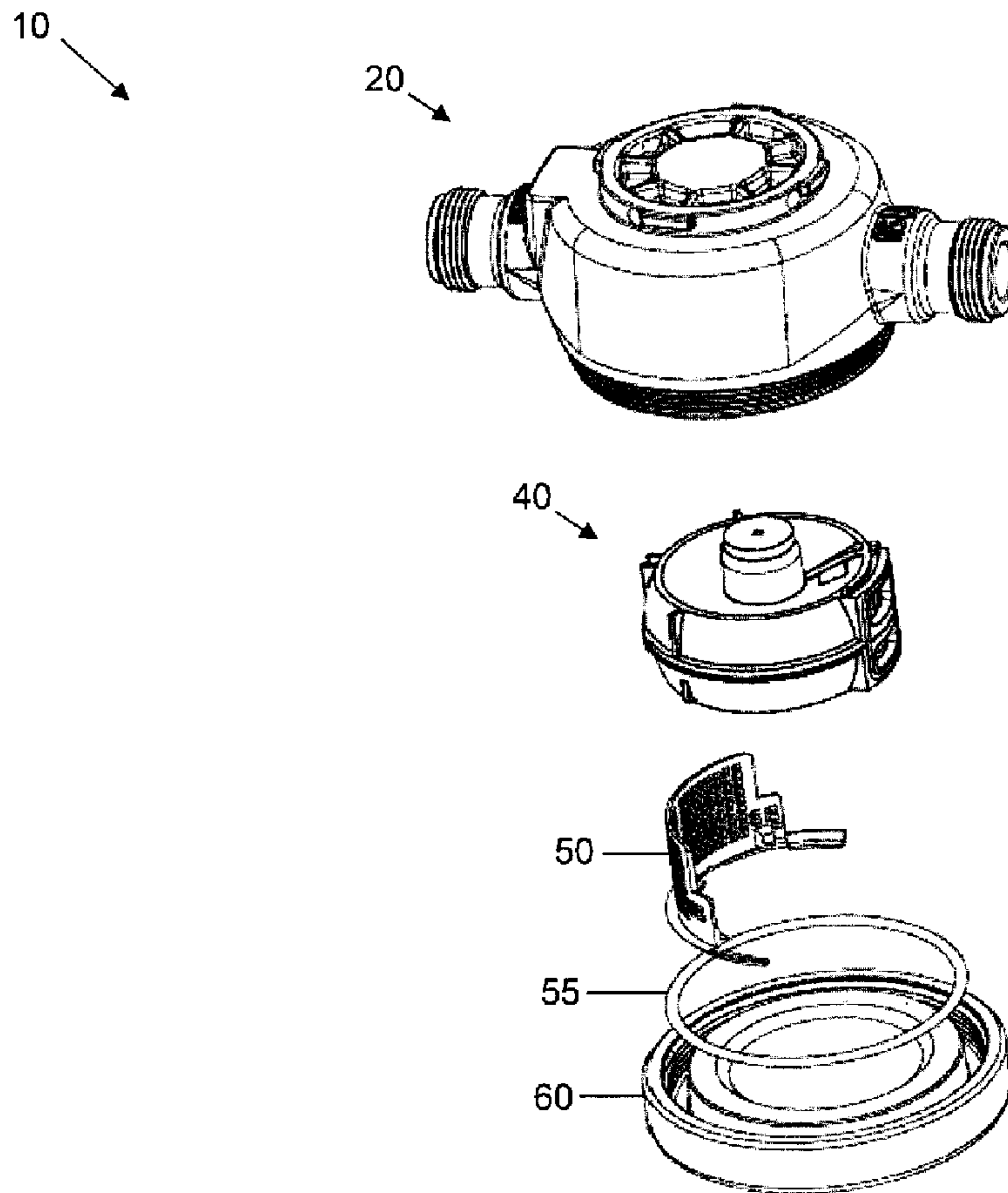




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 (54) Title: PLASTIC WATER METER WITH METAL THREADS



