US011639599B2

(12) **United States Patent**
Mesun et al.

(10) **Patent No.: US 11,639,599 B2**
(45) **Date of Patent: May 2, 2023**

(54) **FLUID CONNECTOR FOR TOILET**

(71) Applicant: **Kohler Co.**, Kohler, WI (US)

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(73) Assignee: **Kohler Co.**, Kohler, WI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **17/681,330**

(22) Filed: **Feb. 25, 2022**

(65) **Prior Publication Data**

US 2022/0178130 A1 Jun. 9, 2022

Related U.S. Application Data

(63) Continuation of application No. 16/788,570, filed on Feb. 12, 2020, now Pat. No. 11,299,877.
(Continued)

(51) **Int. Cl.**
E03D 11/13 (2006.01)
E03D 11/18 (2006.01)

(52) **U.S. Cl.**
CPC ***E03D 11/13*** (2013.01); ***E03D 11/18*** (2013.01)

(58) **Field of Classification Search**
CPC E03D 11/13; E03D 11/18; E03D 5/00; E03D 11/00; E03D 11/03
(Continued)

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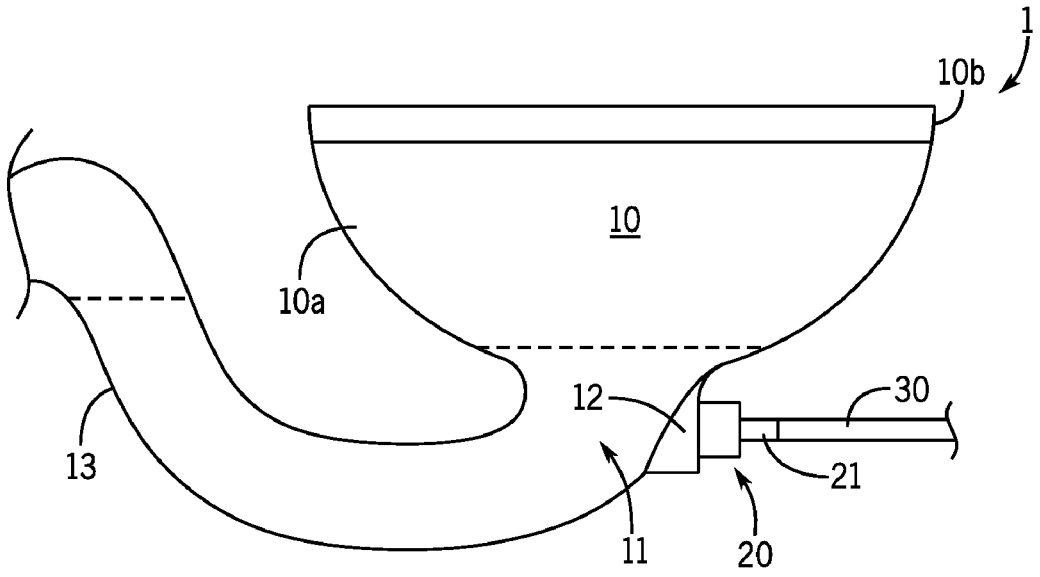
Primary Examiner — Benjamin R Shaw
(74) *Attorney, Agent, or Firm* — Lempia Summerfield Katz LLC

(57) **ABSTRACT**

A toilet assembly includes a toilet, a non-vitreous fluid delivery component, and a connector assembly. The non-vitreous fluid delivery component is coupled to, and in fluid communication with, the toilet. The connector assembly couples the non-vitreous fluid delivery component to the toilet in a substantially watertight manner. The connector assembly includes a connector body, a nut adjustably coupled to the connector body, and a sealing member disposed on the connector body. The nut is configured to be adjusted relative to the connector body to cause the connector body to compress the sealing member against a portion of the toilet, such that the sealing member creates a substantially watertight seal between the toilet and the connector body.

15 Claims, 21 Drawing Sheets



Related U.S. Application Data

(60) Provisional application No. 62/811,988, filed on Feb. 28, 2019.

(58) **Field of Classification Search**
USPC 4/425
See application file for complete search history.

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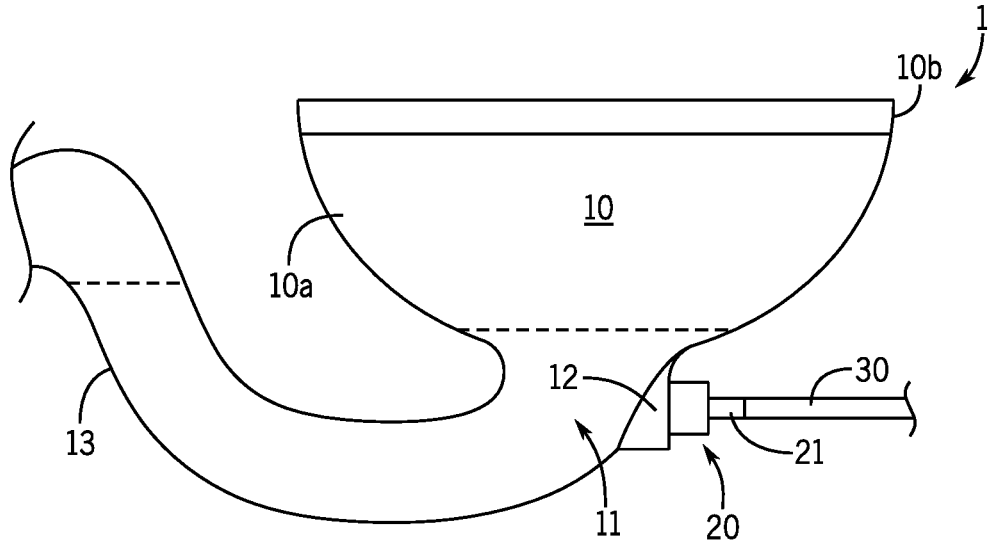
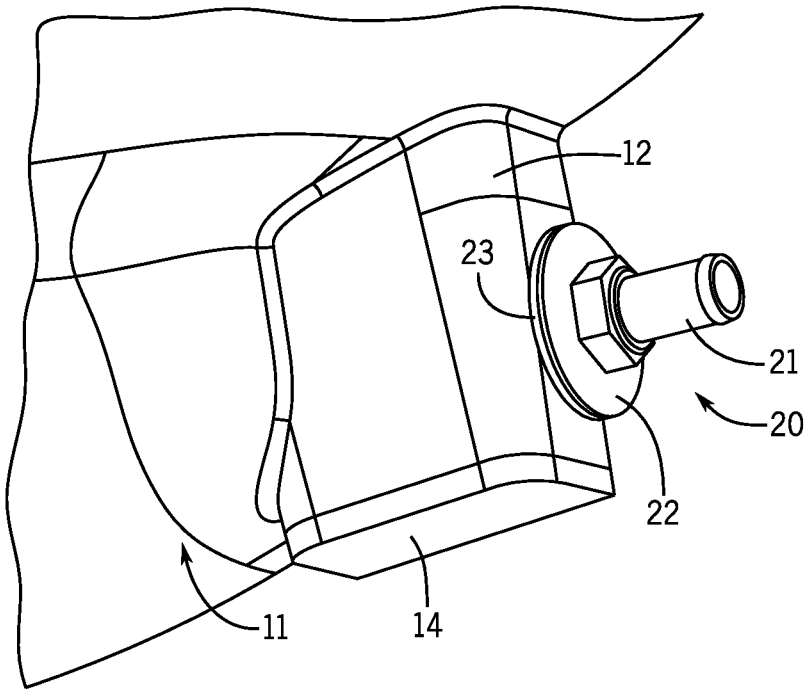


FIG. 1



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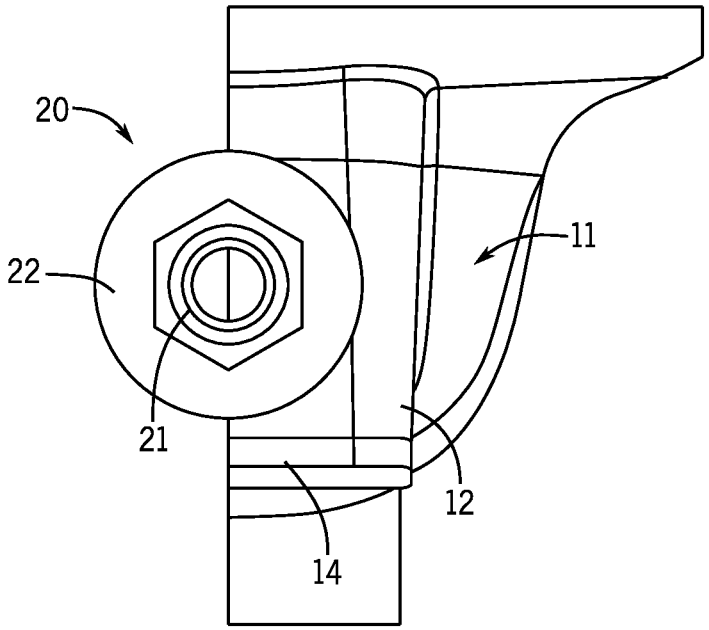
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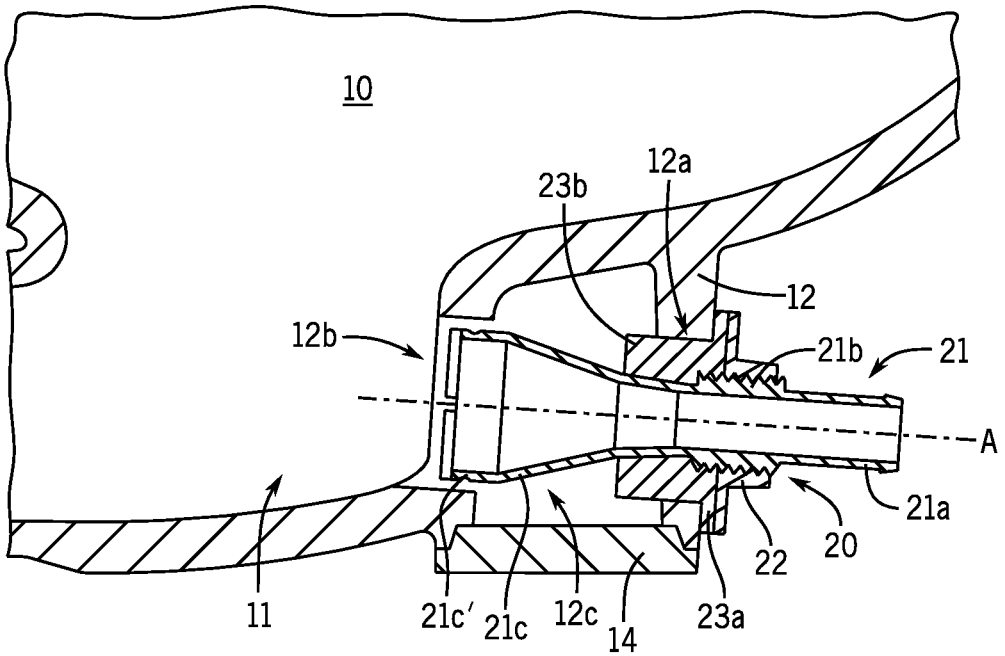
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FIG. 4

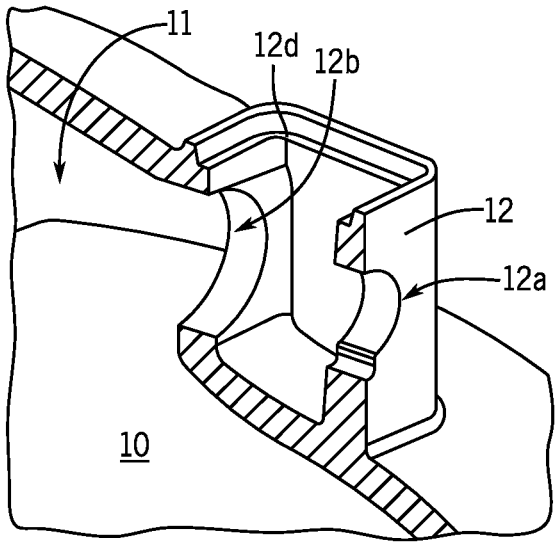
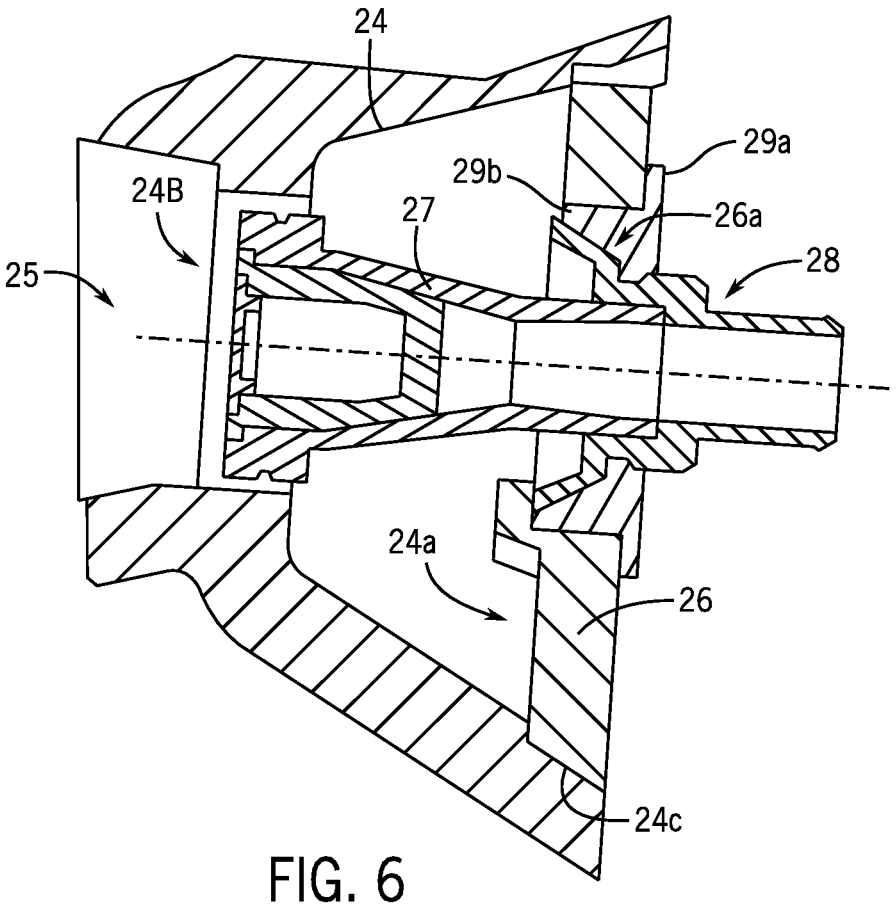


FIG. 5



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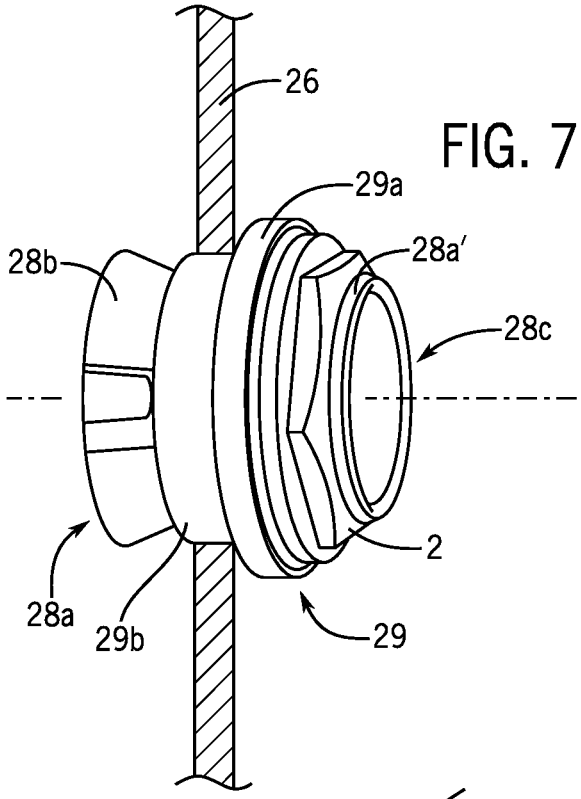

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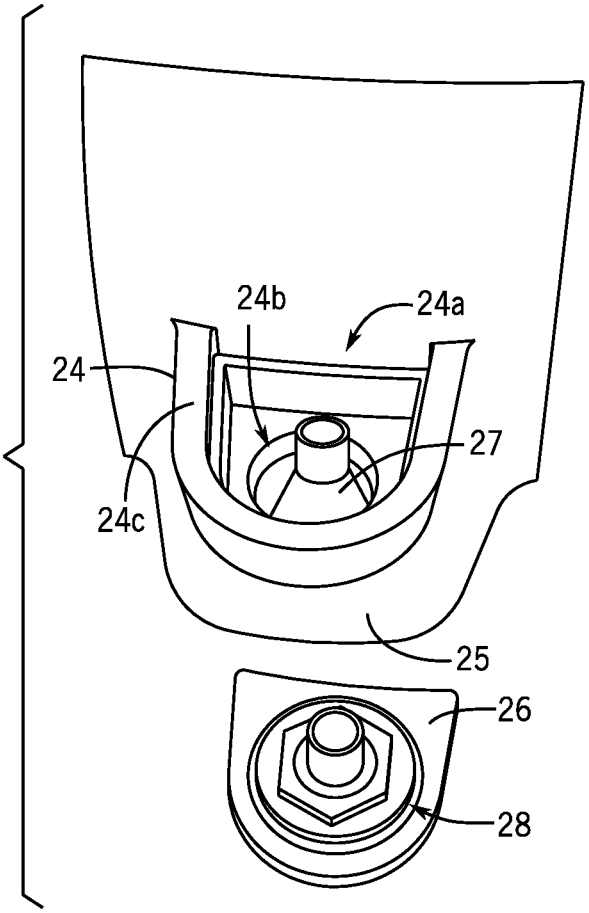

