236** may be limited in an axially upward direction by the radial lip of the first engagement structure first end **250**, the first tangential lip of the second engagement structure first portion **252**, and the second tangential lip of the second engagement structure second portion **254**. More specifically, the radial lip, the first tangential lip, and/or the second tangential lip loosely contacting a top surface of the first endplate first portion **232** limits movement of the first endplate first portion **232** in the axially upward direction. The relative movement of the first endplate first portion **232** and the first endplate second portion **236** may be limited in an axially downward direction by the oblique member of the second engagement structures **242**, as described above with respect to FIGS. **9**A and **9**B. In some embodiments, the relative movement of the first endplate first portion **232** and the first endplate second portion **236** may be limited in an axially downward direction by the oblique member of the first engagement structures **240**, as described above with respect to FIGS. **9**A and **9**B.

[0082] The relative movement of the first endplate first portion **232** and the first endplate second portion **236** may be limited in the radial direction by a difference in the size of the openings **234** and the elongated member of the first engagement structure **240** and the first prong and the second prong of the second engagement structure **242**. The relative movement of the first endplate first portion **232** and the first endplate second portion **236** may be limited in the circumferential direction by a difference in the size of the openings **234** and the elongated member of the first engagement structure **240** and the first prong and the second prong of the second engagement structure **242**. More specifically, the openings **234** may be larger than the elongated member of the first engagement structure **240** and/or the first prong and the second prong of the second engagement structure **242** in the radial direction and/or in the circumferential direction. The difference in size between the openings **234** and first engagement structure **240** and/or the first prong and the second prong of the second engagement structure **242** in the radial direction and/or in the circumferential direction bounds the movement of the first endplate first portion **232** relative to the first endplate second portion **236**.

[0083] In some embodiments, the first endplate second portion **236** is substantially stationary during operation of the filtration system **100**A. For example, the first endplate second portion **236** may be held in place by the interaction between the filter head **102**, the shell **108**, and the seal member **280** with the endplate sealing surface **238**. Accordingly, the first endplate first portion **232** may move relative to the first endplate second portion **236**. For example, during operation of the filtration system **100**A, fluid pressure may impart a force on the first endplate first portion **232** or a component of the filtration system **100**A fixed to the first endplate first portion **232**, such as the filter media **224**. The force imparted by the fluid pressure may cause the first endplate first portion **232** to move relative to the filter head **102** and the shell **108**. The loose coupling of the first endplate first portion **232** and the first endplate second portion **236** enables the first endplate second portion **236** to remain stationary relative to the filter head **102** and the shell **108** advantageously reducing stress on the seal member **280**.

[0084] FIG. **10**C is a perspective view of the filter element **220** shown in a disassembled state. When the first endplate second portion **236** is coupled to the first endplate first portion **232**, the first engagement structures **240** and the second engagement structures **242** each align with a corresponding opening **234**.

Threading Feature

[0085] Now referring to FIGS. **11**A-**11**B various views of a filter element **320** are shown, according to another example embodiment. The filter element **320** is configured for use in any of the filtration systems **100**, **100**A, etc. described herein. The filter element **320** is configured to filter a fluid (e.g., by removing contaminants). In some embodiments, the filter element **320** is removably coupled to the shell **108** of the filtration system **100**, **100**A. In other embodiments, the filter element **320** is permanently secured within the shell **108** such that the filter element **320** cannot be removed from the shell **108** without causing damage to the filter element **320** and/or the shell **108**. The filter element **320** is at least partially contained within the shell **108** and/or the filter head **102** of the filtration system **100**, **100**A.