(57) Abrégé/Abstract:

Embodiments of the present invention generally relate to flow meters and more particularly to improved plastic water flow meters for commercial or residential use. In various embodiments, a plastic water meter is provided that may include metal threads for



(57) **Abrégé(suite)/Abstract(continued):**

connecting the water meter to a water system. In particular, the plastic water meter may include at least one spud that is shaped to receive and engage a plastic spud insert, in which the plastic spud insert may include a metal ring with a threaded outer surface. The plastic spud insert may include an annular lip portion extending outwardly to discourage removal of the metal ring when the spud insert is engaged with the water meter. Furthermore, the plastic spud insert and the inner surface of the metal ring may have complementary circumferential profiles to discourage relative rotation between the metal ring and the spud insert.

ABSTRACT OF THE DISCLOSURE

Embodiments of the present invention generally relate to flow meters and more particularly to improved plastic water flow meters for commercial or residential use. In various embodiments, a plastic water meter is provided that may include metal threads for connecting the water meter to a water system. In particular, the plastic water meter may include at least one spud that is shaped to receive and engage a plastic spud insert, in which the plastic spud insert may include a metal ring with a threaded outer surface. The plastic spud insert may include an annular lip portion extending outwardly to discourage removal of the metal ring when the spud insert is engaged with the water meter. Furthermore, the plastic spud insert and the inner surface of the metal ring may have complementary circumferential profiles to discourage relative rotation between the metal ring and the spud insert.

PLASTIC WATER METER WITH METAL THREADS

[0001] [Blank]

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention generally relates to flow meters and more particularly to improved plastic water flow meters for commercial and residential use.

2. Description of Related Art

[0003] Water meters are designed to measure the volume of water usage or the volume of water flow. Water meters can be used in both commercial and residential settings, and they can be utilized at a water source, a point of water usage, or anywhere in between. Typically, water meters are manufactured from one of two types of material: metal or plastic. The trend with water meters is towards the use of plastic meters, as opposed to metal meters. One reason for this trend is that many jurisdictions now require zero lead content in the water supply and accordingly, meters in contact with the water supply also need to have zero lead content. Plastic meters satisfy this zero lead content requirement.

[0004] Generally, a water meter possesses threaded inlets and outlets to facilitate the connection between the water meter and the water system. Plastic water meters generally utilize plastic threads, but water systems typically employ metal threads for the mating connections with water meters. Accordingly, the plastic threads have a tendency to strip or cross thread during installation. Therefore, there is a desire for a plastic water meter with improved inlet and outlet connectivity.

BRIEF SUMMARY OF THE INVENTION

[0005] The following summary is not an extensive overview and is not intended to identify key or critical elements of the apparatuses, methods, systems, processes, and the like, or to

delineate the scope of such elements. This Summary provides a conceptual introduction in a simplified form as a prelude to the more-detailed description that follows.