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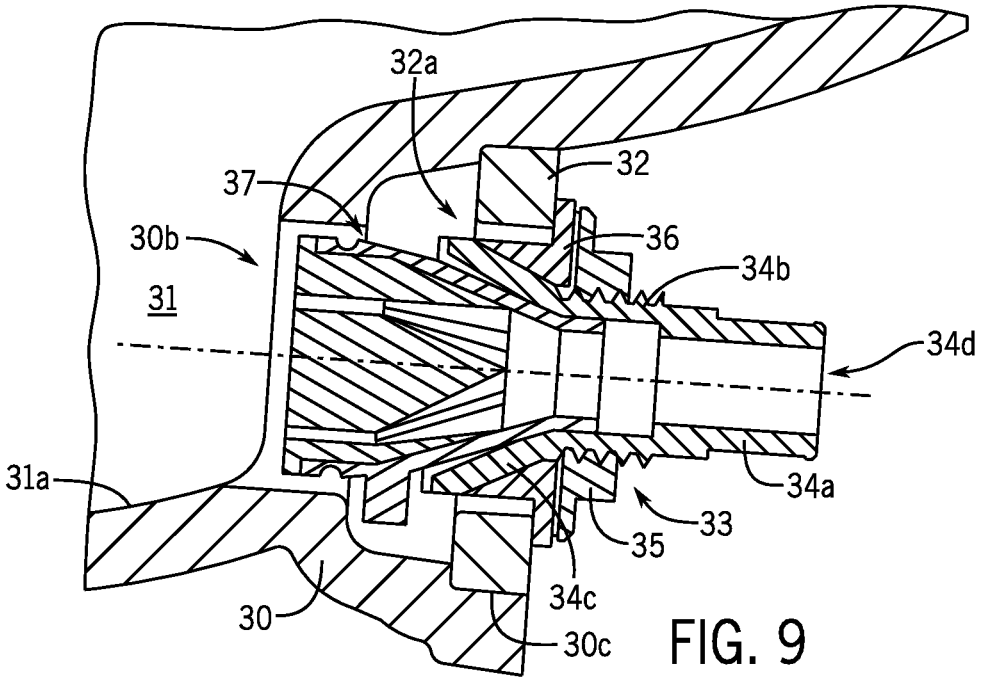

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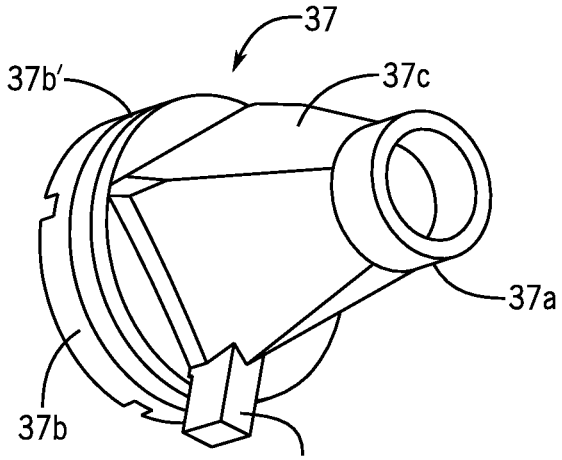

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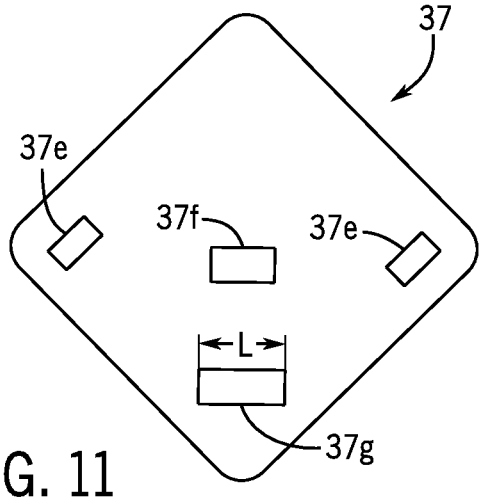

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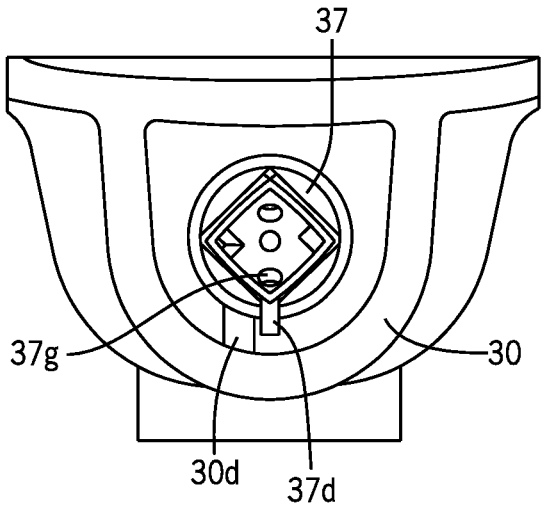

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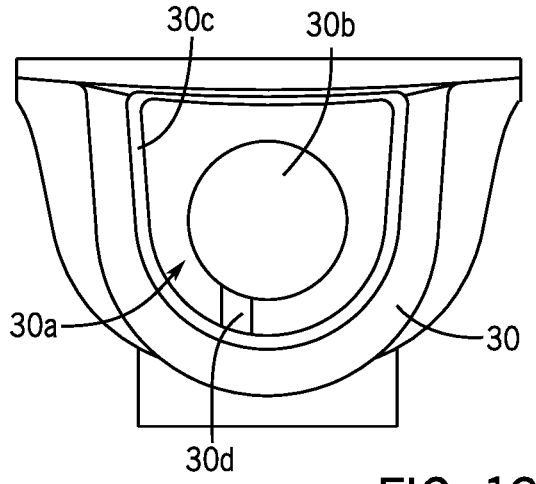

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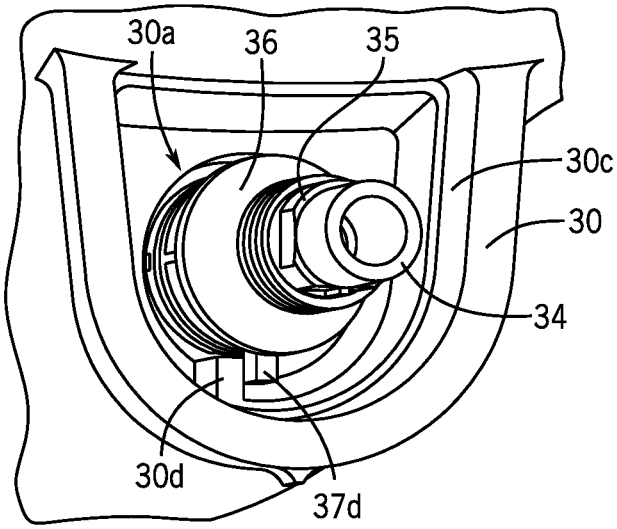

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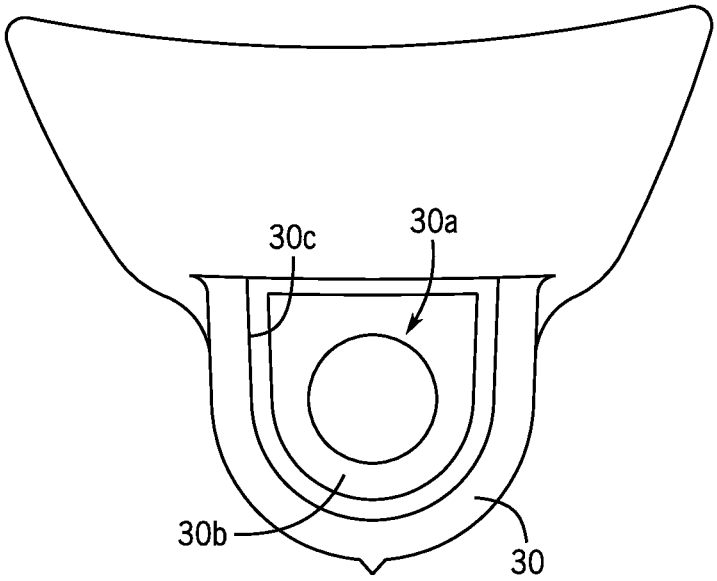


FIG. 15

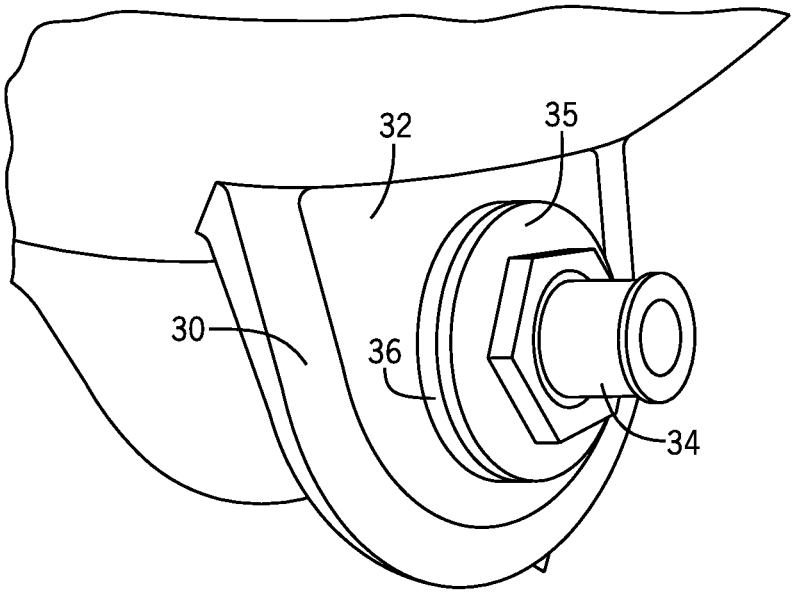


FIG. 16

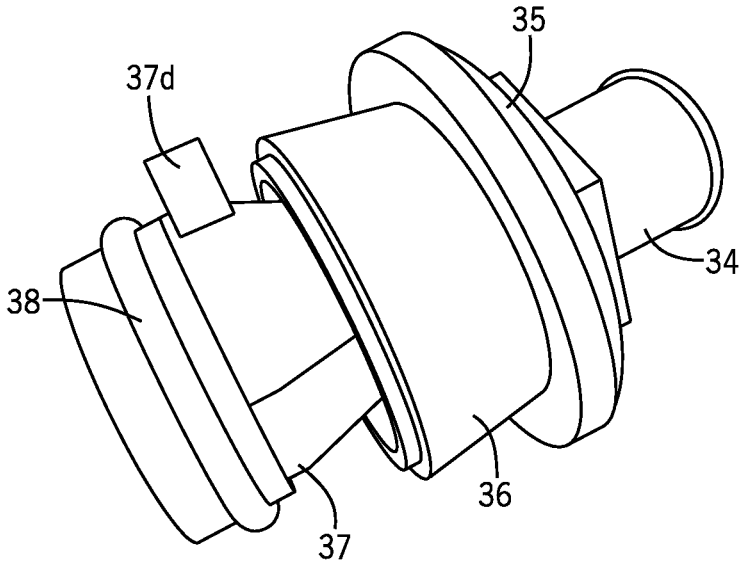
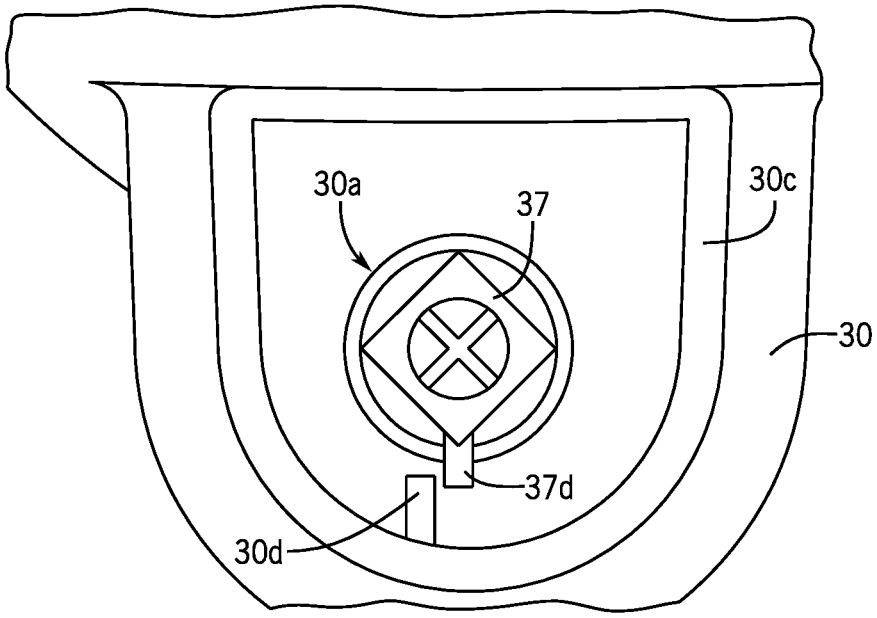


FIG. 17



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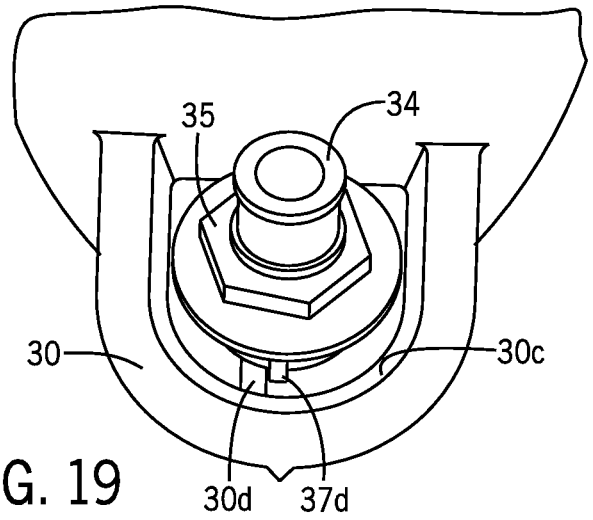

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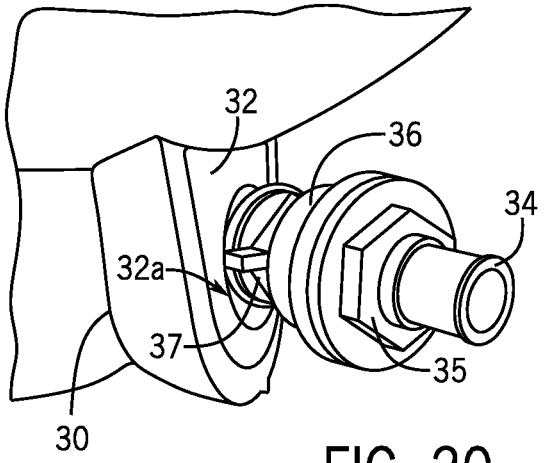

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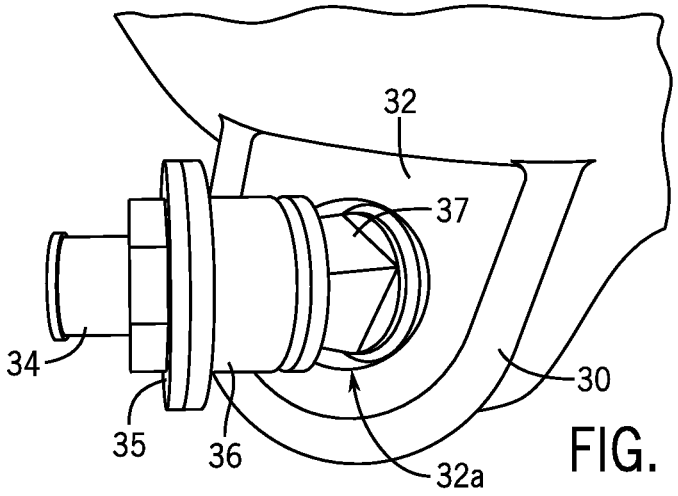

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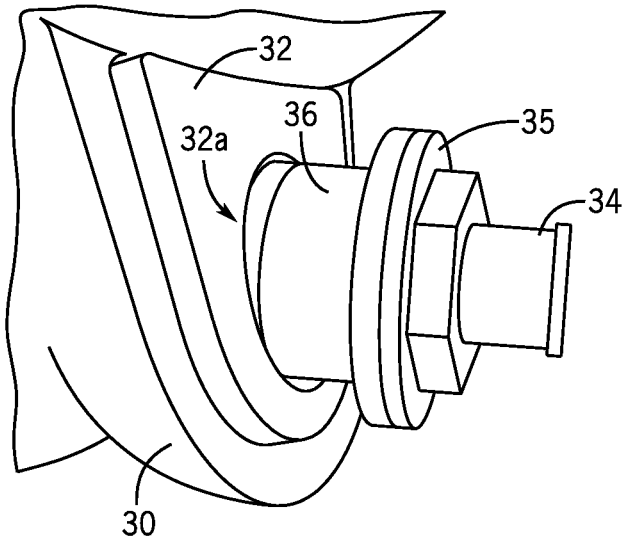
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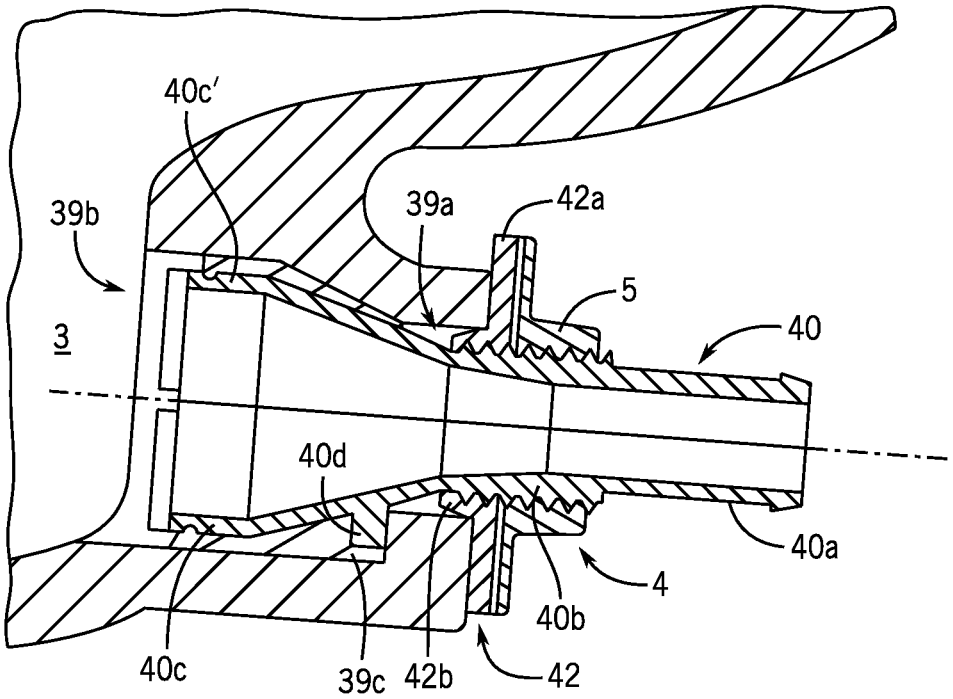
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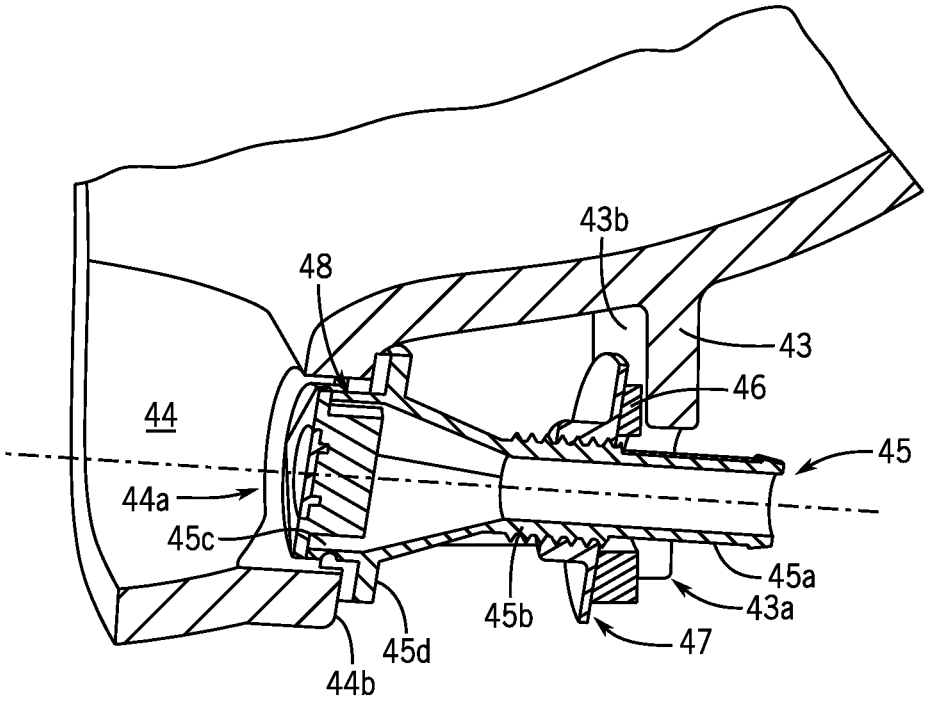
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FIG. 24