[0086] As shown, the filter element **320** includes a filter media **324**, a first endplate **330**, and a second endplate **390**. The filter media **324** may be fitted between the first endplate **330** and the second endplate **390**. In an example arrangement, the filter media **324** is embedded to the first endplate **330** by an embedding processes, such as the embedding processes described herein with respect to FIG. **6**B. The filter media **324** may be similarly embedded to the second endplate **390**. The filter media **324** may substantially similar to the filter media **124**, described herein with respect to FIG. **1**. For example, the filter media **324** may at least partially separate different types of fluid (e.g., separating water from fuel). It should be understood that the filter element **320** may include additional or different filter media than shown in FIGS. **11**A and **11**B. For example, the filter element **320** may include a second filter media, a coalescing media for coalescing water, and/or other filter media.

[0087] The first endplate **330** is positioned at a first end of the filter media **324**. The first endplate **330** is shown to include a first endplate first portion **332** and a first endplate second portion **336**. As described in more detail below, the first endplate first portion **332** is removably coupled to the first endplate second portion **336**. The first endplate second portion **336** includes a first endplate sealing surface **338** that at least partially defines a cavity for a seal member **380**. In some embodiments, the seal member **380** may press against the endplate sealing surface **338** and form a seal between the first endplate **330** and the filter head **102** and/or the shell **108** of the filtration system **100**, **100**A. The second endplate **390** is positioned at a second end of the filter media **324**, opposite the first end of the filter media **324**. The second endplate **390** may include a second seal member **392** that forms a radial seal between the second endplate **290** and the shell **108** of the filtration system **100**, **100**A.

[0088] In the embodiment shown in FIG. **11**B, the first endplate first portion **332** includes a first endplate first portion engagement structure shown as one or more first threads **340**. The one or more first threads **340** extend radially outward from a radial edge of the first endplate first portion **332** and around the circumference of the first endplate first portion **332** in a helical pattern. The one or more first threads **340** are configured as external threads or "male" threads.

[0089] The first endplate second portion **336** includes a first endplate second portion engagement structure shown as one or more second threads **350**. The one or more second threads **350** are disposed on an inner surface of the first endplate second portion **336** and extend around the inner circumference of the first endplate second portion **336** in a helical pattern. The one or more second threads **350** are configured as internal threads or "female" threads. The one or more second threads **350** are configured to receive the one or more first threads **340** such that the one or more first threads **340** and the one or more second threads **350** couple the first endplate second portion **336** to the first endplate first portion **332** in a threaded engagement. As described herein, the one or more first threads **340** and the one or more second threads **350** couple the first endplate second portion **336** to the first endplate first portion **332** such that the first endplate first portion **332** may move relative to the first endplate second portion **336**. The one or more first threads **340** and the one or more second threads **350** are described in more detail herein below with respect to FIGS. **12**A-**12**B.

[0090] The first endplate second portion **336** may also include one or more fluid ports **344**. The fluid port **344** allows a fluid to flow between an outside of the first endplate second portion **336** and an inside of the first endplate second portion **336**. In other embodiments, the first endplate second portion **336** does not include the fluid port **344**.

[0091] In the embodiment shown, the first endplate second portion **336** also includes an interlocking interface **348** for positioning the filter element within the filter head **102** and/or the shell **108** of the filtration system **100**, **100**A. The interlocking interface **348** is substantially similar to the interlocking interface **148**, described herein, with respect to FIGS. **2**A and **2**B. The interlocking interface **348** at least partially defines the endplate sealing surface **338**. The endplate sealing surface **338** supports the seal member **380**, such that the seal member **380** moves with the first endplate second portion **336**.

[0092] FIG. **12**A is a sectional view of the filter element **320**. FIG. **12**B is a detailed sectional view of the sectional view shown in FIG. **12**A, showing the one or more first threads **340** and the one or more second threads **350**. As briefly described above, the one or more first threads **340** are external threads extending radially away from the first endplate first portion **332** and towards the first endplate second portion **336**. The one or more second threads **350** are internal threads configured to receive the one or more first threads **340**. The one or more second threads **350** are sized such that the one or more first threads **340** loosely fit within the one or more second threads **350**. The first endplate first portion **332** is loosely coupled to the first endplate second portion **336** by the one or more first threads **340** and the one or more second threads **350** such that the first endplate first portion **332** and the first endplate second portion **336** may move relative to each other. The relative movement of the first endplate first portion **332** and the first endplate second portion **336** may be limited in the axial direction by a difference in axial size between the one or more first threads **340** and the one or more second threads **350**. The relative movement of the first endplate first portion **332** and the first endplate second portion **336** may be limited in the radial direction by an external surface of the first endplate first portion **332** and an internal surface of the first endplate second portion **336**.