[0006] In one embodiment of the present invention, a water meter is provided. The water meter may include a plastic top cover defining an interior cavity shaped to accept a metering device, in which the top cover further defines at least one spud defining a bore in communication with the interior cavity; a metering device positioned in the interior cavity; a bottom cover engaging the top cover and enclosing the metering device within the interior cavity; and at least one connector assembly engaging the at least one spud. The connector assembly may include a plastic spud insert having a first end and a second end, in which the plastic spud insert may include an engagement portion proximate the first end engaging the spud, an annular lip portion positioned proximate the second end and extending outwardly, and a collar portion having a circumferential profile and positioned intermediate the engagement portion and lip portion. The assembly may also include a metal ring having an inner surface and outer surface, in which threads may be formed on the outer surface and the inner surface may have a profile complementary with the profile of the collar, the metal ring may be positioned proximate the lip portion with the inner surface engaging the collar portion, and the circumferential profile of the collar portion and the complementary profile of the metal ring may be configured to discourage relative relational movement. In alternative embodiments, the water meter may include an inlet spud and an outlet spud and an inlet connector assembly and an outlet connector assembly, in which each connector assembly may engage its respective inlet spud or outlet spud. In such embodiments, the inlet spud may be situated approximately 180 degrees opposite the outlet spud. In regard to the materials that makeup the components of the connector assembly, the plastic top cover and/or the plastic spud insert may be styrene, polystyrene, nylon, or glass reinforced thermoplastic, among other materials, and the metal ring may be brass, bronze, a brass derivative, a bronze derivative, or stainless steel, among other materials. Furthermore, the metering device included in the water meter may be a nutating disk displacement flow meter. Even more, the engagement portion of the plastic spud insert may engage the spud by a mild interference fit and may be secured to the spud by spin welding, solvent welding, sonic welding, or by an adhesive, among other methods. Additionally, the circumferential profile of the collar may define various shapes, including a shape having at least one linear section, a shape having a

plurality of linear sections, and a substantially oval shape, among other shapes. Furthermore, the inner surface of the metal ring may engage the collar portion by a key-fit arrangement.

[0007] In another embodiment of the present invention, a connector assembly for use with a plastic device having a spud defining a bore is provided. The assembly may include a plastic spud insert having a first end and a second end, in which the plastic spud insert may include an engagement portion proximate the first end configured to engage with the bore, an annular lip portion positioned proximate the second end and extending outwardly, and a collar portion having a circumferential profile and positioned intermediate the engagement portion and lip portion. The assembly may also include a metal ring having an inner surface and outer surface, in which threads may be formed on the outer surface and the inner surface may have a profile complementary with the profile of the collar, the metal ring may be positioned proximate the lip portion with the inner surface engaging the collar portion, and the circumferential profile of the collar portion and the complementary profile of the metal ring may be configured to discourage relative relational movement. The circumferential profile of the collar may define various shapes, including a shape having at least one linear section, a shape having a plurality of linear sections, and a substantially oval shape, among other shapes. Furthermore, the inner surface of the metal ring may engage the collar portion by a key-fit arrangement. As for the materials that makeup the components of the connector assembly, the plastic spud insert may be styrene, polystyrene, nylon, or glass reinforced thermoplastic, among other materials, and the metal ring may be brass, bronze, a brass derivative, a bronze derivative, or stainless steel, among other materials.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0008] Reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

[0009] Fig. 1 is an exploded view of a plastic water meter **10** according to one embodiment of the present invention.

[0010] Fig. 2 is an exploded view of the housing assembly **20** shown in Fig. 1.

[0011] Fig. 3 is an exploded, cross-section view of a plastic water meter **10** according to one embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0012] The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all embodiments of the inventions are shown. Indeed, these inventions may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like numbers refer to like elements throughout.

[0013] Various embodiments of the present invention provide improved plastic water meters that address issues known in the art, some of which are discussed above. Fig. 1 illustrates a plastic water meter **10** according to one embodiment of the present invention. This embodiment may include a water meter housing assembly **20** that may enclose a metering device **40** and a strainer **50**. The metering device **40** and the strainer **50** may be positioned inside the housing assembly **20**, and a bottom cover **60** and an o-ring **55** may enclose them within the housing assembly **20**.

[0014] Referring to Figs. 2 and 3, the housing assembly **20** may include a top cover **21** and two connector assemblies **24A, B**. Each connector assembly **24A, B** may include a plastic spud insert **26A, B** and a metal ring **25A, B**, and one connector assembly may function as an inlet connector assembly **24A** and the other connector assembly may function as an outlet connector assembly **24B**. Additionally, the top cover **21** may include an integrated inlet spud **23A** and an integrated outlet spud **23B**. The top cover **21** and the two spud inserts **26A, B** may be made from various types of plastic or high-strength polymer materials, including styrene, polystyrene, nylon, or the like. In a preferred embodiment, the top cover **21** and the two spud inserts **26A, B** may be composed of glass reinforced thermoplastic. Factors that may be considered when selecting a material include working pressures of the meter, and working temperature ranges.