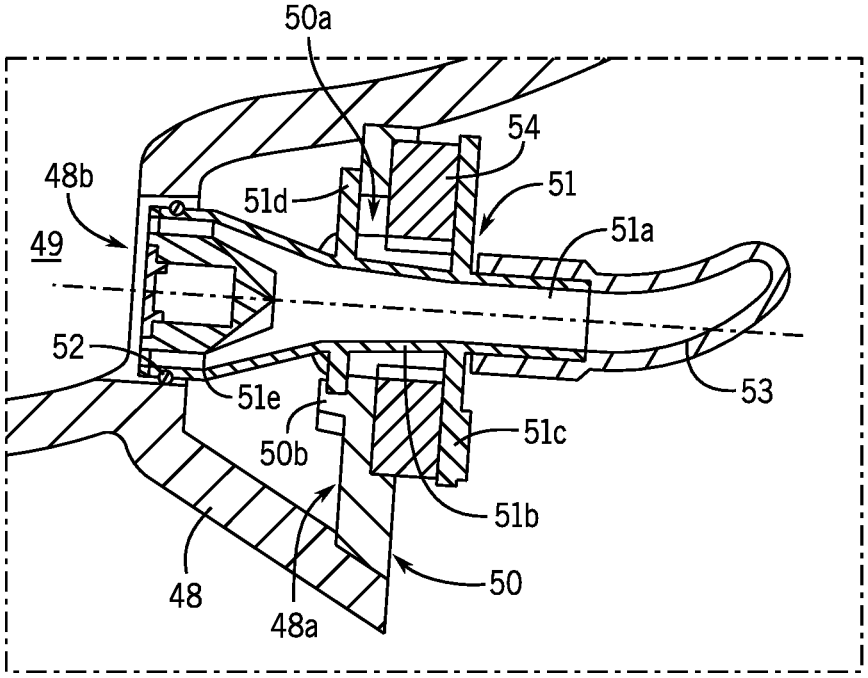
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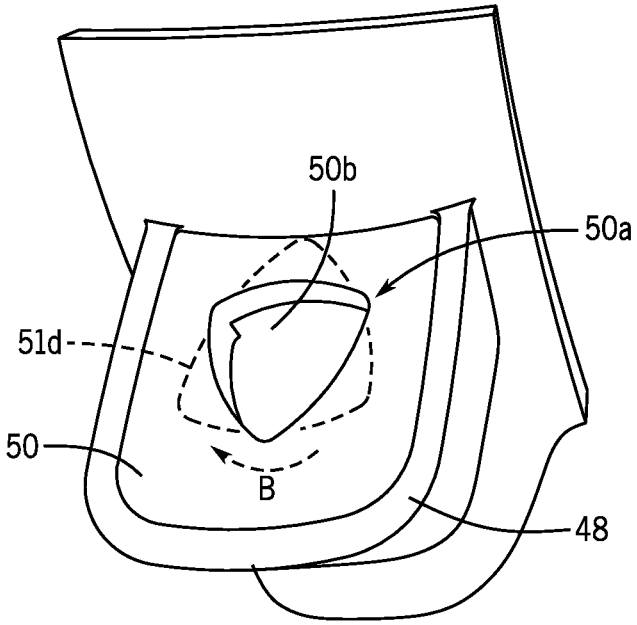
FIG. 25



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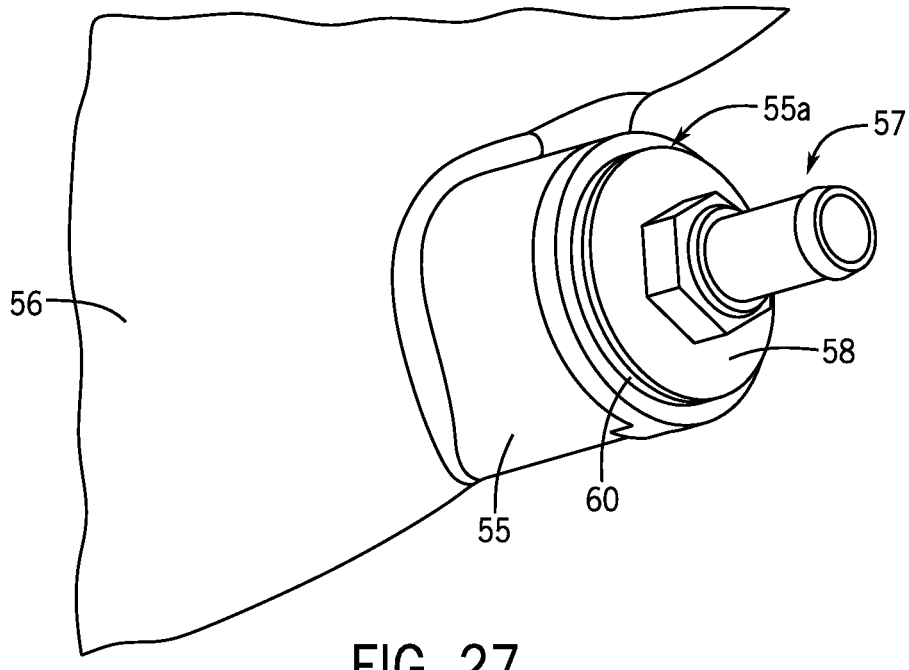
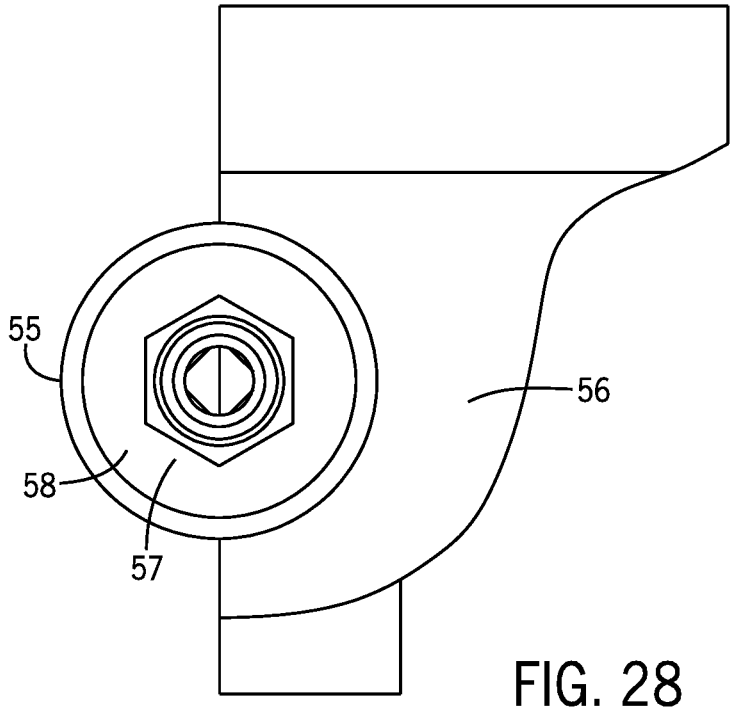


FIG. 27



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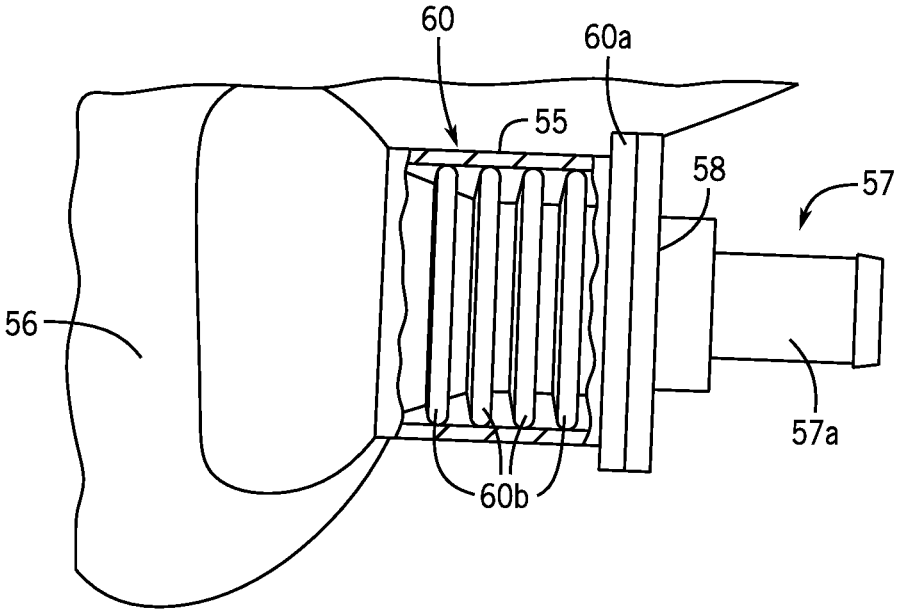


FIG. 29

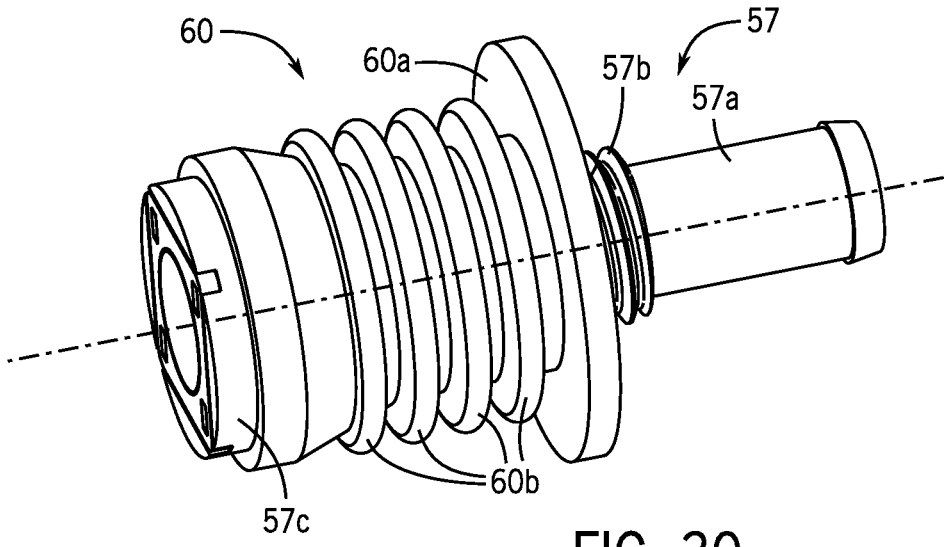
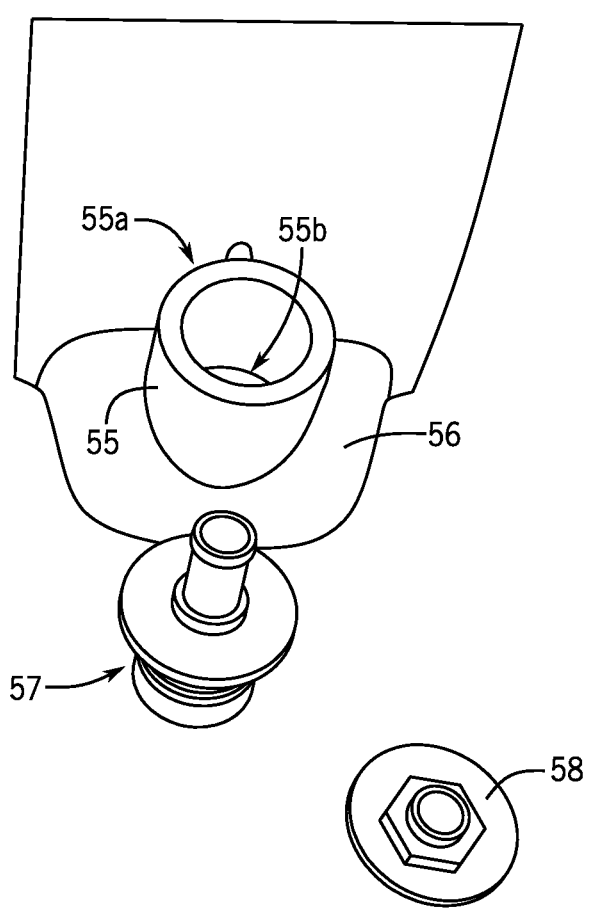


FIG. 30



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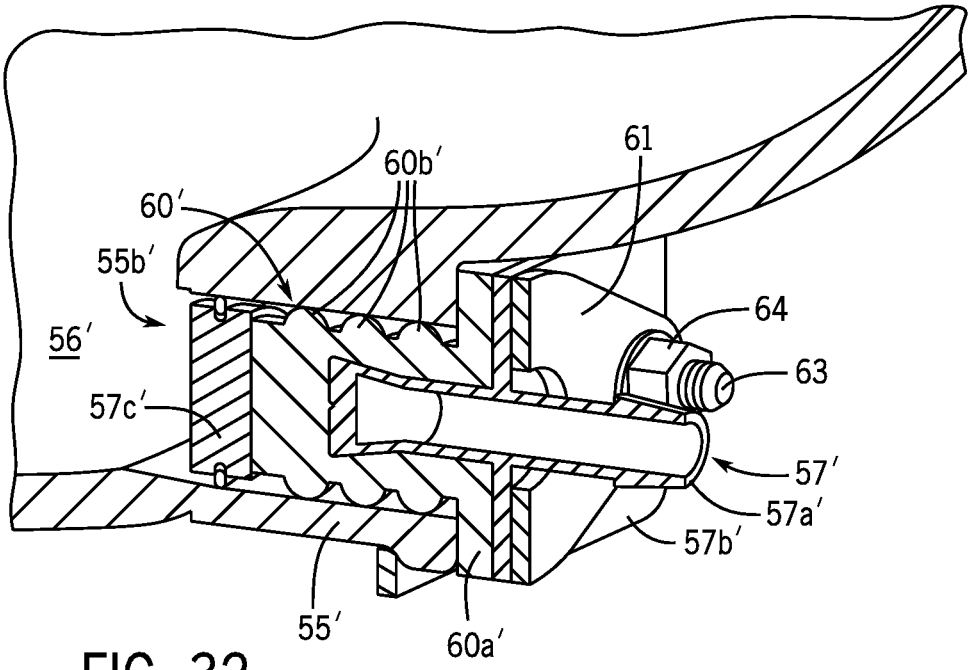

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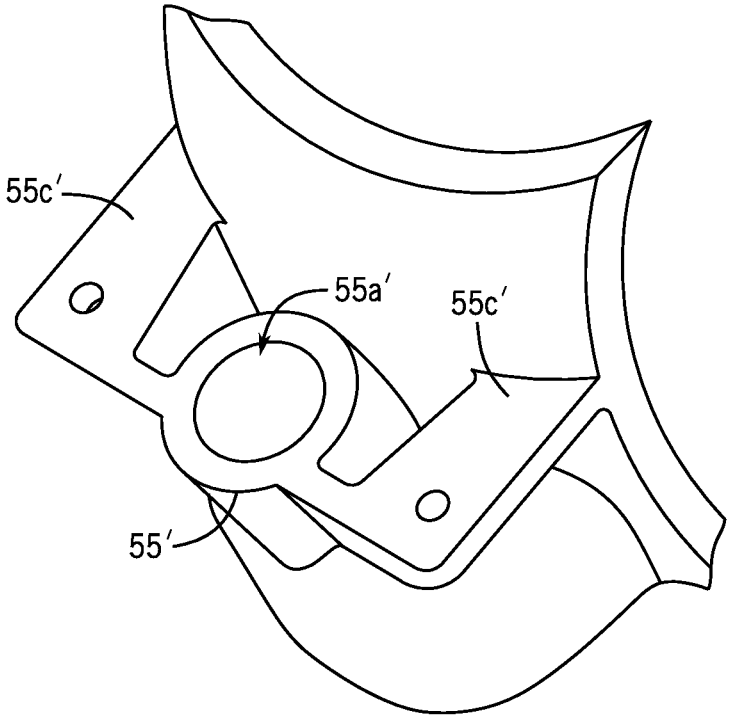