[0093] Now referring to FIGS. **13**A-**13**C, additional views of the components of the filter element **320** are shown. Specifically, FIG. **13**A is a perspective view of the first endplate first portion **332**. As described herein, the first endplate first portion **332** may be fixed to the filter media **324** by an embedding processes, such as the embedding process described herein with respect to FIG. **6**A. FIG. **13**B is a perspective view of the first endplate second portion **336**. FIG. **13**C is a perspective view of the filter element **320** shown in a disassembled state. When the first endplate second portion **336** is coupled to the first endplate first portion **332**, the one or more second threads **350** may receive the one or more first threads **340**.

Locate, Rotate, & Fix Feature

[0094] Referring generally to FIGS. **14**-**16**C, various views of a filtration system **100**B and components thereof are shown, according to various example embodiments. Referring first to FIG. **14**, a sectional view of the filtration system **100**B is shown, according to an example embodiment. The filtration system **100**B shown in FIG. **14** is similar to the filtration system **100** of FIG. **1**, except that the filtration system **100**B of FIG. **14** includes a different filter element shown as filter element **420**. For example, the filtration system **100**B includes the filter head **102** and the shell **108**. The filter head **102** and the shell **108** are described herein with respect to FIG. **1**. The filtration system **100**B also includes a filter element **420**. It should be understood that the filtration system **100**B may include more or fewer components than as shown in FIG. **14**.

[0095] The filter element **420** is configured to filter a fluid (e.g., by removing contaminants). In some embodiments, the filter element **420** is removably coupled to the shell **108**. In other embodiments, the filter element **420** is permanently secured within the shell **108** such that the filter element **420** cannot be removed from the shell **108** without causing damage to the filter element **420** and/or the shell **108**. The filter element **420** is at least partially contained within the shell **108** and/or the filter head **102**.

[0096] As shown, the filter element **420** includes a filter media **424**, a first endplate **430**, and a second endplate **490**. The filter media **424** may be fitted between the first endplate **430** and the second endplate **490**. In an example arrangement, the filter media **424** is embedded to the first endplate **430** by an embedding processes, such as the embedding processes described herein with respect to FIG. **6**B. The filter media **424** may be similarly embedded to the second endplate **490**. The filter media **424** may substantially similar to the filter media **124**, described herein with respect to FIG. **1**. For example, the filter media **424** may at least partially separate different types of fluid (e.g., separating water from fuel). It should be understood that the filter element **420** may include additional or different filter media than shown in FIG. **14**. For example, the filter element **420** may include a second filter media, a coalescing media for coalescing water, and/or other filter media.

[0097] The first endplate **430** is positioned at a first end of the filter media **424**. The first endplate **430** is shown to include a first endplate first portion **432** and a first endplate second portion **436**. As described in more detail below, the first endplate first portion **432** is removably coupled to the first endplate second portion **436**. The first endplate second portion **436** includes a first endplate sealing surface **438** that at least partially defines a cavity for a seal member **480**. In some embodiments, the seal member **480** may press against the endplate sealing surface **438** and form a seal between the first endplate **430** and the filter head **102** and/or the shell **108**. The second endplate **490** is positioned at a second end of the filter media **424**, opposite the first end of the filter media **424**. The second endplate **490** may include a second seal member **492** that forms a radial seal between the second endplate **490** and the shell **108**.