[0015] The top cover **21** may be substantially cylindrical in shape with an integrated top face portion **22**, although those skilled in the art will recognize that the top cover **21** may take other shapes. The bottom of the top cover **21** remains open, thus forming an aperture that leads to the interior cavity **31** of the top cover **21**.

[0016] Proximate the bottom of the top cover **21** may be external threads **30**, which may enable the bottom cover **60** to engage to the top cover **21**. In use, the top cover may flex outwards because of pressure in the system thereby causing the internal threads in the top cover

to be urged against the complementary threads on the bottom cover. In other embodiments, the top cover may include internal threads designed to engage external threads on the bottom cover.

[0017] One advantage of the external bottom threads **30** provided in various embodiments of the present invention may be that external bottom threads **30** are easier to manufacture than internal bottom threads. As will be understood by those skilled in the art, forming internal threads requires an insert mold, while forming external threads does not. In some cases, an additional manufacturing step may be required to remove the internal thread mold insert, which may reduce the efficiency of the molding process.

[0018] In the illustrated embodiment, the top cover **21** may include an integrated inlet spud **23A**, through which water enters the interior cavity **31** defined by the top cover **21**, and an integrated outlet spud **23B**, through which water exits the top cover **21**. The inlet spud **23A** and outlet spud **23B** may be in communication with the interior cavity **31** of the top cover **21**. Also, the inlet spud **23A** and the outlet spud **23B** may be each designed to receive and engage a portion of the spud insert **26A, B**.

[0019] Both the inlet spud **23A** and the outlet spud **23B** protrude substantially perpendicularly from the exterior of the top cover **21**, with the outlet spud **23B** situated approximately 180 degrees around the exterior of the top cover **21** from the inlet spud **23A**. As will be understood by those of skill in the art, the inlet spud **23A** and outlet spud **23B** may have a relative orientation other than 180 degrees.

[0020] The spuds **23A, B** may be substantially similar to each other and may have a substantially cylindrical in shape. Each spud **23A, B** defines an axial bore with a proximate orifice that opens through the wall of the top cover **21** into the interior cavity **31** of the top cover **21** and a distal orifice that opens away from the top cover **21**. The proximate orifice and distal orifice of each spud **23A, B** may be substantially circular in shape. In alternative embodiments of the present invention, each spud **23A, B**, may not protrude from the exterior of the top cover **21**, but may instead be an orifice in the exterior of the top cover **21**.

[0021] The bores defined by the inlet spud **23A** and the outlet spud **23B** may be each sized to receive a spud insert **26A, B** respectively, and each spud insert **26A, B** may include an externally threaded metal ring **25A, B**. A purpose of the threaded metal rings **25A, B** may be to facilitate connection of the water meter to a water system, which generally utilizes metal threads for the

connection to the water meter. Each spud insert **26A, B** may be substantially cylindrical in shape with a bore formed therein to allow the passage of water.

