

FILTER HOUSING

The present invention relates to a filter housing having a manifold and a bowl with a threaded ring there between to secure the bowl to the manifold. More particularly, it relates to a
5 filter bowl and manifold which has a threaded ring retained in a fixed position relative either to the bowl or manifold and which is used to drive the bowl and manifold together or apart.

BACKGROUND OF THE INVENTION

There are two basic types of filter housings used today for filter cartridges. The first and most recent is the disposable housing. Typically formed of plastic, it has a filter cartridge
10 sealed inside. Once it has been used the entire device, housing, filter and all are simply thrown away. The second and more common type is the disposable filter cartridge in a reusable housing.

In this type of device, the housing is formed of two portions, a manifold and a bowl. At least the manifold is typically connected to the fluid stream and generally supported or fixed in
15 place. A first filtration modular design locates all of the connections at the same end of the module. In this type of module, the feed and permeate ports are typically horizontally oriented at the top or "head" end of the module on opposite sides thereof. Due to their shape, these modules are referred to as having a T configuration. The T configuration facilitates connection of the head to the remaining portion of the filtration module comprising the bowl and the
20 filtration cartridge positioned within the bowl. When fluid only enters or exits through the manifold and correspondingly exits or enters through a separate opening formed in the bowl, the device is commonly referred to as an "in line" type housing (as fluid flows in line through one end of the device [either manifold or bowl] and out the other end of the device).

In either of these embodiments, the bowl is removably attached to the manifold via a
25 threaded ring that mates with threads on the manifold. The bowl and manifold are simply held together by the threaded ring. One or more filter cartridges are secured inside the bowl. To replace a filter cartridge, one simply removes unscrews the ring, pulls the bowl from the

manifold, removes the cartridge, replaces it with a new cartridge reattaches the bowl to the manifold and then secures the threaded ring in place to maintain the connection between the two components.

5 This design presents several problems. First, the connection between the manifold and the bowl must be liquid tight. This typically accomplished with a series of O-rings between the manifold and bowl and/or the cartridge and the manifold. While forming a secure seal, during use the seal becomes somewhat fixed (or stuck together) and difficult to break when one tries to replace the spent filter.

10 Secondly, most of these systems hang vertically downward and require two hands to remove and reattach the bowl to the manifold.

Even when the bowl and manifold separate easily, the bowl is not supported by anything, meaning that the bowl can easily drop either breaking the bowl or spilling its contents, which in many cases especially in the semiconductor industry is a hazardous material.

15 What is needed is a device that overcomes all of these disadvantages. The present invention provides such a device.

SUMMARY OF THE INVENTION

20 A filter cartridge housing formed of a manifold and a bowl is disclosed. A threaded ring substantially fixed in a position relative to either the bowl or the manifold is used to positively drive the manifold and bowl together and apart as needed and to form a secure and liquid tight seal between the two components when they are together. The threads of the ring mate with corresponding threads on component that does not contain the ring. The threaded ring is held in its substantially fixed position relative to the one component by a device which allows for the free rotational movement of the ring relative to the component to which it is mounted but which restricts its vertical movement relative to that component. One such device is a key on the ring
25 that fits in the keyway on of the outer surface of the component. The threads of the ring mate with the threads on the other component. As the ring is relatively fixed by the key/keyway to its position on the first component, it moves that component in a vertical direction relative to the other component as the ring is rotated onto or off of the mating threads of the second

component. Alternatively, other retention devices such as a ridge may be used in lieu of the key/keyway design.

It is an object of the present invention to provide a filter housing comprising a bowl and a manifold, a threaded ring retained in a fixed position relative either to the bowl or manifold and which is used to drive the bowl and manifold together or apart.

It is another object of the present invention to provide a filter housing comprising a manifold and a bowl, the manifold having a series of threads formed on its outer surface, the bowl having a ring with threads on its inner surface which mate with the threads of the manifold, the ring being secured to the bowl so as to maintain a relatively fixed position on the vertical axis of the ring.

It is a further object of the present invention to provide a filter housing comprising a manifold and a bowl, the bowl having a series of threads formed on its outer surface, the manifold having a ring with threads on its inner surface which mate with the threads of the bowl, the ring being secured to the manifold so as to maintain a relatively fixed position on the vertical axis of the manifold.

It is another object of the present invention to provide a filter housing comprising a bowl and a manifold, a threaded ring retained in a fixed position relative either to the bowl or manifold and which is used to drive the bowl and manifold together or apart wherein the ring is secured to the bowl via a keyway and a key formed on the inner surface of the ring and mounted within the keyway of the bowl.