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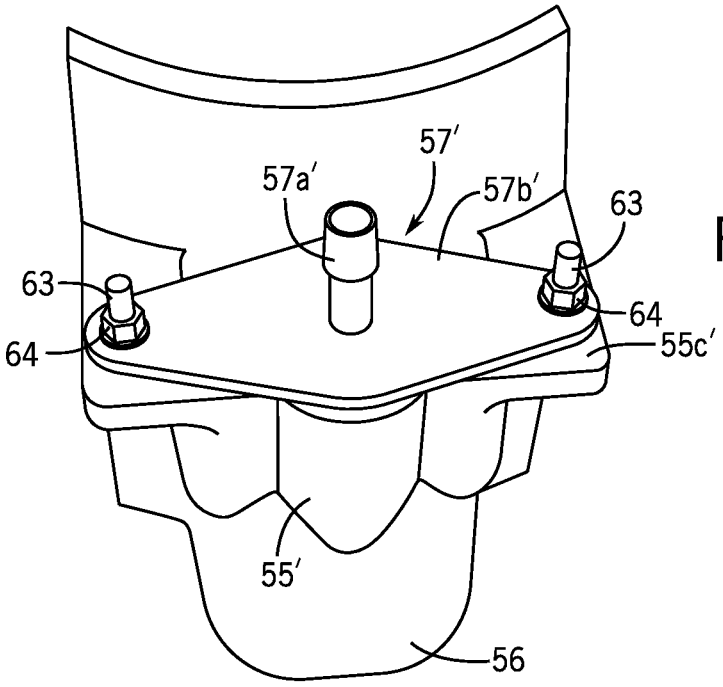

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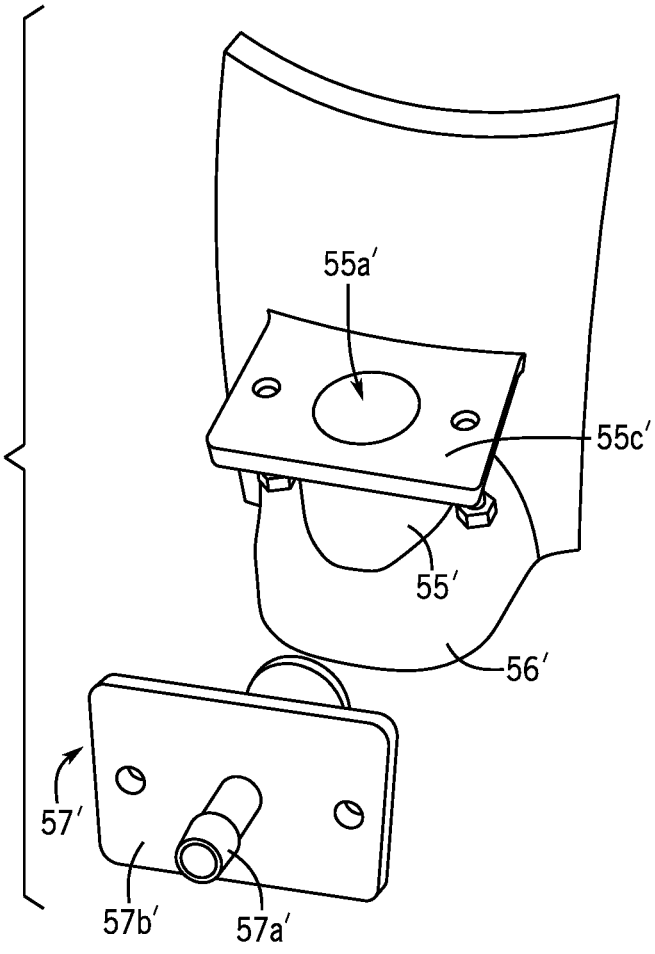

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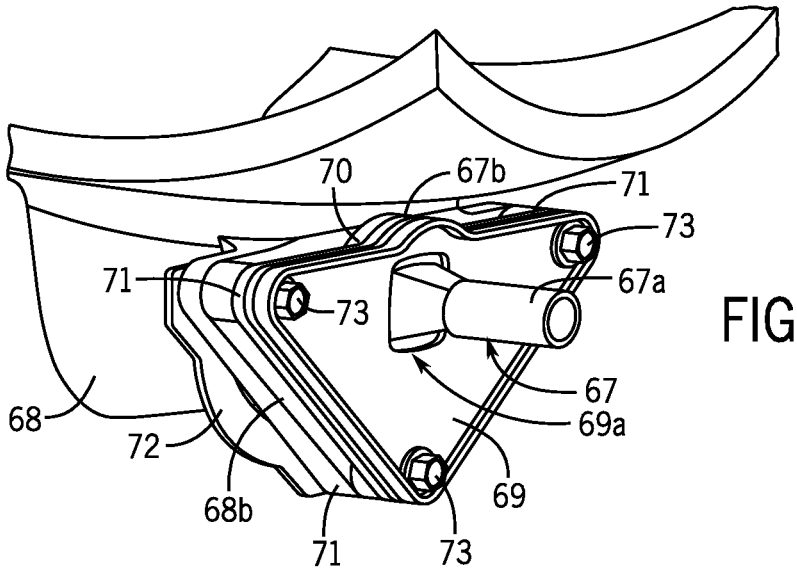
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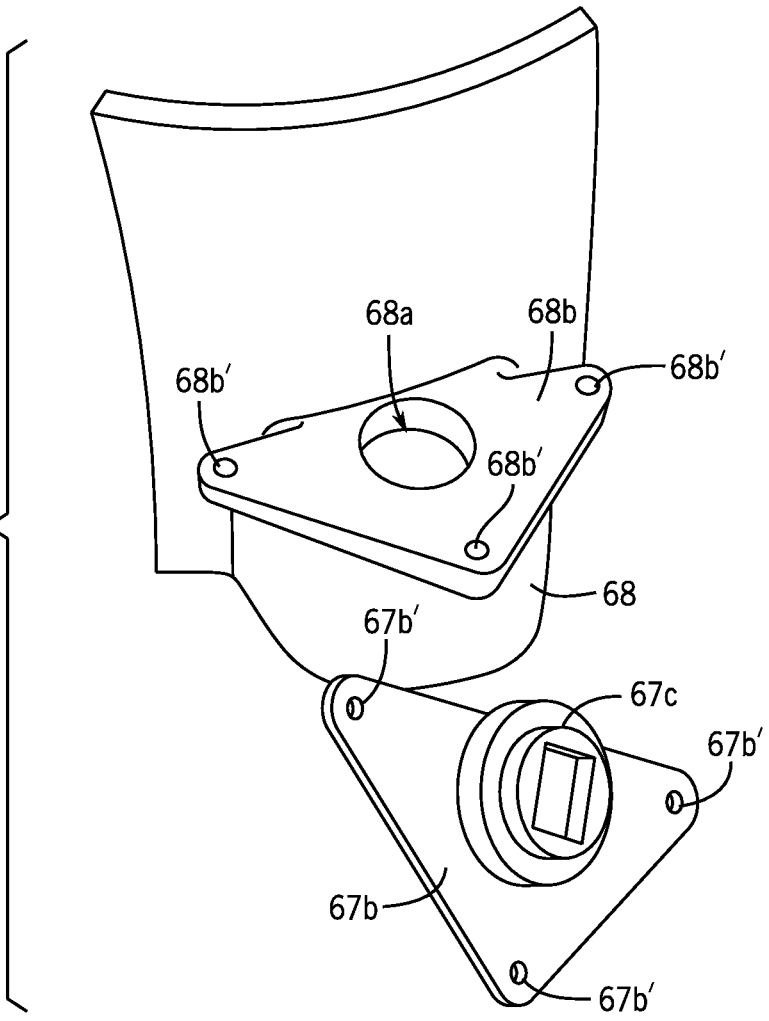
FIG. 36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67b′