[0022] Each spud insert **26A, B** may include a first end proximate to the top cover **21** and a second end distal the top cover **21**. Proximate the second end of each spud insert **26A, B** may be an annular lip portion or rim **29A, B** that extends outwardly. Each threaded metal ring **25A, B** may be positioned proximate the annular lip portion **29A, B** on the spud insert **26A, B**. A purpose of the annular lip portion **29A, B** may be to aid in positioning the threaded metal ring **25A, B** on the spud insert **26A, B** and to discourage removal of the threaded metal ring **25A, B** when the spud insert **26A, B** may be engaged with the top cover **21**, as will be discussed in greater detail later. Additionally, the spud insert **26A, B** may include a collar portion **28A, B** that may have a circumferential profile and may be positioned proximate to the lip portion **29A, B**. The collar portion **28A, B** may be shaped to engage a complementary shaped profile of the inner surface of the threaded metal ring **25A, B** to discourage relative rotation between the threaded metal ring **25A, B** and the spud insert **26A, B**. In one embodiment, the circumferential profile of the collar portion **28A, B** may define a shape having at least one linear section or facet. In other embodiments, the circumferential profile of the collar portion **28A, B** may define a shape having a plurality of linear sections. In such embodiments, the circumferential profile may take the shape of, for example, a triangle, square, pentagon, hexagon, or octagon. In even more embodiments, the circumferential profile of the collar portion **28A, B** may be substantially oval. In further embodiments, inner surface of the threaded metal ring **25A, B** may engage the collar portion **28A, B** by a key-fit arrangement.

[0023] Extending from the collar **28A, B** of each spud insert **26A, B** may be an engagement portion **27A, B**. This engagement portion **27A, B** may have a cylindrical shape and may be sized to be positioned within the axial bore of a spud **23A, B**. The orifice proximate the engagement portion **27A, B** of each spud insert **26A, B** may be substantially circular in shape and may be substantially perpendicular to each cylindrically-shaped spud insert **26A, B**. In various embodiments, the exterior diameter of the engagement portion **27A, B** of each spud insert **26A, B** may be substantially similar to the interior diameter of the axial bore of each spud **23A, B**. Thus, the engagement portion **27A, B** of each spud insert **26A, B** fits snugly into its associated spud **23A, B**. In some embodiments, there may be a mild interference fit. The spud insert **26A, B** may be secured to the respective spud **23A, B** using spin welding, solvent welding, sonic

welding, or an adhesive. An advantage of this arrangement may be that the metal threads do not contact the water supply and therefore do not impact the zero lead content requirements present in many jurisdiction.

[0024] The threaded metal ring **25A, B** may be made from various types of metals and metal alloys, including brass, bronze, brass or bronze derivatives, stainless steel, or other similar metal materials. In a preferred embodiment, the threaded metal ring **25A, B** may be made of bronze. Factors that may be considered when selecting a material for the threaded metal ring **25A, B** include material strength and corrosion resistance.

[0025] In alternative embodiments, the top cover **21** may include one spud or may include more than two spuds, in accordance with the present invention. In such embodiments, each spud would be similar in construction to the spuds disclosed above and would be shaped to engage a spud insert that may include a metal threaded ring, in accordance with the above disclosure.

[0026] In various embodiments, the metering device **40** may be a nutating disk displacement flow meter, wobble plate meter, or other metering device known in the art. The metering device **40** may contain an inlet through which water enters the metering device **40** and an outlet through which water exits the metering device **40**. Referring to Fig. 3, the metering device **40** may contain a nutating disk **42** mounted on a sphere **44** that is “wobbled” by the fluid flow where each “wobble” represents a finite amount of fluid transferred. It should be understood that other types of metering devices may be used in connection with the present invention.

[0027] The strainer **50** may be semi-cylindrical in shape and may be designed to be situated between the inlet spud of the top cover **21** and the inlet of the metering device **40**. The strainer **50** may be designed to strain foreign objects from the water before the water enters the metering device **40**.

[0028] The metering device **40** and the strainer **50** may be positioned inside the top cover **21** and the bottom cover **60** may enclose them within the top cover **21**. The bottom cover **60** may be circular in shape and may contain a top face that may be configured to be positioned proximate to the top cover **21** and a bottom face that may be distal to the top cover **21**. The top face of the bottom cover **60** may contain a substantially annular channel that may be shaped and sized to engage the bottom end of the top cover **21**. In particular, the width of the channel may be substantially similar to thickness of the wall of the bottom end of the top cover **21**. The exterior wall of the channel may include threads that are configured to engage the external bottom

threads **30** of the top cover **21** to enclose the metering device **40** and the strainer **50** within the interior cavity **31** of the top cover **21**.