[0098] Now referring to FIGS. **15**A and **15**B, various views of the filter element **420** are shown, according to an example embodiment. Specifically, FIG. **15**A, is a detailed perspective view of the filter element **420** showing the first endplate **430**, and FIG. **15**B is a cutaway perspective view showing the filter element **420**. As briefly described above, the filter element **420** includes a filter media **424**, a first endplate **430**, and a second endplate **490**. The first endplate **430** includes the first endplate first portion **432** and the first endplate second portion **436**.

[0099] In the embodiment shown, the first endplate first portion **432** includes channels **460** that extend radially inwards from an outer edge of the first endplate first portion **432** and at least partially towards the center of the first endplate first portion **432**. The channels **460** are part of a locate, rotate, and fix feature, described herein in detail with respect to FIGS. **16**A-**16**B.

[0100] The first endplate second portion **436** includes one or more first engagement structures **440**. The one or more first engagement structures **440** extend axially away from the first endplate second portion **436** towards the first endplate first portion **432**. The one or more first engagement structures **440** are circumferentially spaced from each other by such that a gap **444** is defined between the one or more first engagement structures **440**. The fluid may flow through the gaps **444**, between the one or more first engagement structures **440**. The one or more first engagement structures **440** are received by a respective channel **460** to couple the first endplate second portion **436** to the first endplate first portion **432** in a locate, rotate, and fix arrangement. As described herein, the one or more first engagement structures **440** couple the first endplate second portion **436** to the first endplate first portion **432** such that the first endplate first portion **432** may move relative to the first endplate second portion **436**. The channels **460** and the one or more first engagement structures **440** are described in more detail herein below with respect to FIGS. **16**A and **16**B.

[0101] In the embodiment shown, the first endplate second portion **436** also includes an interlocking interface **448** for positioning the filter element within the filter head **102** and/or the shell **108** of the filtration system **100**B. The interlocking interface **448** may be substantially similar or the same as the interlocking interface **148** of FIG. **2**A. The interlocking interface **448** at least partially defines the endplate sealing surface **438**. As briefly described above, the endplate sealing surface **438** may support the seal member **480**, such that the seal member **480** moves with the first endplate second portion **436**.

[0102] Now referring to FIGS. **16**A-**16**C, additional views of the components of the filter element **420** are shown. Specifically, FIG. **16**A is a perspective view of the first endplate first portion **432**. As briefly described above, the first endplate first portion **432** includes channels **460** for receiving the first engagement structures **440**. As shown the first endplate first portion **432** includes four channels **460**. In other embodiments, the first endplate first portion **432** may include more or fewer channels **460** (e.g., at least one channels **460**). Each of the channels **460** include a first channel portion **462** and a second channel portion **464**. The first channel portion **462** extends radially inward from an outer edge of the first endplate first portion **432** and at least partially towards the center of the first endplate first portion **432**. The second channel portion **464** extends away from the first channel portion **462** in a circumferential direction. Together, the first channel portion **462** and the second channel portion **464** define an "L" shaped channel **460**.

[0103] Now referring to FIG. **16**B, a perspective view of the first endplate second portion **436** is shown. As described above, the first endplate second portion **436** includes the first engagement structures **440**. As shown the first endplate second portion **436** includes four first engagement structures **440**. In other embodiments, the first endplate second portion **436** may include more or fewer first engagement structures **440** (e.g., at least one first engagement structure **440**).

[0104] The one or more first engagement structures **440** each include an extended portion **450**. The extended portion **450** extends axially away from the first endplate second portion **436**, such that, when the first endplate second portion **436** is coupled to the first endplate first portion **432**, extended portion **450** at least partially extends through a corresponding channel **460** of the first endplate first portion **432**. The first engagement structures **440** also include a lower flange **452** that extends radially away from the extended portion **450**. As shown in FIG. **16**B, the lower flange **452** extends in a radially outward direction. In other embodiments, the lower flange **452** may extend in a radially inward direction. The first engagement structures **440** also include an upper flange **454** disposed axially above the lower flange **452** and extends radially away from the extended portion **450**. As shown in FIG. **16**B, the upper flange **454** extends in both a radially outward direction and a radially inward direction. In other embodiments, the upper flange **454** may extend in one of a radially inward direction and a radially outward direction.