FIG. 37

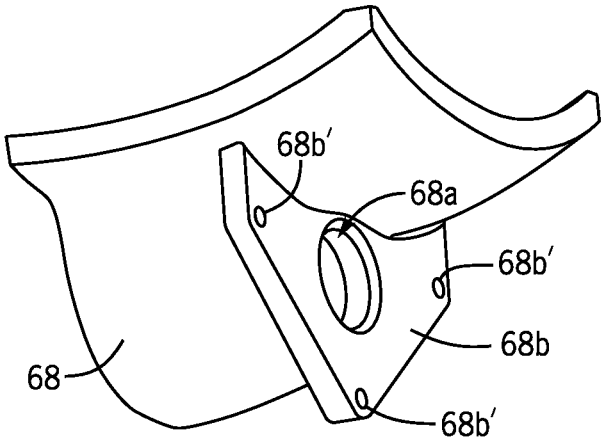

FIG. 38

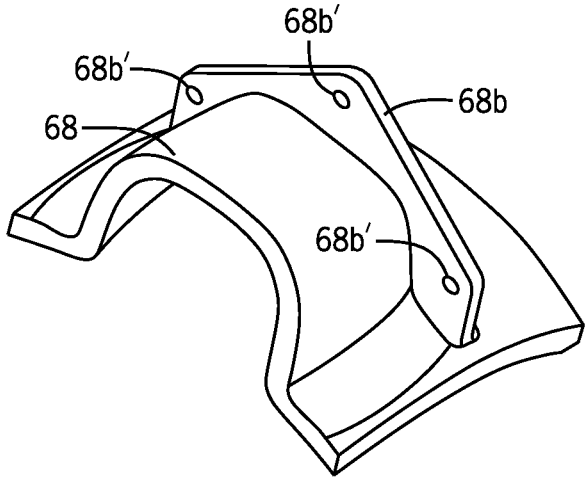

FIG. 39

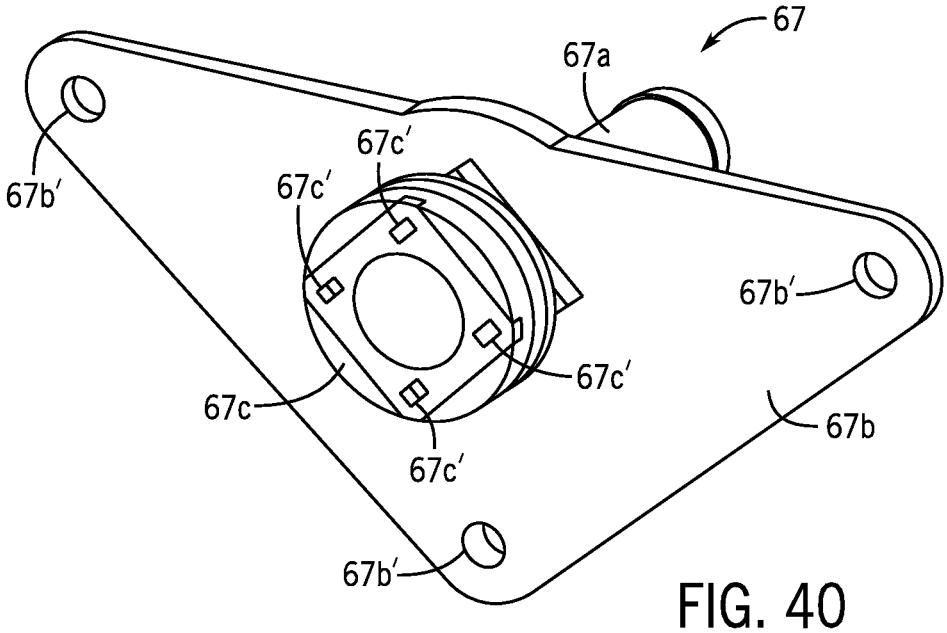

FIG. 40

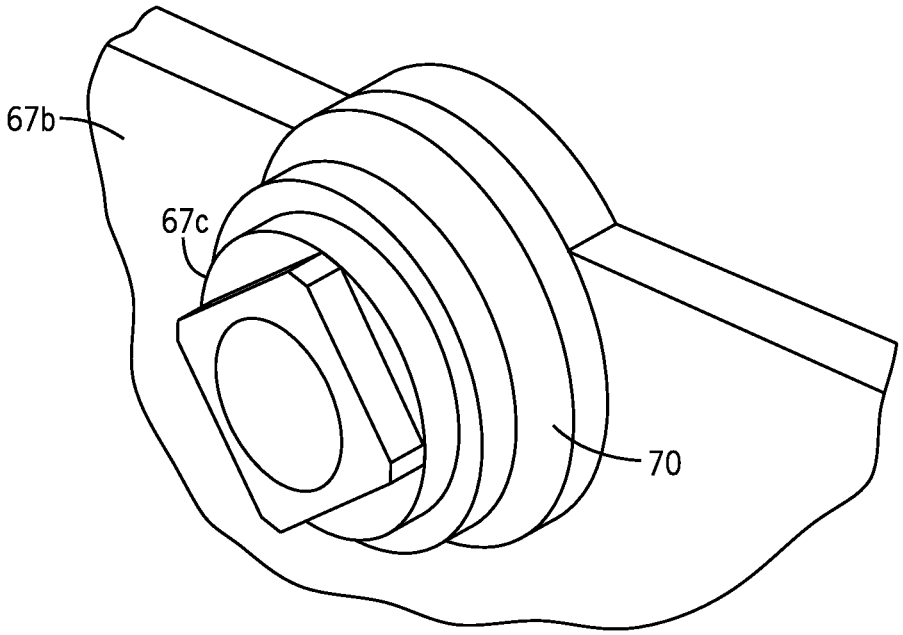

FIG. 41

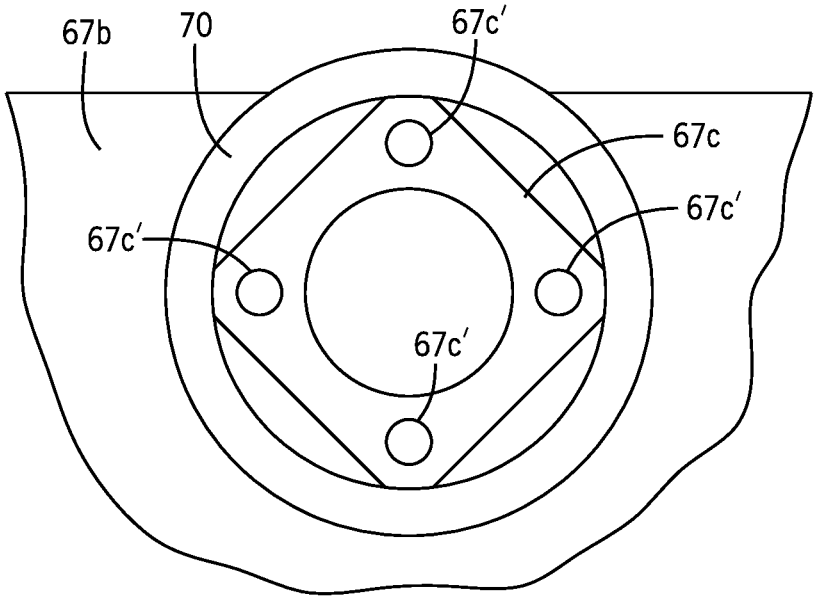

FIG. 42

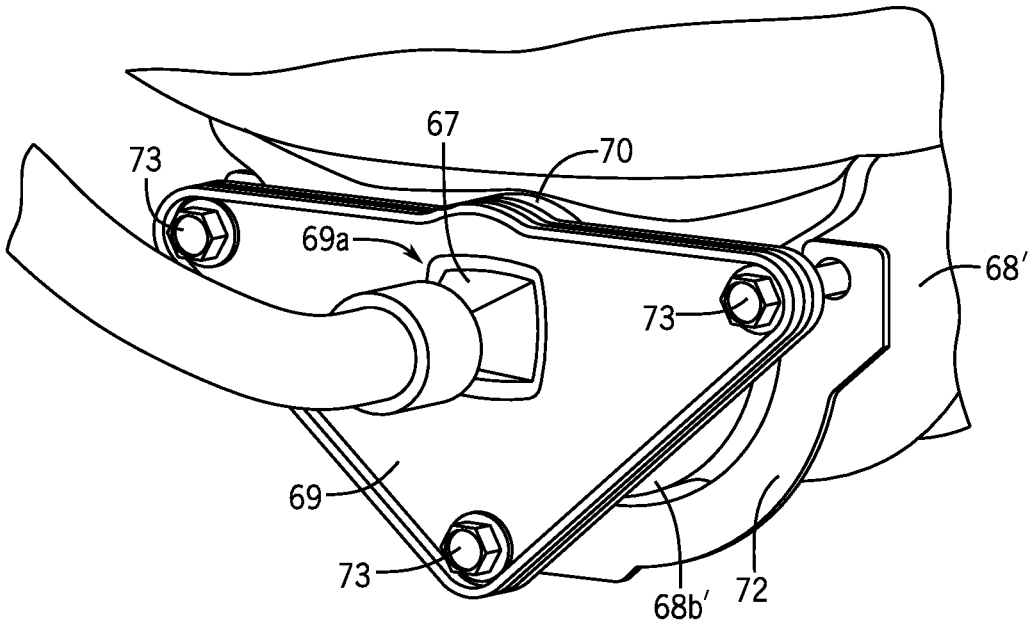

FIG. 43

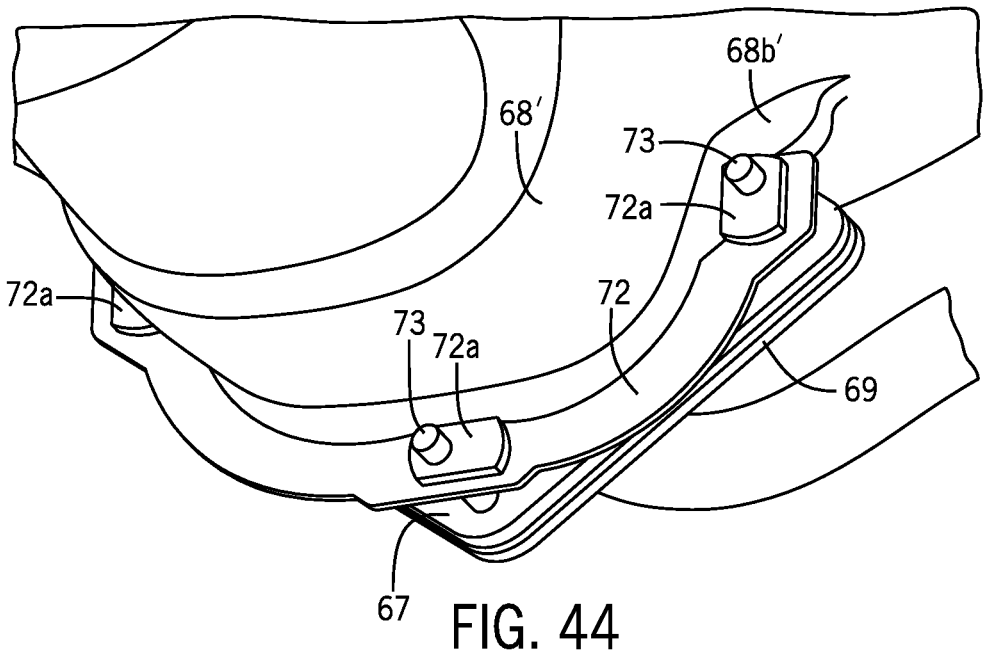

FIG. 44

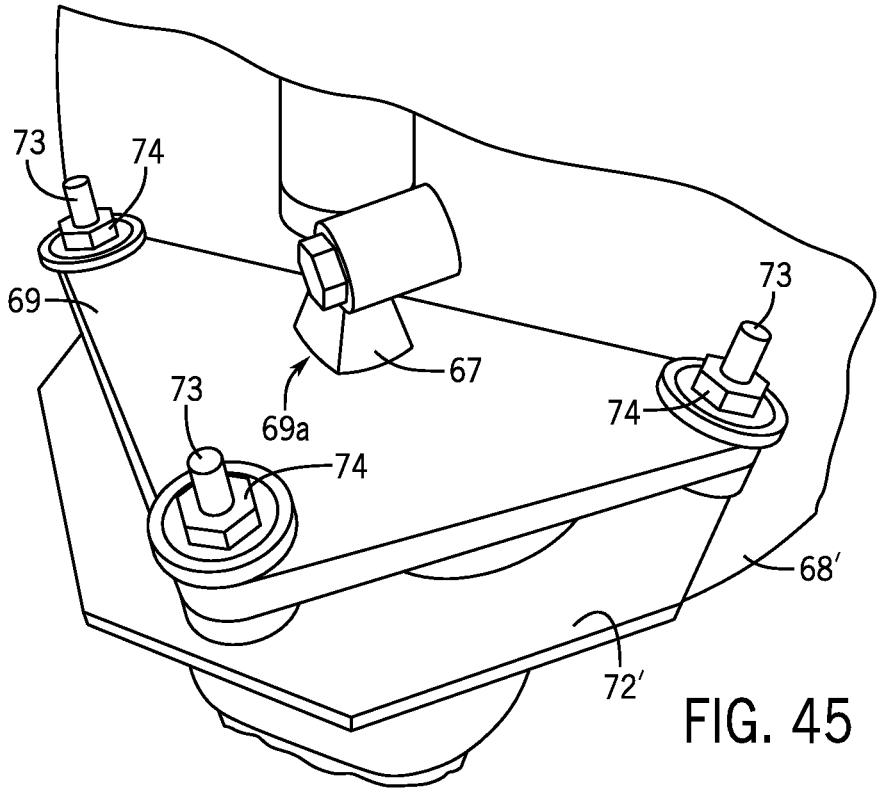

FIG. 45

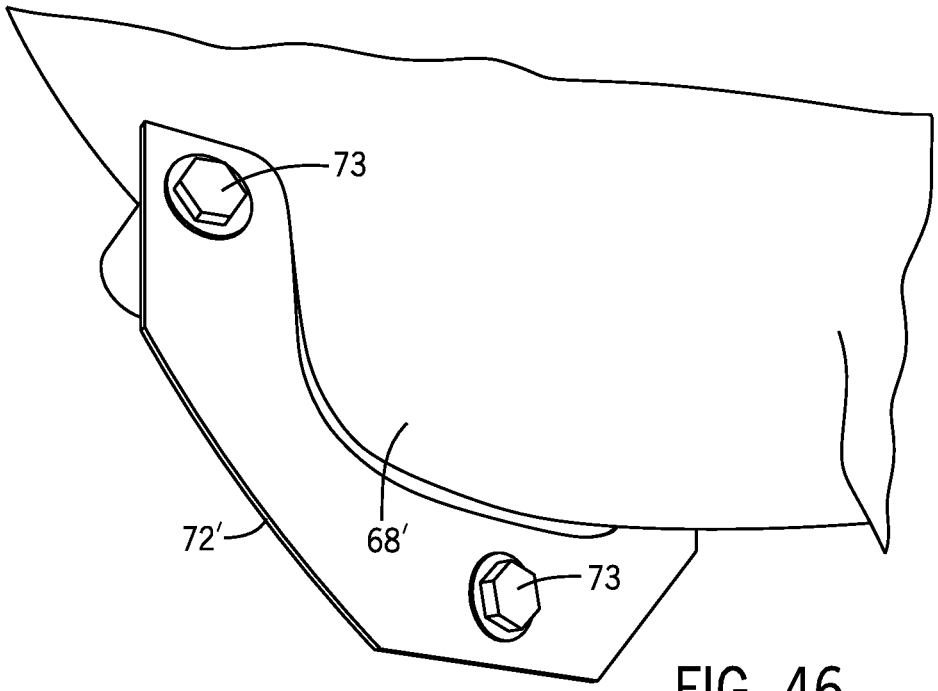

FIG. 46

FLUID CONNECTOR FOR TOILET

CROSS-REFERENCE TO RELATED PATENT APPLICATION

This application is a Continuation of U.S. patent application Ser. No. 16/788,570 filed Feb. 12, 2020, which claims the benefit of and priority to U.S. Provisional Patent Application No. 62/811,988, filed Feb. 28, 2019, the entire disclosures of which is are incorporated herein by reference.

BACKGROUND

The present application relates generally to the field of connectors for fluidly coupling a non-vitreous fluid delivery component to a vitreous plumbing fixture, such as a toilet.

Generally speaking, a toilet can include various openings for fluidly coupling a fluid delivery component (e.g., conduit, sump jet, etc.) to the toilet, such as at a sump or a rim of the toilet. Most toilets are typically made from a vitreous material, which can present significant challenges for connecting a component that is made from a non-vitreous material (e.g., plastic, etc.) to the toilet in a watertight manner. Specifically, most non-vitreous components do not bond to vitreous material. Thus, conventional techniques of joining two vitreous components together may not be used to couple a non-vitreous component to a toilet.

Accordingly, it would be advantageous to provide a connector between a non-vitreous fluid delivery component and a vitreous toilet to ensure a substantially watertight connection between the fluid delivery component and the toilet.

SUMMARY

One embodiment relates to a toilet assembly. The toilet assembly includes a toilet, a non-vitreous fluid delivery component, and a connector assembly. The non-vitreous fluid delivery component is coupled to, and in fluid communication with, the toilet. The connector assembly couples the non-vitreous fluid delivery component to the toilet in a substantially watertight manner. The connector assembly includes a connector body, a nut adjustably coupled to the connector body, and a sealing member disposed on the connector body. The nut is configured to be adjusted relative to the connector body to cause the connector body to compress the sealing member against a portion of the toilet, such that the sealing member creates a substantially watertight seal between the toilet and the connector body.

Another embodiment relates to a connector assembly for coupling a non-vitreous fluid delivery component to a toilet. The connector assembly includes a connector body, a nut adjustably coupled to the connector body, and a sealing member disposed on the connector body. The nut is configured to be adjusted relative to the connector body to cause the connector body to compress the sealing member against a portion of the toilet, such that the sealing member creates a substantially watertight seal between the toilet and the connector body.

Another embodiment relates to a sump jet assembly for a toilet. The sump jet assembly includes a non-vitreous sump jet configured to be coupled to, and in fluid communication with, a sump of the toilet. The sump jet assembly further includes a connector assembly for coupling the non-vitreous sump jet to the toilet in a substantially watertight manner. The connector assembly includes a connector body, a nut adjustably coupled to the connector body, and a sealing member disposed on the connector body. The nut is configured to be adjusted relative to the connector body to cause the connector body to compress the sealing member against a portion of the toilet, such that the sealing member creates a substantially watertight seal between the toilet and the connector body.

In some exemplary embodiments, the connector body includes a first portion for fluidly coupling to a conduit, a second portion extending from the first portion, the second portion including threads for threadably engaging the nut, and a third portion extending from the second portion, wherein the sealing member is disposed on the third portion.

In some exemplary embodiments, the third portion has a frusto-conical shape, and the connector body includes an opening extending through each of the first, second, and third portions.

In some exemplary embodiments, the sealing member includes a body and a flange, the flange extending radially away from an end of the body, and the sealing member is arranged on the connector body with the flange facing toward the first portion and the body facing toward the third portion.

In some exemplary embodiments, the toilet includes an opening for receiving at least a portion of the body therethrough, and the flange is engaged with a surface of the toilet adjacent the opening.

In some exemplary embodiments, the body of the sealing member extends radially outwardly in the opening of the toilet in response to tightening of the nut on the connector body so as to create the substantially watertight seal between the toilet and the connector body.

In some exemplary embodiments, the toilet includes a sump, and the non-vitreous fluid delivery component is a sump jet that is coupled to the sump.

In some exemplary embodiments, the toilet is made from at least one of a vitreous material, an epoxy material, or a ceramic material.

In some exemplary embodiments, the non-vitreous fluid delivery component is integrally formed with the connector body.

In some exemplary embodiments, the non-vitreous fluid delivery component is coupled to the connector body.

This summary is illustrative only and is not intended to be in any way limiting.

BRIEF DESCRIPTION OF THE FIGURES

The disclosure will become more fully understood from the following detailed description, taken in conjunction with the accompanying figures, wherein like reference numerals refer to like elements, in which:

FIG. **1** is a schematic view of a toilet assembly including a toilet and a non-vitreous fluid delivery component coupled to the toilet according to an exemplary embodiment.

FIG. **2** is a partial perspective view of the toilet assembly of FIG. **1**.

FIG. **3** is a partial front view of the toilet assembly of FIG. **1**.

FIG. **4** is a partial cross-sectional view of the toilet assembly of FIG. **1**.

FIG. **5** is a partial cutaway view of the toilet of FIG. **1**.

FIG. **6** is a partial cross-sectional view of a non-vitreous fluid delivery component coupled to a toilet according to another exemplary embodiment.

FIG. **7** is a partial cross-sectional view of a connector assembly of FIG. **6**.

FIG. **8** is a perspective view of a prototype version of the non-vitreous fluid delivery component, toilet, and connector assembly of FIG. **6**.

FIG. **9** is a partial cross-sectional view of a toilet assembly including a non-vitreous fluid delivery component coupled to a toilet according to another exemplary embodiment.

FIG. **10** is a perspective view of the non-vitreous fluid delivery component of FIG. **8**.

FIG. **11** is a partial front view of the non-vitreous fluid delivery component of FIG. **8**.

FIG. **12** is a partial front view of the assembly of FIG. **9** without a connector.

FIG. **13** is a partial front view of the toilet of FIG. **9**.

FIG. **14** is a partial perspective view of the assembly of FIG. **9** with a connector.

FIG. **15** is a front view of a prototype version of a portion of the toilet of FIG. **9**.

FIG. **16** is a perspective view of a prototype version of the assembly of FIG. **9**.

FIG. **17** is a perspective view of a prototype version of the non-vitreous fluid delivery component and connector of FIG. **9**.

FIG. **18** is a partial front view of a prototype version of the assembly of FIG. **9** without a connector.

FIG. **19** is a partial front view of a prototype version of the assembly of FIG. **9** with a connector.

FIGS. **20-22** illustrate a method of assembling a prototype version of the non-vitreous fluid delivery component of FIG. **9** to a toilet according to another exemplary embodiment.

FIG. **23** is a partial cross-sectional view of a toilet assembly including a non-vitreous fluid delivery component coupled to a toilet according to another exemplary embodiment.

FIG. **24** is a partial cross-sectional view of a toilet assembly including a non-vitreous fluid delivery component coupled to a toilet according to another exemplary embodiment.

FIG. **25** is a partial cross-sectional view of a toilet assembly including a non-vitreous fluid delivery component coupled to a toilet according to another exemplary embodiment.

FIG. **26** is a perspective view of a prototype version of the toilet of FIG. **25**, which illustrates an exemplary installation of the non-vitreous fluid delivery component.

FIG. **27** is a partial perspective view of a toilet assembly including a non-vitreous fluid delivery component coupled to a toilet according to another exemplary embodiment.

FIG. **28** is a partial front view of the toilet assembly of FIG. **27**.

FIG. **29** is a partial perspective view of a prototype version of the toilet assembly of FIG. **27** including a transparent portion to illustrate a seal interface between a sealing member of the non-vitreous fluid delivery component and a portion of a toilet.

FIG. **30** is a perspective view of the non-vitreous fluid delivery component of FIG. **27**.

FIG. **31** is an exploded view of a prototype version of the toilet assembly of FIG. **27**.

FIG. **32** is a partial cross-sectional view of a toilet assembly including a non-vitreous fluid delivery component coupled to a toilet according to another exemplary embodiment.

FIG. **33** is a partial perspective view of the toilet of FIG. **32**.

FIG. **34** is a perspective view of a prototype version of the toilet assembly of FIG. **32**.

FIG. **35** is an exploded view of a prototype version of a toilet assembly including a non-vitreous fluid delivery component coupled to a toilet according to another exemplary embodiment.

FIG. **36** is a partial cutaway view of a toilet assembly including a non-vitreous fluid delivery component coupled to a toilet according to another exemplary embodiment.

FIG. **37** is an exploded view of a prototype version of the toilet assembly of FIG. **36**.

FIGS. **38-39** are partial cutaway views of the toilet of FIG. **36**.

FIG. **40** is a rear perspective view of the non-vitreous fluid delivery component of FIG. **36**.

FIGS. **41-42** are partial perspective views of a prototype version of the non-vitreous fluid delivery component of FIG. **36**.

FIGS. **43-46** are partial perspective views of a toilet assembly including a non-vitreous fluid delivery component coupled to a toilet according to another exemplary embodiment.

DETAILED DESCRIPTION

Before turning to the figures, which illustrate certain exemplary embodiments in detail, it should be understood that the present disclosure is not limited to the details or methodology set forth in the description or illustrated in the figures. It should also be understood that the terminology used herein is for the purpose of description only and should not be regarded as limiting.

Referring generally to the FIGURES, disclosed herein are connectors for fluidly coupling a non-vitreous fluid delivery component to an inlet in a vitreous toilet according to various exemplary embodiments. Specifically, the connectors provide a substantially watertight seal with a portion of the vitreous toilet (e.g., a toilet sump, a toilet rim, etc.), such that the non-vitreous fluid delivery component can be fluidly coupled to the toilet in a substantially watertight manner.

According to various exemplary embodiments, the connectors disclosed herein are used specifically for fluidly coupling a non-vitreous fluid delivery component to a sump of a vitreous toilet. According to an exemplary embodiment, the toilet is a siphonic toilet that relies on a siphon effect to empty the contents of the toilet bowl, and the non-vitreous fluid delivery component is a sump jet made from a non-vitreous material (e.g., plastic, etc.) that can introduce a flow of water into the sump of the toilet to help to prime the siphon. It should be appreciated, however, that the various connectors disclosed herein may be used to fluidly couple other non-vitreous components to other vitreous portions of a toilet (e.g., a fluid conduit to a rim of a toilet, a waste pipe to a toilet, an internal fluid conduit of a toilet, etc.). According to other exemplary embodiments, the disclosed connectors may be used to couple other non-vitreous fluid delivery components (e.g., fluidic jets, nozzles, etc.) to plumbing fixtures made from vitreous or other materials besides vitreous in a substantially watertight manner, such as epoxy, ceramic, or other types of materials or combinations of materials.

According to an exemplary embodiment, the sump jets used in conjunction with the various connectors disclosed herein are configured substantially the same as each other (e.g., similar jet orifice configuration, etc.). According to other exemplary embodiments, the sump jets may be configured differently from each other. According to various exemplary embodiments, the sump jets disclosed herein may be configured the same as, or similar to, any one of, or a

combination of, the sump jets disclosed in U.S. patent application Ser. No. 15/414,576, entitled "LINE PRESSURE-DRIVEN, TANKLESS, SIPHONIC TOILET," filed Jan. 24, 2017, the entire disclosure of which is hereby incorporated by reference herein.

In the various exemplary embodiments disclosed herein, the non-vitreous fluid delivery components are made from a non-vitreous material, such as plastic (e.g., a fiber-reinforced plastic such as HDPE, PVC, GF Polypropylene, PBT, etc.), although other types of non-vitreous materials or combinations of materials may be used (e.g., aluminum, composites, etc.). The various sealing members and seals disclosed herein (e.g., sealing member **23**, etc.) may be made from a compressible material (e.g., rubber, etc.) that is configured to sealingly engage a vitreous surface of a plumbing fixture, such as a toilet, so as to create a substantially watertight seal therebetween.

Referring to FIG. **1**, a toilet assembly **1** is shown according to an exemplary embodiment. The toilet assembly **1** includes a toilet **10** and a non-vitreous fluid delivery component, shown as a sump jet **21**, fluidly coupled to the toilet **10**. According to an exemplary embodiment, the toilet **10** is a siphonic toilet that relies on a siphon effect to empty the contents of the toilet bowl. For example, the toilet **10** includes a bowl **10***a*, a sump **11** extending from the bowl **10***a*, and a trapway **13** extending from the sump **11** to a drain. The trapway **13** routes rearwardly and then upwardly to a height above the normal water level in the bowl **10***a* to create a weir that acts as a gas trap for back gases from the drain. The trapway **13** is configured to induce a siphon effect, which provides pressure to suction waste water from the bowl **10***a* when a flush is activated. The sump jet **21**, described in more detail below, is coupled to and in fluid communication with the sump **11**. According to an exemplary embodiment, the sump jet **21** is configured to receive a flow of water at a low inlet flow rate, such as at a normal household water flow rate of between about 2.5 gpm and about 5 gpm, and to increase the flow rate before introducing the flow of water into the sump **11**. The flow of water provided by the sump jet **21** can, advantageously, increase the flow rate of water in the sump **11** and the trapway **13** to a flow rate comparable to a conventional gravity-based toilet design (e.g., about 20-25 gpm) to initiate the siphon effect. According to other exemplary embodiments, the toilet **10** may be configured as a gravity-fed toilet or other type of toilet and the sump jet **21** may be configured as any other type of fluidic jet or nozzle for delivering fluid to the toilet to, for example, help to induce a siphon in the trapway of the toilet.