[0029] The bottom cover **60** may be made from various types of plastic or high-strength polymer materials, including styrene, polystyrene, nylon, or the like. In a preferred embodiment, the bottom cover **60** may be composed of glass reinforced thermoplastic. Factors that may be considered when selecting a material include working pressures of the meter, and working temperature ranges.

[0030] The o-ring **55** may be positioned in the channel to provide a seal between the top cover **21** and the cover **60**. In the illustrated embodiment, the cross section of the o-ring is circular; however, other o-ring profiles may be used in connection with embodiments of the present invention.

[0031] Many modifications and other embodiments of the inventions set forth herein will come to mind to one skilled in the art to which these inventions pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the inventions are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

THAT WHICH IS CLAIMED

1. A water meter comprising:

a plastic top cover defining an interior cavity shaped to accept a metering device, said top cover further defining at least one spud defining a bore in communication with the interior cavity;

said metering device positioned in the interior cavity;

a bottom cover engaging the top cover and enclosing the metering device within the interior cavity; and

at least one connector assembly engaging the at least one spud, said connector assembly comprising:

a plastic spud insert having a first end and a second end comprising:

an engagement portion proximate the first end engaging the at least one spud, an annular lip portion positioned proximate the second end and extending outwardly, and

a collar portion having a circumferential profile and positioned intermediate the engagement portion and lip portion, and

a metal ring having an inner surface and outer surface, wherein threads are formed on the outer surface and the inner surface has a profile complementary with the profile of the collar, wherein the metal ring is positioned proximate the lip portion with the inner surface engaging the collar portion, and wherein the circumferential profile of the collar portion and the complementary profile of the metal ring are configured to discourage relative rotational movement, by key fit arrangement.

2. The water meter of Claim 1, wherein the at least one spud comprises an inlet spud and an outlet spud and wherein the at least one connector assembly comprises an inlet connector assembly and an outlet connector assembly engaging respective inlet and outlet spuds.

3. The water meter of Claim 2, wherein the inlet spud is situated approximately 180 degrees

opposite the outlet spud.

4. The water meter of Claim 1, wherein the plastic top cover comprises a material selected from the group consisting of styrene, polystyrene, nylon, and glass reinforced thermoplastic.
5. The water meter of Claim 1, wherein the plastic spud insert comprises a material selected from the group consisting of styrene, polystyrene, nylon, and glass reinforced thermoplastic.
6. The water meter of Claim 1, wherein the metering device comprises a nutating disk displacement flow meter.
7. The water meter of Claim 1, wherein the engagement portion engages the spud by a mild interference fit.
8. The water meter of Claim 1, wherein the engagement portion is secured to the spud by spin welding.
9. The water meter of Claim 1, wherein the engagement portion is secured to the spud by solvent welding.
10. The water meter of Claim 1, wherein the engagement portion is secured to the spud by sonic welding.
11. The water meter of Claim 1, wherein the engagement portion is secured to the spud by an adhesive.
12. The water meter of Claim 1, wherein the circumferential profile of the collar portion defines a shape having at least one linear section.
13. The water meter of Claim 1, wherein the circumferential profile of the collar portion defines a shape having a plurality of linear sections.
14. The water meter of Claim 1, wherein the circumferential profile of the collar portion is substantially oval.
15. The water meter of Claim 1, wherein the inner surface of the metal ring engages the

collar portion by a key-fit arrangement.