[0105] Now referring to FIG. **16**C, a perspective view of the filter element **420** shown in a disassembled state. To couple the first endplate second portion **436** to the first endplate first portion **432**, first, the first engagement structures **440** each align with a corresponding channel **460**. Specifically, the upper flange **454** of the first engagement structure **440** aligns with the first channel portion **462** of a corresponding channel **460** such that the first endplate second portion **436** is located relative to the first endplate first portion **432**. The extended portion **450** of the first engagement structure **440** extends at least partially through the corresponding channel **460** such that the upper flange **454** is above a top surface of the first endplate first portion **432** and the lower flange **452** is below a bottom surface of the first endplate first portion **432**. Next the first endplate second portion **436** is rotated such that the extended portion **450** follows the second channel portion **464**. In this position, the first endplate second portion **436** is fixed to the first

endplate first portion **432**. The locate, rotate, and fix feature includes the first engagement structures **440** and the channels **460**.

[0106] The first endplate first portion **432** is at least partially retained by the first engagement structures **440**. More specifically, the first endplate first portion **432** is at least partially retained by the extended portion **450** extending through the channels **460**. Additionally, the first endplate first portion **432** is at least partially retained between the lower flange **452** and the upper flange **454**. According to an example embodiment, the first endplate first portion **432** is loosely retained by the one or more first engagement structures **440** such that the first endplate first portion **432** and the first endplate second portion **436** may move relative to each other. The relative movement of the first endplate first portion **432** and the first endplate second portion **436** may be limited in an axially upward direction by the upper flange **454**. The relative movement of the first endplate first portion **432** and the first endplate second portion **436** may be limited in an axially downward direction by the lower flange **452**. The relative movement of the first endplate first portion **432** and the first endplate second portion **436** may be limited in the radial direction by a difference in the size of the channels **460** and the extended portion **450** extending through the channels **460**. The relative movement of the first endplate first portion **432** and the first endplate second portion **436** may be limited in the circumferential direction by an end of the second channel portion **464** and the extended portion **450**.

[0107] In some embodiments, the first endplate second portion **436** is substantially stationary during operation of the filtration system **100**B. For example, the first endplate second portion **436** may be held in place by the interaction between the filter head **102**, the shell **108**, and the seal member **480** with the endplate sealing surface **438**. Accordingly, the first endplate first portion **432** may move relative to the first endplate second portion **436**. For example, during operation of the filtration system **100**B, fluid pressure may impart a force on the first endplate first portion **432** or a component of the filtration system **100**B fixed to the first endplate first portion **432**, such as the filter media **424**. The force imparted by the fluid pressure may cause the first endplate first portion **432** to move relative to the filter head **102** and the shell **108**. The loose coupling of the first endplate first portion **432** and the first endplate second portion **436** enables the first endplate second portion **436** to remain stationary relative to the filter head **102** and the shell **108** advantageously reducing stress on the seal member **480**.

[0108] It should be noted that the term "example" as used herein to describe various embodiments is intended to indicate that such embodiments are possible examples, representations, and/or illustrations of possible embodiments (and such term is not intended to connote that such embodiments are necessarily extraordinary or superlative examples).

[0109] As utilized herein, the term "approximately" and similar terms are intended to have a broad meaning in harmony with the common and accepted usage by those of ordinary skill in the art to which the subject matter of this disclosure pertains. The term "approximately" as used herein refers to ±10% of the referenced measurement, position, or dimension. It should be understood by those of skill in the art who review this disclosure that these terms are intended to allow a description of certain features described and claimed without restricting the scope of these features to the precise numerical ranges provided. Accordingly, these terms should be interpreted as indicating that insubstantial or inconsequential modifications or alterations of the subject matter described and claimed are considered to be within the scope of the invention as recited in the appended claims.