As shown in FIGS. **2-5**, the toilet **10** further includes a secondary chamber **12** (e.g., jet chamber, etc.) extending outwardly or forward in front of the sump **11**. The secondary chamber **12** is formed of a vitreous material, and may be integrally formed with, or coupled to, the toilet **10**. The sump jet **21** is coupled to the secondary chamber **12** at a first opening **12***a* (e.g., first inlet, etc.). The secondary chamber **12** is in fluid communication with the sump **11** by a second opening **12***b* (e.g., second inlet, sump inlet, etc.). The sump jet **21** extends through the first opening **12***a* and into the secondary chamber **12** adjacent the sump **11** at the second opening **12***b*. The sump jet **21** is fluidly coupled to a conduit **30**, which is in turn in fluid communication with a water source, such as a household water supply.

According to an exemplary embodiment, the sump jet **21** is configured to receive a flow of water from a water source and deliver the flow of water to the sump **11** to prime a siphon in the trapway **13**. A connector assembly **20** couples the sump jet **21** to the sump **11** in a substantially watertight manner. The connector assembly **20** comprises a nut **22** that is adjustably coupled to a portion of the sump jet **21** (e.g., second portion **21***b*, discussed in greater detail below). The connector assembly **20** further comprises a sealing member **23** (e.g., a spud seal, etc.) disposed between the nut **22** and a portion of the secondary chamber **12**. The sealing member **23** includes a flange **23***a* and a body **23***b* extending from the flange **23***a*. The flange **23***a* is configured to sealingly engage an outer vitreous surface of the toilet that defines part of the secondary chamber **12**. The body **23***b* extends at least partially into the opening **12***a* of the secondary chamber, and is configured to sealingly engage a vitreous portion of the secondary chamber that defines the opening **12***a*. The sealing member **23** is configured to create a substantially watertight seal between the sump jet **21** and a vitreous portion of the secondary chamber **12**, as discussed in greater detail below.

Referring to FIG. **4**, the sump jet **21** includes a first portion **21***a* (e.g., inlet portion, etc.) having a generally hollow cylindrical shape that defines a central channel having an axis represented by a dashed line in FIG. **4**. The first portion **21***a* further includes a flared end that defines a hose barb configured to couple to, and be in fluid communication with, the conduit **30**. The sump jet **21** further includes a second portion **21***b* (e.g., intermediate portion, etc.) extending from the first portion **21***a*. The second portion **21***b* includes a plurality of threads disposed on an outer surface thereof for threadably engaging corresponding threads on the nut **22**. The sump jet **21** further includes a third portion **21***c* (e.g., outlet portion, etc.) extending from the second portion **21***b*. The third portion **21***c* includes one or more jet orifices in fluid communication with the central channel for introducing a flow of water from a water source into the sump **11**. The third portion **21***c* gradually increases in diameter from the second portion **21***b*, so as to define a generally frusto-conical shape. The third portion **21***c* includes a channel **21***c*' extending along an outer periphery thereof for receiving a seal (e.g., an O-ring, etc.), so as to create a seal between the third portion **21***c* and a vitreous portion of the toilet **10** that defines the second opening **12***b*. According to an exemplary embodiment, the seal created between the seal at the channel **21***c*' and the vitreous portion of the toilet at the second opening **12***b* is not watertight, but can help to axially align the sump jet **21** to the secondary chamber **12** at the second opening **12***b*.

As shown in FIG. **4**, the sump jet **21** is shown with the third portion **21***c* at least partially disposed in the second opening **12***b* between the secondary chamber **12** and the sump **11**. The second portion **21***b* is disposed at least partially into the first opening **12***a* between the secondary chamber **12** and an outer vitreous surface of the toilet. The first portion **21***a* is disposed entirely outside of the toilet to couple to the conduit **30**. The sealing member **23** is disposed around the second portion **21***b* with the body **23***b* facing toward the third portion **21***c* and the flange **23***a* facing toward the first portion **21***a*. The sump jet **21** may be inserted into the secondary chamber **12** such that the second portion **21***a* extends partially into the first opening **12***a* and past an outer surface of the toilet **10** that defines the secondary chamber **12**. The sealing member **23** may be positioned such that the body **23***b* is inserted through the first opening **12***a* between the second portion **21***b* and the secondary chamber **12**. The flange **23***a* of the sealing member **23** may be sealingly engaged with an outer vitreous surface of the secondary chamber **12** adjacent the first opening **12***a*. The nut **22** may be threadably coupled to the second portion **21***b* extending in front of the secondary chamber **12** and abutting

the flange **23***a*. The nut **22** may be tightened against the flange **23***a* and the vitreous portion of the secondary chamber **12** until a trailing edge of the body **23***b* is sufficiently engaged by the third portion **21***c*, so as to sandwich the sealing member **23** between the third portion **21***c* and the vitreous portion of the secondary chamber **12** to create a substantially watertight seal between the sump jet **21** and the secondary chamber **12**.

In other words, the frusto-conical profile of the third portion **21***c* is urged toward the first opening **12***a* as the nut **22** is adjusted on the second portion **21***b*, which causes the sealing member **23** to compress and expand radially between the secondary chamber **12** and the sump jet **21** into the first opening **12***a*. In this manner, the connector assembly **20** can create a substantially watertight seal between the non-vitreous sump jet **21** and the vitreous toilet **10**.

Referring to FIGS. **4-5**, the secondary chamber **12** may include an open bottom **12***c* to provide access to an interior of the secondary chamber **12**. The secondary chamber **12** includes a peripheral flange **12***d* (e.g., channel, recess, etc.) for receiving a cover **14** to enclose the secondary chamber **12** after installation of the sump jet **21** and connector assembly **20**. According to an exemplary embodiment, the cover **14** is made from a vitreous material and is bonded to the peripheral flange **12***d* (e.g., glued, etc.). According to other exemplary embodiments, the cover **14** is made from a material other than vitreous and is otherwise coupled to the secondary chamber **12**. According to another exemplary embodiment shown in FIGS. **6-8**, for example, the secondary chamber **12** may have an open front area for receiving a cover instead of the bottom of the secondary chamber, depending on manufacturing preference.

Referring to FIGS. **6-8**, a non-vitreous fluid delivery component, shown as a sump jet **27**, is coupled to a secondary chamber **24** of a toilet by a connector assembly **28**, according to another exemplary embodiment. In this exemplary embodiment, the connector assembly **28** and the sump jet **27** are configured to be substantially the same as the connector assembly **20** and the sump jet **21** of the embodiment of FIG. **4**, but the secondary chamber **24** includes an opening at a front portion of the secondary chamber instead of along a bottom portion of the secondary chamber, as shown in the embodiment of FIG. **4**. As shown in FIG. **6**, the secondary chamber **24** has a generally trapezoidal shaped cross-section with an open base that defines a first opening **24***a* between the secondary chamber **24** and an area surrounding the toilet. The secondary chamber **24** further includes a peripheral channel **24***c* (e.g., flange, recess, etc.) for receiving a cover **26** therein at the front of the secondary chamber **24**. The cover **26** may be made from a vitreous material that is coupled to the secondary chamber **24** at the channel **24***c* (e.g., adhesively bonded, etc.). The cover **26** includes an opening **26***a* for receiving the sump jet **27** therein. The cover **26** is configured to interface with the connector assembly **28** to couple the sump jet **27** to the secondary chamber **24** in a substantially watertight manner. The secondary chamber **24** further includes a second base that defines a second opening **24***b* between the secondary chamber **24** and a sump **25** of the toilet. The sump jet **27** may be at least partially disposed in the second opening **24***b*, and is configured to be in fluid communication with the sump **25**. The sump jet **27** is made from a non-vitreous material (e.g., plastic, metal, etc.) and may be coupled to, or integrally formed with, a portion of the connector assembly **28** (e.g., connector body **28***a*, etc.).

Referring to FIG. **7**, a portion of the connector assembly **28** is shown in greater detail. The connector assembly **28** includes a connector body **28***a* having a generally hollow cylindrical shape. The connector body **28***a* includes a central opening **28***c* extending therethrough for directing fluid to the sump jet **27**, which may be coupled to, or integrally formed with, the connector body **28***a*. The connector body **28***a* further includes a first portion **28***a*' having a plurality of threads disposed on an outer surface thereof, and a second portion **28***b* located opposite the first portion **28***a*'. As shown in FIG. **6**, the first portion **28***a*' may include a flared end that defines a hose barb for fluidly coupling the connector body **28***a* to a fluid conduit (e.g., conduit **30**, etc.). The second portion **28***b* gradually tapers radially away from the central opening **28***c* to define a generally frusto-conical shape with the widest portion located farthest away from the first portion **28***a*'. The connector assembly **28** further includes a sealing member **29** disposed around the connector body **28***a* between the first portion **28***a*' and the second portion **28***b*. The sealing member **29** includes a flange **29***a* and a body **29***b* extending from the flange **29***a*. The flange **29***a* extends radially away from the body **29***b* and is arranged to face toward the first portion **28***a*'. The body **29***b* has a generally hollow cylindrical shape and is arranged to face toward the second portion **28***b*. The connector assembly **28** further includes a nut **2** adjustably coupled to the first portion **28***a'*.

Still referring to FIG. **7**, the connector assembly **28** is shown coupled to the cover **26** at the first opening **26***a*. The connector assembly **28** is positioned through the first opening **26***a* such that the flange **29***a* abuts a front vitreous surface of the cover **26***a*, and the body **29***b* is disposed at least partially into the first opening **26***a* between the cover **26** and the connector body **28***a*. The first portion **28***a*' is located in front of the cover **26** and the second portion **28***b* is located on an opposite side of the cover **26** that corresponds to, for example, an interior of the secondary chamber **24**. The nut **2** may be tightened along the threads of the first portion **28***a*' until a trailing edge of the body **29***b* sufficiently engages the second portion **28***b*, so as to sandwich the sealing member **29** between the second portion **28***b* and the cover **26** to create a substantially watertight seal between the connector assembly **28** and the secondary chamber **24**. In other words, the generally frusto-conical profile of the second portion **28***b* is urged toward the first opening **26***a* as the nut **2** is tightened on the first portion **28***a*', which causes the sealing member **29** to compress and expand radially between the cover **26** and the connector body **28***a* into the first opening **26***a*. In this manner, the connector assembly **28** can create a substantially watertight seal between the non-vitreous sump jet **27** and the vitreous toilet sump **25**.

Referring to FIGS. **9-19**, a non-vitreous fluid delivery component, shown as a sump jet **37**, is coupled to a secondary chamber **30** of a toilet by a connector assembly **33**, according to another exemplary embodiment. As shown in FIG. **9**, the secondary chamber **30** has a similar configuration as the secondary chamber **24** shown in the embodiment of FIG. **6**, but with a slightly different perimeter wall shape (i.e., a generally U-shaped cross-section). The secondary chamber **30** has an open front portion that defines a first opening **30***a* between the secondary chamber **30** and an area surrounding the toilet. The secondary chamber **30** further includes a peripheral channel **30***c* (e.g., flange, recess, etc.) for receiving a cover **32** therein. The cover **32** may be made from a vitreous material that is coupled to the secondary chamber **30** at the channel **30***c* (e.g., adhesively bonded, etc.). The cover **32** includes an opening **32***a* for receiving the sump jet **37** therein. The cover **32** is configured to interface with the connector assembly **33** to couple the sump jet **37** to the secondary chamber **30** in a substantially

watertight manner. The secondary chamber **30** further includes a second opening **30***b* between the secondary chamber **30** and a sump **31** of the toilet. The sump jet **37** is at least partially disposed in the second opening **30***b*, and is configured to be in fluid communication with the sump **31**. The sump jet **37** is made from a non-vitreous material (e.g., plastic, etc.) and may be coupled to, or integrally formed with, a portion of the connector assembly **33** (e.g., connector body **34**, etc.).

In the exemplary embodiment shown in FIGS. **9-11**, the sump jet **37** is shown as a separate component that is coupled to the connector assembly **33**. The sump jet **37** includes an inlet portion **37***a* having a generally hollow cylindrical shape that defines an axis represented by a dashed line in FIG. **9**. The sump jet **37** further includes an intermediate portion **37***c* extending from the inlet portion **37***a*. The intermediate portion **37***c* extends gradually outwardly from the inlet portion **37***a*, and has a generally rectangular cross-sectional shape taken along its width (see, for example, FIG. **11**). The sump jet **37** further includes an outlet portion **37***b* extending from the intermediate portion **37***c*. The outlet portion **37***b* has a generally outer cylindrical shape, and includes a plurality of jet orifices (e.g., side jet orifices **37***e*, upper jet orifice **37***f*, lower jet orifice **37***g*, etc.) located at an interior of the third portion **37***b*. The plurality of jet orifices are each configured to receive a flow of water from the inlet portion **37***a* and to increase the velocity of the flow of water to the sump **31**, so as to entrain a flow in the sump **31** and help to prime a siphon. The outlet portion **37***b* further includes an outer peripheral channel **37***b*' that is configured to receive a seal, such as an O-ring (e.g., O-ring **38** shown in FIG. **17**, etc.), so as to create a seal between a vitreous portion of the secondary chamber **30** and the sump **31** at the second opening **30***b*.

As shown in the cross-sectional view of FIG. **11**, which illustrates a cross-section of the intermediate portion **37***c*, the sump jet **37** is shown oriented at an installation position for coupling to the sump of the toilet (e.g., sump **21**, etc.). As shown in FIG. **11**, the sump jet **37** is oriented such that the plurality of jet orifices define a generally triangular shaped pattern. For example, the sump jet **37** includes a pair of side jet orifices **37***e* (e.g., first jet orifices, etc.) located at diagonally opposed first and second corners of the sump jet **37**. The side jet orifices **37***e* have a generally rectangular shape, and are each oriented at an acute angle at the installation position shown in FIG. **11**. That is to say, the side jet orifices **37***e* are oriented substantially parallel to the respective adjacent sides of the square cross-section of the intermediate portion **37***c*. Thus, when the sump jet **37** is oriented at the installation position shown in FIG. **11** (e.g., rotated 45 degrees from horizontal, etc.), the side jet orifices **37***e* are each oriented at an acute angle relative to horizontal (e.g., 45 degrees, etc.). The sump jet **37** further includes an upper jet orifice **37***f* (e.g., third jet orifice, etc.) located at a central portion of the sump jet between the side jet orifices **37***e*, and a lower jet orifice **37***g* (e.g., fourth jet orifice, etc.) located near a bottom corner, diagonally opposite from a top corner of the sump jet. The upper jet orifice **37***f* has a generally rectangular shape, and is oriented substantially horizontally (i.e., with its widest portion oriented parallel to horizontal) at the installation position shown in FIG. **11**. The lower jet orifice **37***g* has a generally rectangular shape, and is also oriented substantially horizontally at the installation position. The various jet orifices may have other shapes (e.g., circular, etc.) and relative orientations, according to other exemplary embodiments. The lower jet orifice **37***g* has a length "L" that is longer than the lengths of the upper jet orifice **37***f* and the side jet orifices **37***e*, which is particularly advantageous in the embodiment shown in FIGS. **9-19**.

For example, as shown in FIGS. **9** and **12**, the sump jet **37** is configured to be oriented relative to the sump **31**, such that the lower jet orifice **37***g* can direct fluid toward a lower surface **31***a* of the sump **31**. The lower surface **31***a* typically accumulates a larger amount of waste, as compared to other portions of the sump **31** (e.g., sidewall, upper wall, etc.), which can be difficult to remove from the sump **31** during a flush cycle. According to the exemplary embodiment shown, the lower jet orifice **37***g* has a length "L" that is longer than the length of the other jet orifices of the sump jet **37**, such that water discharged by the lower jet orifice **37***g* is distributed (e.g., "fanned" out) across a larger surface area (e.g., wider) of the lower surface **31***a*, as compared to other areas of the sump **31**, which can, advantageously, help to remove waste that may be present along the lower surface **31***a*.

Additionally, the upper jet orifice **37***f* is located closer to the lower jet orifice **37***g* (i.e., near a central portion of the sump jet above the lower jet orifice **37***g*), as compared to the relative distance between the two side jet orifices **37***e*, so as to direct additional fluid closer to the lower surface **31***a*. In this manner, the sump jet **37** can effectively remove waste that may be present along the lower surface **31***a* of the sump **31**.

Referring to FIGS. **9-10** and **12-19**, to maintain the installation position of the sump jet **37** shown in FIGS. **9** and **11**, and thereby the position of the lower jet orifice **37***g* relative to the lower surface **31***a*, the sump jet **37** includes a first protrusion **37***d* extending outwardly from the sump jet **37** (e.g., the intermediate portion **37***c*, etc.) that is configured to engage a second protrusion **30***d* extending from an interior wall that defines part of the secondary chamber **30**. For example, as shown in FIG. **13**, the first protrusion **37***d* extends radially outwardly a sufficient distance to at least partially overlap the second protrusion **30***d* extending inwardly toward the center of the second opening **30***b*. Thus, during installation when the sump jet **37** is inserted through the first opening **32***a* and at least partially into the second opening **30***b*, the sump jet **37** can be rotated along an axis defined by the first opening **32***a* until the first protrusion **37***d* engages the second protrusion **30***d*. The first protrusion **37***d* and the second protrusion **30***d* are positioned such that when they engage each other, the sump jet **37** is oriented such that the lower jet orifice **37***g* is located nearest to the lower surface **31***a*, as shown in FIGS. **9** and **12**. In this way, the first protrusion **37***d* and the second protrusion **30***d* can cooperate to maintain an orientation of the sump jet **37** relative to the sump **31**.