It is a further object of the present invention to provide a filter housing comprising a bowl and a manifold, a threaded ring retained in a fixed position relative either to the bowl or manifold and which is used to drive the bowl and manifold together or apart wherein the ring is secured to the manifold via a keyway and a key formed on the inner surface of the ring and mounted within the keyway of the manifold.

It is an additional object of the present invention to provide a filter housing comprising a bowl and a manifold, a threaded ring retained in a fixed position relative either to the bowl or manifold and which is used to drive the bowl and manifold together or apart wherein the ring is

secured to either the bowl or manifold via a ridge formed below the ring on the outer surface of the bowl or manifold.

It is another object of the present invention to provide a filter housing comprising a bowl and a manifold, a threaded ring retained in a fixed position relative either to the bowl or manifold and which is used to drive the bowl and manifold together or apart wherein the ring drives the housing and manifold together and apart as it is rotated in the appropriate direction.

IN THE DRAWINGS

Figure 1 shows a first embodiment of the present invention in cross section.

Figure 2 shows a second embodiment of the present invention in cross section.

Figure 3 shows another embodiment of the present invention in cross section.

Figure 4 shows a further embodiment of the present invention in cross section.

Figure 5 shows a fifth embodiment of the present invention in cross section.

Figure 6 shows another embodiment of the present invention in cross section.

Figure 7 shows a further embodiment of the present invention in cross section

DETAILED DESCRIPTION OF THE INVENTION

In Figure 1 is shown a first embodiment of the present invention.

In this embodiment there is shown a filter housing 1. The housing 1 is of a U line design, although the invention will work equally well with inline and other such housing designs. The housing 1 is formed of a first component 2 and a second component 3. A threaded ring 4 is substantially fixed in its position upon the first component 2. The threads 5 of the ring 4 mate and thread easily with corresponding threads 6 formed on the second component 3.

In this embodiment as shown in the Figure 1, the first component 2 is a cartridge bowl and the second component 3 is a manifold. As the ring 4 is substantially fixed in its position

relative to the first component in this case the bowl 2, i.e. it cannot move any substantial distance along the length of the bowl 2. When its threads 5 are mated to the corresponding threads 6 on the second component, in this case the manifold, 3 and the threads 5,6 are drawn together, the ring 4 carries or drives the first component or bowl 2 into affirmative contact with the second component or manifold 3. Conversely, when the ring 4 is rotated so as to drive the threads 5,6 apart, the first component or bowl 2 is positively carried or driven away from the second component or manifold 3.

The device used to fix the position of the ring 4 to one of the two components can be a variety of devices. As shown in Figure 1, the ring 4 is fixed to the first component 2, i.e. the bowl in this embodiment, using a key 7 formed on the ring 4 which key 7 mates and is held within a keyway 8 formed in the bowl 2. The ring 4 is shown with a knurled feature 9 on a portion of its outer side surface. The use of knurling or other such devices for providing an easy, slip-free surface to the ring is well known and may be used in this invention. Additionally, the use of lugs or tapered surfaces on the outer surface of the ring may be used to allow one to attach a wrench or other device for moving the ring relative to the other threaded component. While it is contemplated in the preferred embodiments of this present invention that no wrench or other device is necessary to move the ring, it is still within the scope of the present invention.

While the ring 4 is shown as being fixed to the bowl 2 in this embodiment, it may as easily be fixed to the manifold 3 as in Figure 2 (the same numbers as in Figure 1 apply where relevant in figure 2) . Here the ring 4 is attached to the manifold 3 rather than the bowl 2 of Figure 1. The keyway 8 is formed in the manifold surface and the key 7 of the ring 4 is trapped within it. The threads 5 of the ring 4 mate with the threads 6 of the manifold 3 to drive the manifold 3 and bowl 2 together and apart.

Alternatively, the ring may be retained to either component by the use of a different type of retention device. In Figure 3 is shown an embodiment in which one or more ridges 10, in this case one ramped ridge is formed on the surface 11 of the component to which it is desired to attach the ring 12. In this instance, the ring 12 is attached and substantially fixed to the manifold 13 of the housing 14. The other component of the housing is the bowl 11. The ring 12 in this instance is made of plastic and is force fit or snap fit over the ridge 10 and thereafter retained in a substantially fixed position relative to the length of the bowl 11. In this instance,

there is also formed a keyway 17 in the manifold to help hold the ring in place. No such keyway is necessary so long as the surface of the component containing the ridge 10 has a portion adjacent its distal end that is of a diameter greater than that of the ridge. For an example of such a feature, see the lip 44 of Figure 7. As can be seen the diameter of the lip is adjacent a distal end of the component on which the ridge is formed and it has a diameter greater than that of the ridge. The threads 15 of the ring 12 mate with the threads 16 of the bowl 11 and as the ring is rotated they are either driven together or apart (depending on the relative movement of the threads against each other).