[0110] The terms "coupled," "attached," and the like as used herein mean the joining of two members directly to one another. Such joining may be stationary (e.g., permanent) or moveable (e.g., removable or releasable).

[0111] References herein to the positions of elements (e.g., "top," "bottom," "above," "below," etc.) are merely used to describe the orientation of various elements in the FIGURES. It should be noted that the orientation of various elements may differ according to other exemplary embodiments, and that such variations are intended to be encompassed by the present disclosure.

[0112] It is important to note that the construction and arrangement of the various example embodiments are illustrative only. Although only a few embodiments have been described in detail in this disclosure, those skilled in the art who review this disclosure will readily appreciate that many modifications are possible (e.g., variations in sizes, dimensions, structures, shapes and proportions of the various elements, various parameters, mounting arrangements, use of materials, colors, orientations, etc.) without materially departing from the novel teachings and advantages of the subject matter described herein. For example, elements shown as integrally formed may be constructed of multiple parts or elements, the position of elements may be reversed or otherwise varied, and the nature or number of discrete elements or positions may be altered or varied. The order or sequence of any process or method steps may be varied or re-sequenced according to alternative embodiments. Other substitutions, modifications, changes and omissions may also be made in the design, operating conditions and arrangement of the various example embodiments without departing from the scope of the concepts presented herein. While this specification contains many specific implementation details, these should not be construed as limitations on the scope of any inventions or of what may be claimed, but rather as descriptions of features specific to particular implementations of particular inventions. Certain features described in this specification in the context of separate implementations can also be implemented in combination in a single implementation. Conversely, various features described in the context of a single implementation can also be implemented in multiple implementations separately or in any suitable subcombination. Moreover, although features may be described above as acting in certain combinations and even initially claimed as such, one or more features from a claimed combination can in some cases be excised from the combination, and the claimed combination may be directed to a subcombination or variation of a subcombination.

What is claimed is:

1. A filtration system comprising:

a filter housing comprising a shell and a filter head; and

a filter element positioned within the filter housing, the filter element comprising:

a filter media;

a first endplate positioned at a filter media first end, the first endplate comprising:

a first endplate first portion; and
a first endplate second portion comprising:
a first engagement structure coupling the first endplate second portion to the first endplate first portion such that the first endplate first portion is movable relative to the first endplate second portion while remaining coupled to the first endplate second portion.

2. The filtration system of claim **1**, wherein the first endplate second portion further comprises a second engagement structure configured to couple the first endplate second portion to the first endplate first portion such that the first endplate first portion is movable relative to the first endplate second portion while remaining coupled to the first endplate second portion.

3. The filtration system of claim **2**, wherein:
the first engagement structure comprises:
a first axial wall extending axially away from the first endplate second portion towards the first endplate first portion; and
a first engagement structure first end disposed at a first axial end of the first axial wall, the first engagement structure first end having a radial wall that extends radially inward from the first axial wall and axially below the first endplate first portion; and
the second engagement structure comprises:
a second axial wall extending axially away from the first endplate second portion and above the first endplate first portion; and
a second engagement structure first end disposed at a second axial end of the second axial wall, the second engagement structure first end having a tab that extends radially inward from the second axial wall and axially above the first endplate first portion.

4. The filtration system of claim **1**, wherein the first engagement structure comprises:
an elongated member extending axially away from the first endplate second portion and through an opening of the first endplate first portion; and
a first engagement structure first end disposed at an axial end of the elongated member, the first engagement structure having a lip that extends above the first endplate first portion.

5. The filtration system of claim **1**, wherein:
the first endplate first portion comprises an external thread; and
the first engagement structure comprises an internal thread configured to receive the external thread.

6. The filtration system of claim **1**, wherein the first engagement structure comprises:
an extended portion, the extended portion extending axially away from the first endplate second portion and through a channel of the first endplate first portion;
a lower flange extending away from the extended portion and axially below the first endplate first portion; and
an upper flange extending away from the extended portion and axially above the first endplate first portion.