Still referring to FIG. **9**, the connector assembly **33** further includes a connector body **34** having a generally hollow cylindrical shape. The connector body **34** includes a central opening **34***d* extending therethrough for directing fluid to the sump jet **37**, which may be coupled to, or integrally formed with, the connector body **34**. The connector body **34** further includes a first portion **34***a* including a flared end that defines a hose barb for fluidly coupling to a fluid conduit (e.g., conduit **30**, etc.). The connector body **34** further includes a second portion **34***b* extending from the first portion **34***a*. The second portion **34***b* has a generally hollow cylindrical shape, and includes a plurality of threads disposed on an outer surface thereof. The connector body **34** further includes a third portion **34***c* extending from the second portion **34***b*. The third portion **34***c* gradually tapers radially away from the central opening **34***d* to define a generally frusto-conical shape with the widest portion of the third portion **34***c* located farthest away from the first portion **34***a*. The connector

assembly **33** further includes a sealing member **36** disposed around a portion of the connector body **34** (e.g., along the third portion **34***c*). The sealing member **36** includes a flange **36***a* and a body **36***b* extending from the flange **36***a*. The flange **36***a* extends radially away from the body **36***b* and is arranged to face toward the first portion **34***a*. The body **36***b* has a generally frusto-conical shape that is complementary to the third portion **34***c*. The body **36***b* is arranged to face toward the third portion **34***c*. The connector assembly **33** further includes a nut **35** adjustably coupled to the second portion **34***b*.

As shown in FIG. **9**, the connector assembly **33** is coupled to the cover **32** at the first opening **32***a*. The connector assembly **33** is positioned through the first opening **32***a* such that the flange **36***a* abuts a front vitreous surface of the cover **32**, and the body **36***b* is disposed at least partially into the first opening **32***a* between the cover **32** and the connector body **34**. The first portion **34***a* and at least a portion of the second portion **34***b* are located in front of the cover **32**. At least a portion of the third portion **34***c* is located on an opposite side of the cover **32** at an interior of the secondary chamber **30**. The nut **35** may be tightened along the threads of the second portion **34***b* until the third portion **34***c* sufficiently engages the body **36***b*, so as to sandwich the sealing member **36** between the connector body **34** and the cover **32** to create a substantially watertight seal between the connector assembly **33** and a vitreous portion of the secondary chamber **30**.

In other words, the frusto-conical profile of the third portion **34***c* is urged toward the first opening **32***a* as the nut **35** is tightened on the first portion **34***a*, which causes the sealing member **36** to compress and expand radially between the cover **32** and the connector body **34** into the first opening **32***a*. In this manner, the connector assembly **33** can create a substantially watertight seal between the sump jet **37** and the toilet sump **31**. In addition, the orientation of the sump jet **37** relative to the sump **31** is maintained during coupling of the nut **35** to the connector body **34**, because the first protrusion **37***d* is engaged with the second protrusion **30***d* on the secondary chamber **30**, as explained above.

Referring to FIGS. **20-22**, an exemplary installation sequence for the sump jet **37** is shown according to an exemplary embodiment. In a first step shown in FIGS. **20-22**, the sump jet **37** is inserted into the first opening **32***a* of the cover **32** until the sealing member **36** engages a portion of the cover **32** at the opening **32***a*. In a second step, the sump jet **37** is rotated relative to the secondary chamber **30** until the first protrusion **37***d* engages the second protrusion **30***d* on a wall of the secondary chamber **30**, so as to rotationally align the sump jet **37** relative to the toilet sump **31** (see, for example, FIG. **19**). In a third step, the nut **35** is tightened along the threads of the second portion **34***b* until the third portion **34***c* of the connector body **34** sufficiently engages the body **36***b* of the sealing member **36**, so as to sandwich the sealing member **36** between the connector body **34** and the cover **32** to create a substantially watertight seal between the connector assembly **33** and the secondary chamber **30**. That is to say, the frusto-conical profile of the third portion **34***c* is urged toward the first opening **32***a* as the nut **35** is tightened on the first portion **34***a*, which causes the sealing member **36** to compress and expand radially between the cover **32** and the connector body **34** into the first opening **32***a*. In this manner, the connector assembly **33** can create a substantially watertight seal between the sump jet **37** and the toilet sump **31**.

Referring to FIG. **23**, a non-vitreous fluid delivery component, shown as a sump jet **40**, is coupled to a secondary chamber **39** of a toilet by a connector assembly **4**, according to another exemplary embodiment. In this exemplary embodiment, the secondary chamber **39** extends forward from a sump **3** of the toilet, and includes a first opening **39***a* between the secondary chamber **39** and an outer area surrounding the toilet. The first opening **39***a* is partially defined by a flange portion **39***c* extending radially inward toward the first opening **39***a*. The secondary chamber **39** further includes a second opening **39***b* between the secondary chamber **39** and the sump **3** of the toilet. The sump jet **40** may be at least partially disposed in, or positioned adjacent to, the second opening **39***b*, and is configured to be in fluid communication with the sump **3**. The sump jet **40** is made from a non-vitreous material (e.g., plastic, metal, etc.) and may be coupled to, or integrally formed with, a portion of the connector assembly **4** (e.g., sealing member **42**, nut **5**, etc.).

Still referring to FIG. **23**, the connector assembly **4** comprises a nut **5** that is threadably coupled to a portion of the sump jet **40** (e.g., second portion **40***b*, discussed in greater detail below). The connector assembly **4** further comprises a sealing member **42** (e.g., a spud seal, a flange seal, etc.) disposed between the nut **5** and a vitreous portion of the secondary chamber **39**. The sealing member **42** includes a flange **42***a* and a body **42***b* extending from the flange **42***a*. The flange **42***a* is configured to engage an outer vitreous surface of the toilet that defines part of the secondary chamber **39**. The body **42***b* extends at least partially into the first opening **39***a* of the secondary chamber **39**, and is configured to engage a vitreous portion of the secondary chamber that defines the first opening **39***a*. The sealing member **42** is configured to create a substantially watertight seal between the sump jet **40** and a vitreous portion of the secondary chamber **39**.

The sump jet **40** includes a first portion **40***a* having a generally hollow cylindrical shape that defines a central channel having an axis represented by a dashed line in FIG. **23**. The first portion **40***a* further includes a flared end that defines a hose barb configured to couple to, and be in fluid communication with, a fluid conduit (e.g., conduit **30**, etc.). The sump jet **40** further includes a second portion **40***b* extending from the first portion **40***a*. The second portion **40***b* includes a plurality of threads disposed on an outer surface thereof for threadably engaging corresponding threads on the nut **5**. The sump jet **21** further includes a third portion **40***c* extending from the second portion **40***b*. The third portion **40***c* includes one or more jet orifices in fluid communication with the central channel for introducing a flow of water from a water source into the sump **11**. According to an exemplary embodiment, the sump jet **40** may be configured to have the same jet orifice configuration as the sump jet **37** discussed above. According to other exemplary embodiments, the sump jet **40** may have a different jet orifice configuration. The third portion **40***c* gradually increases in diameter from the second portion **40***b*, so as to define an outer surface profile that has a generally frusto-conical shape. The third portion **40***c* includes a channel **40***c*' extending along an outer periphery thereof for receiving a seal (e.g., an O-ring, etc.), so as to create a seal between the third portion **40***c* and a vitreous portion of the secondary chamber **39** that defines the second opening **39***b*. The sump jet **40** further includes a protrusion **40***d* extending radially outwardly away from sump jet **40**. The protrusion **40***d* is configured to engage an inner surface of the flange portion **39***c* within the secondary chamber, so as to facilitate coupling of the sump jet **40** to the secondary chamber **39**.

For example, still referring to FIG. **23**, the sump jet **40** is shown with the third portion **40***c* at least partially disposed in the second opening **39***b* between the secondary chamber **39** and the sump **3**. The second portion **40***b* is disposed at least partially into the first opening **39***a* between the secondary chamber **39** and an outer vitreous surface of the toilet. The sealing member **42** is disposed around the second portion **40***b* in front of the secondary chamber **39** adjacent the first opening **39***a*, with the body **42***b* facing toward the third portion **40***c* and the flange **42***a* facing toward the first portion **40***a*. The sump jet **40** may be inserted into the secondary chamber **39** such that the second portion **40***b* extends partially into the first opening **39***a* with the protrusion **40***d* located within the secondary chamber **39** adjacent an inner surface of the flange portion **39***c*. The sealing member **42** may be positioned such that the body **42***b* is inserted at least partially into the first opening **39***a* between the second portion **40***b* and the secondary chamber **39**. The flange **42***a* may be sealingly engaged with an outer vitreous surface of the secondary chamber **39** adjacent the first opening **12***a*. The nut **5** may be threadably coupled to the second portion **40***b* extending in front of the secondary chamber **39** and abutting the flange **42***a*. The nut **5** may be tightened against the flange **42***a* and the vitreous portion of the secondary chamber **39** until the protrusion **40***d* sufficiently engages the flange portion **39***c*, so as to sandwich the sealing member **42** between the sump jet **40** and the vitreous portion of the secondary chamber **39** to create a substantially watertight seal between the sump jet **40** and the secondary chamber **39**.

Referring to FIG. **24**, a non-vitreous fluid delivery component, shown as a sump jet **45**, is coupled to a sump **44** of a toilet by a connector assembly **6**, according to another exemplary embodiment. In this exemplary embodiment, the sump **44** includes an opening **44***a* for receiving a portion of the sump jet **45** (e.g., third portion **45***c*). The toilet further includes an outer wall **43** extending in front of the opening **44***a* that includes a slot **43***a* for receiving an opposite portion of the sump jet **45** (e.g., first portion **45***a*), the details of which are discussed below. The sump jet **45** may be at least partially disposed in the opening **44***a*, and is configured to be in fluid communication with the sump **44**. The sump jet **45** is made from a non-vitreous material (e.g., plastic, metal, etc.) and may be coupled to, or integrally formed with, a portion of the connector assembly **6** (e.g., sealing member **46**, nut **47**, etc.).

Still referring to FIG. **24**, the connector assembly **6** comprises a nut **46** that is threadably coupled to a portion of the sump jet **45** (e.g., second portion **45***b*, discussed in greater detail below). The connector assembly **6** further comprises a sealing member **46** disposed between the nut **47** and an inner surface **43***b* of the outer wall **43**. The sealing member **46** has a wedge shape to facilitate coupling of the sump jet **45** to the toilet and maintaining an axial position of the sump jet **45** relative to the opening **44***a* of the sump **44**. For example, the sump jet **45** includes a first portion **45***a* having a generally hollow cylindrical shape that defines a central channel extending along an axis represented by a dashed line in FIG. **24**. The first portion **45***a* further includes a flared end that defines a hose barb configured to couple to, and be in fluid communication with, a fluid conduit (e.g., conduit **30**, etc.). The sump jet **45** further includes a second portion **45***b* extending from the first portion **45***a*. The second portion **45***b* includes a plurality of threads disposed on an outer surface thereof for threadably engaging corresponding threads on the nut **47**. The sump jet **45** further includes a third portion **45***c* extending from the second portion **45***b*. The third portion **45***c* includes one or more jet orifices in fluid communication with the central channel for introducing a flow of water from a water source into the sump **44**. The third portion **45***c* gradually increases in diameter from the second portion **45***b*, so as to define an outer surface profile that has a generally frusto-conical shape. The third portion **45***c* includes a channel **45***c'* extending along an outer periphery thereof for receiving a seal **48** that is configured to sealingly engage an outer surface **44***b* of the sump **44** adjacent the opening **44***a*, so as to create a substantially watertight seal between the sump jet **45** and the sump **44**. The sump jet **45** further includes a flange **45***d* extending radially outwardly away from the sump jet **45** between the channel **45***c* and the second portion **45***b*. The flange **45***d* is configured to engage a portion of the seal **48**, so as to sandwich the seal **48** between the outer surface **44***b* and the flange **45***d* to facilitate coupling of the sump jet **40** to the sump **44**.

Still referring to FIG. **24**, the sump jet **45** is shown with the third portion **45***c* at least partially disposed in the opening **44***a*. The second portion **45***b* is disposed between the outer surface **44***b* and the inner surface **43***b* of the wall **43**, which faces the outer surface **44***b*. The sealing member **46** is disposed around the second portion **45***b* and is configured to engage the inner surface **43***b* adjacent the slot **43***a*. The third portion **45***c* of the sump jet **45** may be at least partially inserted into the opening **44***a* with the seal **48** engaged with the outer surface **44***b*. The first portion **45***c* of the sump jet **45** may be inserted into the slot **43***a* with the sealing member **46** engaged with the inner surface **43***b*. The nut **47** may be threadably coupled to the second portion **45***b* adjacent the sealing member **46** prior to inserting the sump jet **45** into the opening **44***a*. Once the sump jet **45** is inserted, the nut **46** may be tightened against the sealing member **46** and the inner surface **43***b* until the flange **45***d* sufficiently engages the seal **48** against the outer surface **44***b*, so as to sandwich/compress the seal **48** between the sump jet **45** and the vitreous outer surface **44***b* to create a substantially watertight seal between the sump jet **45** and the sump **44**.

In other words, the sump jet **45** is urged toward the sump **44** as the nut **47** is tightened against the sealing member **46** and the inner surface **43***b*, thereby increasing the pressure exerted by the flange **45***d* against the seal **48** and the outer surface **44***b* to help to create a substantially watertight seal at the sump **44**. The wedge shape of the sealing member **46** can, advantageously, help to maintain an axial position of the sump jet **45** during tightening of the nut **47**, such that the sump jet **45** is not disengaged from the wall **43** through the slot **43***a*.

Referring to FIGS. **25-26**, a non-vitreous fluid delivery component, shown as a sump jet **51**, is coupled to a secondary chamber **48** of a toilet, according to another exemplary embodiment. In this exemplary embodiment, the secondary chamber **48** has a generally trapezoidal shaped cross-section with an open base that defines a first opening **48***a* between the secondary chamber **48** and an area surrounding the toilet. The secondary chamber **24** further includes a peripheral channel **48***c* (e.g., flange, recess, etc.) for receiving a cover **50** therein. The cover **50** may be made from a vitreous material that is coupled to the secondary chamber **48** at the channel **48***c* (e.g., adhesively bonded, etc.). The cover **50** includes an opening **50***a* for receiving the sump jet **51** therein. The cover **50** is configured to interface with a portion of the sump jet **51** and a sealing member **54** to provide a substantially watertight seal with the secondary chamber **48**. The secondary chamber **48** further includes a second base that defines a second opening **48***b* between the

secondary chamber **48** and a sump **49** of the toilet. The sump jet **51** may be at least partially disposed in the second opening **48***b*, and is configured to be in fluid communication with the sump **49**. The sump jet **51** is made from a non-vitreous material (e.g., plastic, metal, etc.) and includes integrated features that cooperatively define a connector for coupling to the cover **50**, the details of which are described in the paragraphs that follow.

Still referring to FIG. **25**, the sump jet **51** includes an inlet portion **51***a* having a generally hollow cylindrical shape that defines a central channel having an axis represented by a dashed line in FIG. **25**. The inlet portion **51***a* is fluidly coupled to a water source, such as a household water supply, by a conduit **53**. The sump jet **51** further includes an intermediate portion **51***b* extending from the inlet portion **51***a*. The intermediate portion **51***b* extends gradually outwardly from the inlet portion **51***a* and includes an outer wall **51***c* (e.g., first wall, outer flange, etc.) extending radially outwardly from a proximal end of the intermediate portion **51***b* nearest the inlet portion **51***a*. The intermediate portion **51***b* further includes an inner wall **51***d* (e.g., second wall, inner flange, etc.) extending radially outwardly from a distal end of the intermediate portion **51***b* that is located farther from the inlet portion **51***a* than the outer wall **51***c*. The inner wall **51***d* and the outer wall **51***c* are oriented substantially parallel to each other, and are configured to cooperate together to couple the sump jet **51** to the cover **50** in a substantially watertight manner, the details of which are discussed below. The sump jet **51** further includes an outlet portion **51***e* extending from the intermediate portion **51***b*. The outlet portion **51***e* extends gradually radially outwardly from the intermediate portion **51***b* to define a generally frusto-conical shape. The outlet portion **51***e* includes a plurality of channels that each define a jet orifice that is configured to receive a flow of water from the inlet portion **51***a* and to increase the velocity of the flow of water to the sump **49**, so as to help to prime a siphon in the toilet. The outlet portion **51***e* further includes an outer peripheral channel **51***e*' that receives a seal, shown as an O-ring **52**, so as to create a seal between a vitreous portion of the secondary chamber **48** and the sump **49** at the second opening **48***b*.

Still referring to FIGS. **25-26**, a sealing member **54** is coupled to the sump jet **51** at the intermediate portion **51***b* between the outer wall **51***c* and the inner wall **51***d*. The sealing member **54** is configured to be disposed in front of the cover **50** at an outer facing surface of the cover. The sealing member **54** is configured to sealingly engage the outer facing surface of the cover **50** by an interference condition created between the cover **50** and the sump jet **51**, so as to create a substantially watertight seal between the cover **50** and the sump jet **51**. For example, the cover **50** includes a rear portion **50***b* that defines one or more slots or receiving channels (e.g., circumferential slots, etc.) disposed adjacent the opening **50***a* for receiving a complementary portion of the inner wall **51***d* when the sump jet **51** is coupled to the cover **50**. The sump jet **51** may be coupled to the cover **50** by inserting the third portion **51***e* through the opening **50***a* such that the inner wall **51***d* is disposed through the opening **50***a* adjacent the rear portion **50***b*. The sump jet **51** may be rotated about an axis defined by the opening **50***a* until the complementary portion of the inner wall **51***d* is sufficiently received in the one or more receiving channels of the rear portion **50***b*. The rear portion **50***b* may include integrated stop features for defining a rotational endpoint for the complementary portion of the inner wall **51***d*, so as to define a fixed rotational position of the sump jet **51** (e.g., a twist-and-lock interface).

According to the exemplary embodiment shown in FIG. **26**, the inner wall **51***d* may have a generally triangular shaped profile that defines three flanges or lobes (e.g., similar to the rotor of a Wankel engine) configured to be received in corresponding slots or receiving channels defined by the rear portion **50***b* of the cover **50**. Similarly, the cover **50** may include a complementary shaped opening **50***a* for receiving the inner wall **51***d* therethrough. The sump jet **51** may be rotated in a direction indicated generally by arrow "B" in FIG. **26** until the flanges or lobes are received in the corresponding receiving channels defined by the rear portion **50***b*. According to other exemplary embodiments, the inner wall **51***d* may be configured to have more or fewer than three flanges or lobes, and the rear portion **50***b* may have a corresponding number of receiving channels.