Other embodiments can also be used. For example, the bracket or surface to which the manifold is mounted may have a portion which extends over the ring and thereby traps it to the manifold when the manifold is secured in place. Other such embodiments will be obvious to one of ordinary skill in the art.

In Figure 4 is shown an embodiment where the ridge 10, again in this example as shown a ramped ridge, is formed on the bowl 11 rather than the manifold 13. The ridge or ridges maintain the position of the ring 12 relative to the bowl 11 and the threads 15 of the ring 12 mate with the threads 18 of the manifold 13 to drive the bowl 11 and manifold 13 relative to one another.

In Figure 5 is shown an embodiment where a snap ring 20 is retained within a raceway 21 for the snap ring 20 and thereby fixes the threaded ring 22 to the desired component, in this embodiment the bowl 23. The threads 24 of the ring 22 mate with the threads 25 of the manifold 26.

In Figure 6 is shown the use of a snap ring 30 within a raceway 31 mounted on the manifold 32 to retain the threaded ring 33. The threads 34 of the ring 33 mate with threads 35 of the bowl 36 which is driven toward and away from the manifold depending upon the direction of rotation of the threaded ring 33.

Figure 7 shows a further embodiment of the present invention and clearly demonstrates what is meant by the term "substantially fixed". In this embodiment, the ring 41 is mounted to the bowl 42 and retained to the bowl 42 by a ridge 43, which in this embodiment is

a circular ring positioned along a portion of the outer surface of the side wall of the bowl 42. The bowl 42 also has a lip 44 which extends outward from the upper portion of the outside surface of the side wall of the bowl 42. The threads 45 of the ring 41 mate with the threads 46 of the manifold 47.

5 As can be seen, there is substantial room between the lip 44 and the ridge 43 along the length of the side wall of the bowl 42. Yet, this embodiment still shows the ring 41 being in a substantially fixed position relative to the bowl 42. By the term "substantially fixed", it is meant that the ring is retained to one component of the housing in such a manner that its travel along the length of the component is less than 50% of that length. Preferably, the amount of
10 travel allowed to the ring relative to the length of the component is less than 25% of the component length.

In other terms, the length of travel of the ring relative to the length of the component should be such that at least for a portion of the rotation of the threads between the ring and the second component, there is a driving force caused by the threads of the ring to move the
15 components affirmatively. Preferably, the length of travel is limited such that the threads of the ring will begin to rotate against those of the other component for some set (as desired by the manufacturer) distance before the ring threads are in a position to positively drive the two components together or apart. In this way, one is staggering the load placed upon the ring making its use easier, quicker and simpler.

20 Alternatively, one can use other devices should as band clamps, lugs, etc to retain the ring in its desired substantially fixed position relative to the component to which it is mounted. The device used to retain the ring in a substantially fixed position relative to the component to which it is attached is not critical so long as it allows the two components to adequately move relative to each other to form a liquid tight seal and to allow the ring to retained in a manner so
25 that it affirmatively drives the two components at least a portion of the way together and apart as desired.

Preferably the housing of the present invention is used in conjunction with a unitary filter/bowl assembly such as is described in the co-pending US Application, 60/103,646 filed October 09,1998 the teachings of which are incorporated herein in their entireties. In this

embodiment the filter cartridge is positively retained within the bowl and travels with it. In one embodiment the bowl and cartridge are formed as an integral disposable unit. In another the cartridge is held to the inner surface of the bowl through the use of a twist or bayonet type flange on the cartridge which rotates in a slot formed on the inner side wall of the bowl. The use of other attachment devices such as lugs or pins which slide and are retained within slots formed in the inner side wall of the bowl are also described. Regardless of the means used to do so, that device coupled with the present invention provides an extremely valuable device in that it allows one to limit the space below the manifold needed to remove the bowl and cartridge and that allows one to easily attach and detach the bowl from the manifold. In prior device designs, one first needed to remove the bowl from the manifold and then remove the cartridge from the manifold. This meant that one needed to leave space slightly greater than the length of the bowl in order to remove the device and replace the cartridge. This was a waste of valuable space within a filtration device. Additionally, with the use of the substantially fixed position ring of the present invention, one can easily attach and detach the bowl from the manifold and can do so usually with one hand and often without the use of any wrench, which was often required in order to free the bowl from the manifold.