7. The filtration system of claim **1**, wherein the first endplate second portion further comprises an endplate sealing surface that supports a seal member, the seal member contacting the filter housing and forming a seal between the shell and the filter head.

8. The filtration system of claim **1**, wherein the first endplate second portion further comprises an interlocking interface, the interlocking interface including an outer surface having an undulating pattern preventing the filter element from rotating with respect to the shell.

9. A filter element comprising:
a filter media;
a first endplate positioned at a filter media first end, the first endplate comprising:
a first endplate first portion; and
a first endplate second portion comprising:
a first engagement structure coupling the first endplate second portion to the first endplate first portion such that the first endplate first portion is movable relative to the first endplate second portion while remaining coupled to the first endplate second portion.

10. The filter element of claim **9**, wherein the first endplate second portion further comprises a second engagement structure configured to couple the first endplate second portion to the first endplate first portion such that the first endplate first portion is movable relative to the first endplate second portion while remaining coupled to the first endplate second portion.

11. The filter element of claim **10**, wherein:
the first engagement structure comprises:
a first axial wall extending axially away from the first endplate second portion towards the first endplate first portion; and
a first engagement structure first end disposed at a first axial end of the first axial wall, the first engagement structure first end having a radial wall that extends radially inward from the first axial wall and axially below the first endplate first portion; and
the second engagement structure comprises:
a second axial wall extending axially away from the first endplate second portion and above the first endplate first portion; and
a second engagement structure first end disposed at a second axial end of the second axial wall, the second engagement structure first end having a tab that extends radially inward from the second axial wall and axially above the first endplate first portion.

12. The filter element of claim **9**, wherein the first engagement structure comprises:
an elongated member extending axially away from the first endplate second portion and through an opening of the first endplate first portion; and
a first engagement structure first end disposed at an axial end of the elongated member, the first engagement structure having a lip that extends above the first endplate first portion.

13. The filter element of claim **9**, wherein:
the first endplate first portion comprises an external thread; and
the first engagement structure comprises an internal thread configured to receive the external thread.

14. The filter element of claim **9**, wherein the first engagement structure comprises:
an extended portion, the extended portion extending axially away from the first endplate second portion and through a channel of the first endplate first portion;
a lower flange extending away from the extended portion and axially below the first endplate first portion; and
an upper flange extending away from the extended portion and axially above the first endplate first portion.

15. The filter element of claim **9**, wherein the first endplate second portion further comprises an interlocking interface, the interlocking interface including an outer surface having an undulating pattern that is configured to engage a filter shell.

16. An endplate for a filter element, the endplate comprising:

an endplate first portion comprising a rib that extends radially from a center of the endplate first portion to an edge of the endplate first portion;

an endplate second portion comprising:

a first wall extending away from a top surface of the endplate second portion and towards a bottom surface of the endplate first portion; and

a second wall extending away from the top surface of the endplate second portion and above the endplate first portion, the second wall having a groove that is sized to receive a portion of the rib such that the endplate first portion is coupled to the endplate second portion and the endplate first portion is movable relative to the endplate second portion while remaining coupled to the endplate second portion.

17. The endplate of claim **16**, wherein the first wall at least partially extends radially inward from the endplate second portion such that a first end of the first wall is disposed at the bottom surface of the endplate first portion.

18. The endplate of claim **16**, further comprising a tab that extends radially inward from the second wall and axially above the endplate first portion.

19. The endplate of claim **18**, wherein a bottom surface of the tab loosely contacts a top surface of the endplate first portion such that the endplate first portion is movable relative to the endplate second portion while remaining coupled to the endplate second portion.

20. The endplate of claim **16**, wherein the endplate second portion further comprises a fluid port that enables fluid to flow between an outside of the endplate second portion and an inside of the endplate second portion.

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