As shown in FIG. **25**, the sealing member **54** may be disposed on the sump jet **51** when the sump jet **51** is inserted through the opening **50***a* of the cover **50**, such that the sealing member **54** engages the outer facing surface of the cover **50**. The combined thickness of the sealing member **54** and the cover **50** is greater than the spacing between the inner wall **51***d* and the outer wall **51***c*, such that the sealing member **54** is compressed against the cover **50** by the outer wall **51***c* when the complementary features of the inner wall **51***d* are engaged with the receiving channels of the rear portion **50***b*. Thus, the outer wall **51***c* and the inner wall **51***d* cooperate with the cover **50** to create an interference condition with the sealing member **54** that provides a substantially watertight seal between the sump jet **51** and the cover **50**.

Referring to FIGS. **27-31**, a non-vitreous fluid delivery component, shown as a sump jet **57**, is coupled to a secondary chamber **55** of a toilet, according to another exemplary embodiment. In this exemplary embodiment, the secondary chamber **55** has a generally hollow cylindrical shape that defines a first opening **55***a* between the secondary chamber **55** and an outer area surrounding the toilet. The secondary chamber **55** further includes a second opening **55***b* (shown in FIG. **31**) between the secondary chamber **55** and a sump **56** of the toilet. The sump jet **57** may be at least partially disposed in the second opening **55***b*, and is configured to be in fluid communication with the sump **56**. The sump jet **57** is made from a non-vitreous material (e.g., plastic, metal, etc.) and includes integrated features that cooperatively define a connector for coupling to the secondary chamber **55** in a substantially watertight manner, the details of which are described in the paragraphs that follow.

Referring to FIGS. **29-30**, the sump jet **57** includes an inlet portion **57***a* having a generally hollow cylindrical shape that defines a central channel having an axis represented by a dashed line in FIG. **30**. The inlet portion **57***a* further includes a flared end that defines a hose barb configured to couple to, and be in fluid communication with, a fluid conduit (e.g., conduit **30**, etc.). The sump jet **57** further includes an intermediate portion **57***b* extending from the inlet portion **57***a*. The intermediate portion **57***b* includes a plurality of threads disposed on an outer surface thereof for threadably engaging corresponding threads on a nut **58**. The sump jet **57** further includes an outlet portion **57***c* extending from the intermediate portion **57***b*. The outlet portion **57***c* extends gradually radially outwardly away from the central axis moving from the intermediate portion **57***b*, so as to define a generally frusto-conical shape. The outlet portion **57***c* further includes one or more jet orifices in fluid communication with the central channel for introducing a flow of water from a water source into the sump **56**. According to an exemplary embodiment, the sump jet **57** may be configured

to have the same jet orifice configuration as the sump jet **37** discussed above. According to other exemplary embodiments, the sump jet **57** may have a different jet orifice configuration. The outlet portion **57***c* is configured to receive a sealing member **60** around an outer surface thereof so as to create a substantially watertight seal with a vitreous portion of the secondary chamber **55**. According to another exemplary embodiment, the sealing member **60** is integrally formed with the sump jet **57**.

Still referring to FIGS. **29-30**, the sealing member **60** has a generally outer cylindrical shape. The sealing member **60** includes a flange **60***a* that is configured to sealingly engage an outer vitreous surface of the secondary chamber **55** adjacent the first opening **55***a*. The sealing member **60** further includes a plurality of ribs **60***b* spaced apart from each other and extending circumferentially about the sealing member **60**. The ribs **60***b* are each configured to expand radially outwardly away from the central axis when the sealing member **60** is compressed, such that the ribs **60***b* can engage an inner vitreous surface of the secondary chamber **55** to create a substantially watertight seal therebetween. For example, as shown in FIGS. **27** and **29**, the sump jet **57** is arranged with the sealing member **60** disposed thereon such that the flange **60***a* is positioned between the plurality of threads on the intermediate portion **57***b* and the outlet portion **57***c*. The sump jet **57** may be inserted into the first opening **55***a* until a rear portion of the flange **60***a* engages an outer vitreous surface of the sump **55** adjacent the first opening **55***a*. A nut **58** may be threadably coupled to the intermediate portion **57***b* and may be tightened against the flange **60***a*. As the nut **58** is tightened along the threads of the intermediate portion **57***b*, the outlet portion **57***c* is urged toward the first opening **55***a*, which causes the plurality of ribs **60***b* to expand radially outwardly away from the central axis. In other words, the frusto-conical profile of the outlet portion **57***c* causes the sealing member **60** to compress and expand radially outwardly between the nut **58** and the third portion **57***c* as the nut **58** is tightened along the intermediate portion **57***b*. The nut **58** may be tightened until the plurality of ribs **60***b* sufficiently sealingly engage an inner vitreous surface of the secondary chamber **55**, so as to create a substantially watertight seal between the sump jet **57** and the secondary chamber **55**.

Referring to FIGS. **32-35**, a non-vitreous fluid delivery component, shown as a sump jet **57'**, is coupled to a secondary chamber **55'** of a toilet, according to another exemplary embodiment. In this exemplary embodiment, the sump jet **57'**, the secondary chamber **55'**, and sealing member **60'** are configured to be substantially the same as the corresponding elements in the embodiment of FIGS. **27-31**. In this exemplary embodiment, however, the intermediate portion **57***b'* of the sump jet **57** includes a flange for coupling to lateral flanges **55***c* extending from the secondary chamber **55'** adjacent the first opening **55***a'*, instead of outer threads that are threadably engaged by a nut. In addition, the plurality of ribs **60***b'* of the sealing member **60'** are sized to engage an inner vitreous surface of the secondary chamber **55'** without having to expand radially outwardly in response to relative movement of the sump jet. In this embodiment, the ribs **60***b'* primarily function to axially align the sump jet **57'** relative to the first opening **55***a'*. As shown in FIGS. **32-34**, a separate outer flange **61** sandwiches the flange of the sump jet **57** and the flange **60***a'* of the sealing member **60'** between the outer flange **61** and the lateral flanges **55***c* of the sump. Each of the lateral flanges **55***c*, the sump jet flange, the flange **60***a'* of the sealing member, and the outer flange **61** includes a through hole for receiving a bolt **63** therethrough. A nut **64** may be threadably coupled to a threaded end of the bolt **63** to compress the flange **60***a'* against an outer vitreous surface of the secondary chamber **55'** and the lateral flanges **55***c*, such that the sealing member **60'** sealingly engages the vitreous surfaces of the secondary chamber **55'** and the lateral flanges **55***c*. In this manner, the sump jet **57'** can be coupled to the secondary chamber **55'** in a substantially watertight manner.

Referring to FIGS. **36-42**, a non-vitreous fluid delivery component, shown as a sump jet **67**, is coupled to a sump **68** of a toilet in a substantially watertight manner, according to another exemplary embodiment. The sump jet **67** includes an inlet portion **67***a* having a generally hollow cylindrical shape that defines a central channel. The inlet portion **67***a* further includes a flared end that defines a hose barb configured to couple to, and be in fluid communication with, a fluid conduit (e.g., conduit **30**, etc.). The sump jet **67** further includes an intermediate portion **67***b* extending from the inlet portion **67***a*. The intermediate portion **67***b* defines a flange for coupling the sump jet **67** to the sump **68** in a substantially watertight manner. The intermediate portion **67***b* may be coupled to, or integrally formed with, the sump jet **67**. In the exemplary embodiment shown, the intermediate portion **67***b* is generally planar and has a triangular shape with through holes **67***b'* disposed at each corner of the triangle. Although the intermediate portion **67***b* is shown to be triangular in shape with three through holes **67***b'*, it is appreciated that the intermediate portion **67***b* may have other shapes with more or fewer than three through holes (e.g., two, etc.), according to other exemplary embodiments. The sump jet **67** further includes an outlet portion **67***c* extending from the intermediate portion **67***b*. The outlet portion **67***c* includes a plurality of jet orifices **67***c'* in fluid communication with the central channel for introducing a flow of water from a water source into the sump **68**. According to an exemplary embodiment, the sump jet **67** may be configured to have the same jet orifice configuration as the sump jet **37** discussed above. According to other exemplary embodiments, the sump jet **67** may have a different jet orifice configuration.

Still referring to FIGS. **36-42**, the sump **68** includes an opening **68***a* for receiving at least a portion of the sump jet **67** therein (e.g., outlet portion **67***c*, etc.). The opening **68***a* is defined, in part, by a flange **68***b* extending radially outwardly from the opening **68***a*. The flange **68***b* is generally planar and has a generally triangular shape including through holes **68***b'* that are configured to be aligned with the through holes **67***b'* of the sump jet **67**. As shown in FIG. **36**, an outer member, shown as a first bracket **69** (e.g., flange, outer cover, etc.), is disposed in front of the sump **68**, adjacent the opening **68***a*. The first bracket **69** is generally planar and includes a central opening **69***a* for receiving at least a portion of the inlet portion **67***a* of the sump jet **67** therethrough. The first bracket **69** further includes a plurality of through holes that are configured to be aligned with the respective through holes of the sump jet **67** and the flange **68***b*, such that a bolt **73** can be received therethrough. A second bracket **72** (e.g., mounting member, etc.) is disposed on a rear side of the flange **68***b*, opposite the opening **68***a*. The second bracket **72** is generally planar and includes a plurality of threaded bores (e.g., weld nuts, etc.) configured to threadably engage the respective bolts **73** therein. A plurality of spacers **71** may be disposed between the first bracket **69** and the flange **68***b* to limit the amount of travel of the bolts **73** when the bolts **73** are tightened relative to the second bracket **72**.

Still referring to FIG. **36**, a sealing member **70** is disposed between the third portion **67***c* of the sump jet **67** and a vitreous portion of the flange **68***b* at the opening **68***a*, so as to create a substantially watertight seal between the sump jet **67** and the sump **68**. For example, the sump jet **67** may be coupled to the sump **68** by placing the third portion **67***c* at least partially into the opening **68***a*. The sealing member **70** may be disposed between the intermediate portion **67***b* and the flange **68***b*. The first bracket **69** may be placed over the sump jet **67** such that the first portion **67***a* is disposed through the central opening **69***a* with the respective through holes aligned (i.e., through holes **67***b*'). One or more spacers **71** may be placed between the flange **68***b* and the intermediate portion **67***b*. With the first bracket **69** held in position, the second bracket **72** may be positioned against a rear surface of the flange **68***b* opposite the opening **68***a* with the through holes **68***b*' aligned with the respective threaded bores of the second bracket **72**. The bolts **73** may be inserted through the through holes and threadably engaged with the respective threaded bores of the second bracket **72**. The bolts **73** may be tightened to the second bracket **72**, such that the sealing member **70** is compressed against the vitreous surface of the flange **68***b* adjacent the opening **68***a*, so as to create a substantially watertight seal therebetween. In this way, the non-vitreous sump jet **67** can be coupled to the vitreous sump **68** in a substantially watertight manner.

Referring to FIGS. **43-46**, the sump jet **67** is shown coupled to a sump **68'** of a toilet in a substantially watertight manner, according to another exemplary embodiment. This exemplary embodiment is the same as the embodiment shown in FIGS. **36-42**, except that the sump **68'** includes a different flange **68***b*' without any through holes, which may help to simplify the toilet manufacturing process. In addition, the flange **68***b*' does not extend radially outwardly as far as the flange **68***b*, which can help to reduce the amount of vitreous material used to manufacture the toilet, thereby reducing cost.

As shown in FIGS. **43-44**, the second bracket **72** includes a plurality of weld nuts **72***a* having threaded bores that are configured to be aligned with the respective through holes of the plate **69** and the intermediate portion **67***b* of the sump jet **67**. An inner peripheral portion of the second bracket **72** is configured to overlap a rear surface of the flange **68***b*', so as to facilitate coupling of the sump jet **67** to the sump **68'**. Thus, when the bolts **73** are threadably engaged with the respective weld nuts **72***a*, the second bracket **72** will be urged or clamped against the flange **68***b*', such that the sealing member **70** can sealingly engage the vitreous portion of the flange **68***b*' and create a substantially watertight seal therebetween.

Referring to FIGS. **45-46**, a second bracket **72'** without any weld nuts or threaded bores is used to couple the sump jet **67** to the sump **68**. In this embodiment, the second bracket **72'** includes through holes that are configured to receive a bolt **73** therethrough. A nut **74** is threadably coupled to each of the bolts **73** to couple the sump jet **67** to the sump **68'** in a substantially watertight manner. According to other exemplary embodiments, other fastening arrangements may be used, such as clips (e.g., spring clips, etc.), bayonet features, press-fit features, or other types of fasteners or fastening arrangements.

The disclosed connectors and connector assemblies provide a substantially watertight seal with a portion of a vitreous toilet (e.g., a toilet sump, a toilet rim, etc.), such that the disclosed non-vitreous fluid delivery components can be fluidly coupled to the toilet in a substantially watertight manner.

As utilized herein, the terms "approximately," "about," "substantially," 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. 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 disclosure as recited in the appended claims.

It should be noted that the term "exemplary" and variations thereof, as used herein to describe various embodiments, are intended to indicate that such embodiments are possible examples, representations, or illustrations of possible embodiments (and such terms are not intended to connote that such embodiments are necessarily extraordinary or superlative examples).

The term "coupled" and variations thereof, as used herein, means the joining of two members directly or indirectly to one another. Such joining may be stationary (e.g., permanent or fixed) or moveable (e.g., removable or releasable). Such joining may be achieved with the two members coupled directly to each other, with the two members coupled to each other using a separate intervening member and any additional intermediate members coupled with one another, or with the two members coupled to each other using an intervening member that is integrally formed as a single unitary body with one of the two members. If "coupled" or variations thereof are modified by an additional term (e.g., directly coupled), the generic definition of "coupled" provided above is modified by the plain language meaning of the additional term (e.g., "directly coupled" means the joining of two members without any separate intervening member), resulting in a narrower definition than the generic definition of "coupled" provided above. Such coupling may be mechanical, electrical, or fluidic.

The term "or," as used herein, is used in its inclusive sense (and not in its exclusive sense) so that when used to connect a list of elements, the term "or" means one, some, or all of the elements in the list. Conjunctive language such as the phrase "at least one of X, Y, and Z," unless specifically stated otherwise, is understood to convey that an element may be either X, Y, Z; X and Y; X and Z; Y and Z; or X, Y, and Z (i.e., any combination of X, Y, and Z). Thus, such conjunctive language is not generally intended to imply that certain embodiments require at least one of X, at least one of Y, and at least one of Z to each be present, unless otherwise indicated.

References herein to the positions of elements (e.g., "top," "bottom," "above," "below") 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.

Although the figures and description may illustrate a specific order of method steps, the order of such steps may differ from what is depicted and described, unless specified differently above. Also, two or more steps may be performed concurrently or with partial concurrence, unless specified differently above.

It is important to note that the construction and arrangement of the assemblies as shown in the various exemplary

embodiments is illustrative only. Additionally, any element disclosed in one embodiment may be incorporated or utilized with any other embodiment disclosed herein. For example, the sump jet **21** may be incorporated in, or replaced with, the sump jet **37**. Although only one example of an element from one embodiment that can be incorporated or utilized in another embodiment has been described above, it should be appreciated that other elements of the various embodiments may be incorporated or utilized with any of the other embodiments disclosed herein.

What is claimed is:

1. A connector assembly for coupling a non-vitreous fluid delivery component to a toilet, the connector assembly comprising:

a connector body disposed within a chamber including a first opening and a second opening, the chamber coupled to and in fluid communication with a sump of a toilet;

a nut adjustably coupled to the connector body; and

a sealing member disposed on the connector body,

wherein a portion of the connector body and a portion of the sealing member are disposed within the first opening.

2. The connector assembly of claim **1**, wherein the chamber coupled to and in fluid communication with the sump extends outward and forward in front of the sump.

3. The connector assembly of claim **1**, wherein the sealing member is configured to expand and compress radially between the chamber and the non-vitreous fluid delivery component.

4. The connector assembly of claim **1**, wherein the sump is in fluid communication with the chamber by the second opening.

5. The connector assembly of claim **4**, wherein the first opening and the second opening are parallel to one another.

6. The connector assembly of claim **4**, wherein the nut is configured to be adjusted relative to the connector body and wherein the sealing member is configured to expand and compress radially between the first opening and the non-vitreous fluid delivery component in response to the nut being adjusted.

7. A toilet assembly comprising:

a toilet, including a sump and a chamber coupled to the sump, the chamber including a first opening and a second opening;

a non-vitreous fluid delivery component coupled to the toilet and in fluid communication with the toilet; and

a connector assembly coupling the non-vitreous fluid delivery component to the toilet, the connector assembly comprising:

a connector body disposed within the chamber;

a nut adjustably coupled to the connector body; and

a sealing member disposed on the connector body,

wherein a portion of the connector body and a portion of the sealing member are disposed within the first opening.

8. The toilet assembly of claim **7**, wherein the non-vitreous fluid delivery component is a sump jet.

9. The toilet assembly of claim **8**, wherein when coupled to the toilet a central channel of the sump jet is substantially horizontal.

10. The toilet assembly of claim **7**, wherein the first opening and the second opening are disposed parallel to one another.

11. The toilet assembly of claim **1**, wherein the chamber is in fluid communication with the sump by the second opening and wherein a portion of the non-vitreous fluid delivery component is disposed in the second opening.

12. The toilet assembly of claim **1**, wherein the sealing member is configured to expand and compress radially between the chamber and the non-vitreous fluid delivery component.

13. The toilet assembly of claim **12**, wherein the nut is configured to be adjusted relative to the connector body to cause the connector body to compress the sealing member against the first opening, such that the non-vitreous fluid delivery component is coupled to the chamber at the first opening.

14. A sump jet assembly for a toilet, the sump jet assembly comprising:

a sump jet configured to be coupled to, and in fluid communication with, a sump of the toilet; and

a connector assembly for coupling the sump jet to the toilet, the connector assembly comprising:

a connector body;

a nut adjustably connected to the connector body; and

a sealing member disposed on the connector body and configured to expand and compress radially between the sump jet and a portion of the toilet, coupling the sump jet to the toilet,

wherein the nut is configured to be adjusted relative to the connector body to cause the connector body to compress the sealing member against a portion of the toilet, such that the sump jet is coupled to the toilet.

15. The sump jet assembly of claim **14**, wherein when the sump jet is coupled is coupled to the toilet, a central channel of the sump jet is substantially horizontal.

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