The selection of filtration media used within the filtration cartridge can be any of those commonly used in the industry. Typically, the media includes but is not limited to flat sheet membrane, spiral wound flat sheet membrane, pleated flat sheet membrane, spiral pleated flat sheet membrane, hollow fiber membrane, depth filter media such as spiral wound continuous fiber depth filter media, sintered metal filter media, ceramic media, particulate media containing an active capture material such as resin or ceramic beads or a membrane with ligands for removing selected materials from the fluid attached to their surfaces, ion exchange media such as anion resin, cation resin or mixtures of the two alone or incorporated into a membrane structure and combinations of any of these.

This media may be formed of any material typically used in filtration such as paper, other cellulosic materials such as regenerated cellulose or nitrocellulose, glass fiber and fabric, metal such as stainless steel, nickel, chromium and alloys and blends thereof, ceramics, plastics, preferably thermoplastic materials such as polyolefins, including polyethylene such as ultrahigh molecular weight polyethylene, polypropylene and the like; homopolymers, copolymers or terpolymers of polyolefins; PVDF, PTFE resin, PFA and other fluorinated resins,

in particular, perfluorinated thermoplastic resins; PVC; nylons; polyamides; polysulphones; modified polysulphones such as polyethersulphones, polyarylsulphones and polyphenylsulphones; polyimides; polycarbonates; PET and the like.

- 5 Lastly, in all of these embodiments the bowl and manifold may be made of a plastic, preferably a thermoplastic including polyolefins such as polyethylenes including ultrahigh molecular weight polyethylenes, polypropylenes; copolymers or terpolymers of polyolefins; nylons; PTFE resin, PFA, PVDF, ECTFE, and other fluorinated resins, particularly perfluorinated thermoplastic resins; polycarbonates; metallocene derived polymers, polysulphones; modified polysulphones such as polyethersulphone, polyarylsulphones or
- 10 polyphenylsulphones; any glass or other reinforced plastic; or a metal such as stainless steel, aluminum, copper, bronze, brass, nickel, chromium or titanium or alloys or blends thereof.

**What is claimed:**

1. A filter housing comprising a first and second component, a threaded ring retained in a substantially fixed position relative to the first component, the second component having threads which are capable of mating with the threads of the ring and the ring is used to drive
5 the first component and second component together and apart.
2. A filter housing comprising a manifold and a bowl, the manifold having a series of threads formed on its outer surface, the bowl having a ring with threads on its inner surface which mate with the threads of the manifold, the ring being secured to the bowl so as to maintain a substantially fixed position on the vertical axis of the ring.
- 10 3. A filter housing comprising a manifold and a bowl, the bowl having a series of threads formed on its outer surface, the manifold having a ring with threads on its inner surface which mate with the threads of the bowl, the ring being secured to the manifold so as to maintain a substantially fixed position on the vertical axis of the manifold.
4. The housing of claims 1 or 2 wherein the ring is secured to the bowl via a keyway and
15 a key formed on the inner surface of the ring and mounted within the keyway of the bowl.
5. The housing of claims 1 or 3 wherein the ring is secured to the manifold via a keyway and a key formed on the inner surface of the ring and mounted within the keyway of the manifold.
6. The housing of claims 1 or 2 wherein the ring is secured to the bowl via a ridge formed
20 below the ring on the outer surface of the bowl.
7. The housing of claims 1 or 3 wherein the ring is secured to the manifold via a ridge formed above the ring on the outer surface of the manifold.
8. The housing of claims 1, 2 or 3 wherein the ring is secured via a snap ring secured to the surface of the component to which the ring is attached.



9. The housing of claims 1, 2 or 3 wherein the ring drives the housing and manifold together and apart as the threads are rotated in an appropriate direction relative the threads of the component which has threads mounted upon it.
10. The housing of claims 1, 2 or 3 wherein the housing, ring and manifold are formed of a material selected from the group consisting of metal and plastic.
11. The housing of claims 1, 2 or 3 wherein the housing, ring and manifold are formed of a metal selected from the group consisting of stainless steel aluminum, copper, bronze, brass, chromium, titanium, alloys and blends thereof.
12. The housing of claims 1, 2 or 3 wherein the housing, ring and manifold are formed of a plastic selected from the group consisting of PTFE resin, PFA, PVDF, ECTFE, fluorinated polymers and copolymers, perfluorinated thermoplastic polymers and copolymers, polyolefin homopolymers, copolymers and terpolymers, ultrahigh molecular weight polyethylene, metallocene derived polymers, PVC, nylons, polysulphones, polyethersulphones, polyarylsulphones, polyphenylsulphones, polycarbonates, polyamides, polyimides and blends thereof.