16. The water meter of Claim 1, wherein the metal ring comprises a material selected from the group consisting of brass, bronze, a brass derivatives, bronze derivatives, and stainless steel.
17. A connector assembly for use with a plastic device having a spud defining a bore, said connector assembly comprising:

a plastic spud insert having a first end and a second end comprising:

an engagement portion proximate the first end configured to engage with the bore, an annular lip portion positioned proximate the second end and extending outwardly, and

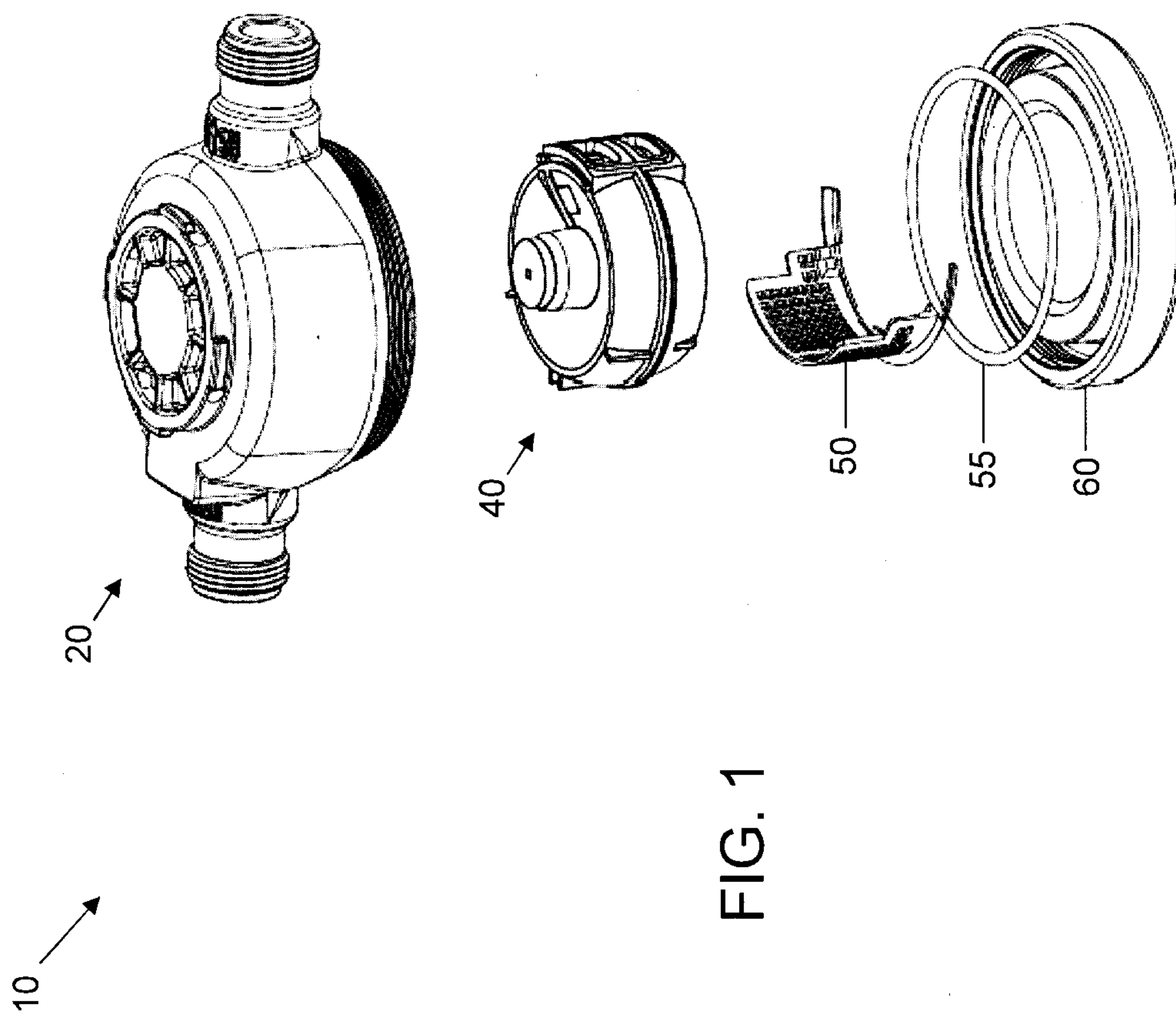
a collar portion having a circumferential profile and positioned intermediate the engagement portion and lip portion; and

a metal ring having an inner surface and outer surface, wherein threads are formed on the outer surface and the inner surface has a profile complementary with the profile of the collar, wherein the metal ring is positioned proximate the lip portion with the inner surface engaging the collar portion, and wherein the circumferential profile of the collar portion and the complementary profile of the metal ring are configured to discourage relative rotational movement, by key fit arrangement.
18. The connector assembly of Claim 17, wherein the circumferential profile of the collar portion defines a shape having at least one linear section.
19. The connector assembly of Claim 17, wherein the circumferential profile of the collar portion defines a shape having a plurality of linear sections.
20. The connector assembly of Claim 17, wherein the circumferential profile of the collar portion is substantially oval.
21. The connector assembly of Claim 17, wherein the inner surface of the metal ring engages the collar portion by a key-fit arrangement.

22. The connector assembly of Claim 17, wherein the plastic spud insert comprises a material selected from the group consisting of styrene, polystyrene, nylon, and glass reinforced thermoplastic.
23. The connector assembly of Claim 17, wherein the metal ring comprises a material selected from the group consisting of brass, bronze, brass derivatives, bronze derivatives, and stainless steel.
24. A water meter comprising:
 - a non-metallic cover defining an interior cavity shaped to accept a metering device;
 - a metering device positioned in the interior cavity;
 - a metal ring including an inner surface and outer surface, wherein threads are formed on the outer surface;
 - a collar portion contacting the inner surface of the metal ring; and
 - an annular lip portion retaining the metal ring relative to the non-metallic cover;and wherein a circumferential profile of the collar portion and a complementary profile of the metal ring are configured to discourage relative rotational movement, by key fit arrangement.
25. The water meter of Claim 24, wherein the collar portion and annular lip portion are connected to the non-metallic cover.
26. The water meter of Claim 24, further comprising at least one spud connected to the non-metallic cover and defining a bore in communication with the interior cavity.
27. The water meter of Claim 26, wherein the at least one spud includes at least an inlet spud and at least an outlet spud.
28. The water meter of Claim 24, wherein the at least one inlet spud is situated approximately 180 degrees opposite the at least one outlet spud.

29. The water meter of Claim 26, wherein the collar portion is connected to the at least one spud.
30. The water meter of Claim 29, wherein the annular lip portion is connected to the collar portion.
31. The water meter of Claim 30, wherein the collar portion and annular lip portion are connected to the at least one spud.
32. The water meter of Claim 26, wherein at least one spud insert engages each at least one spud.
33. The water meter of Claim 32, wherein the collar portion and annular lip portion are connected to the at least one spud insert.
34. The water meter of Claim 32, wherein the at least one spud insert includes an engagement portion to engage the at least one spud inside the bore.
35. The water meter of Claim 24, further comprising a bottom cover fixedly attached to the non-metallic cover and enclosing the metering device within the interior cavity.
36. The water meter of Claim 24, wherein the collar portion has a profile complementary to the inner surface of the metal ring.
37. The water meter of Claim 24, wherein the collar portion receives the metal ring.
38. The water meter of Claim 37, wherein the collar portion receives the metal ring by a key-fit arrangement.
39. The water meter of Claim 24, wherein the non-metallic cover is of a material selected from the group consisting of styrene, polystyrene, nylon, and glass reinforced thermoplastic.
40. The water meter of Claim 24, wherein the metering device includes a nutating disk displacement flow meter.
41. The water meter of Claim 24, wherein the circumferential profile of the collar portion defines a shape including at least one linear section.

42. The water meter of Claim 24, wherein the circumferential profile of the collar portion is substantially oval.
43. The water meter of Claim 24, wherein the metal ring is of a material selected from the group consisting of brass, bronze, brass derivatives, bronze derivatives, and stainless steel.



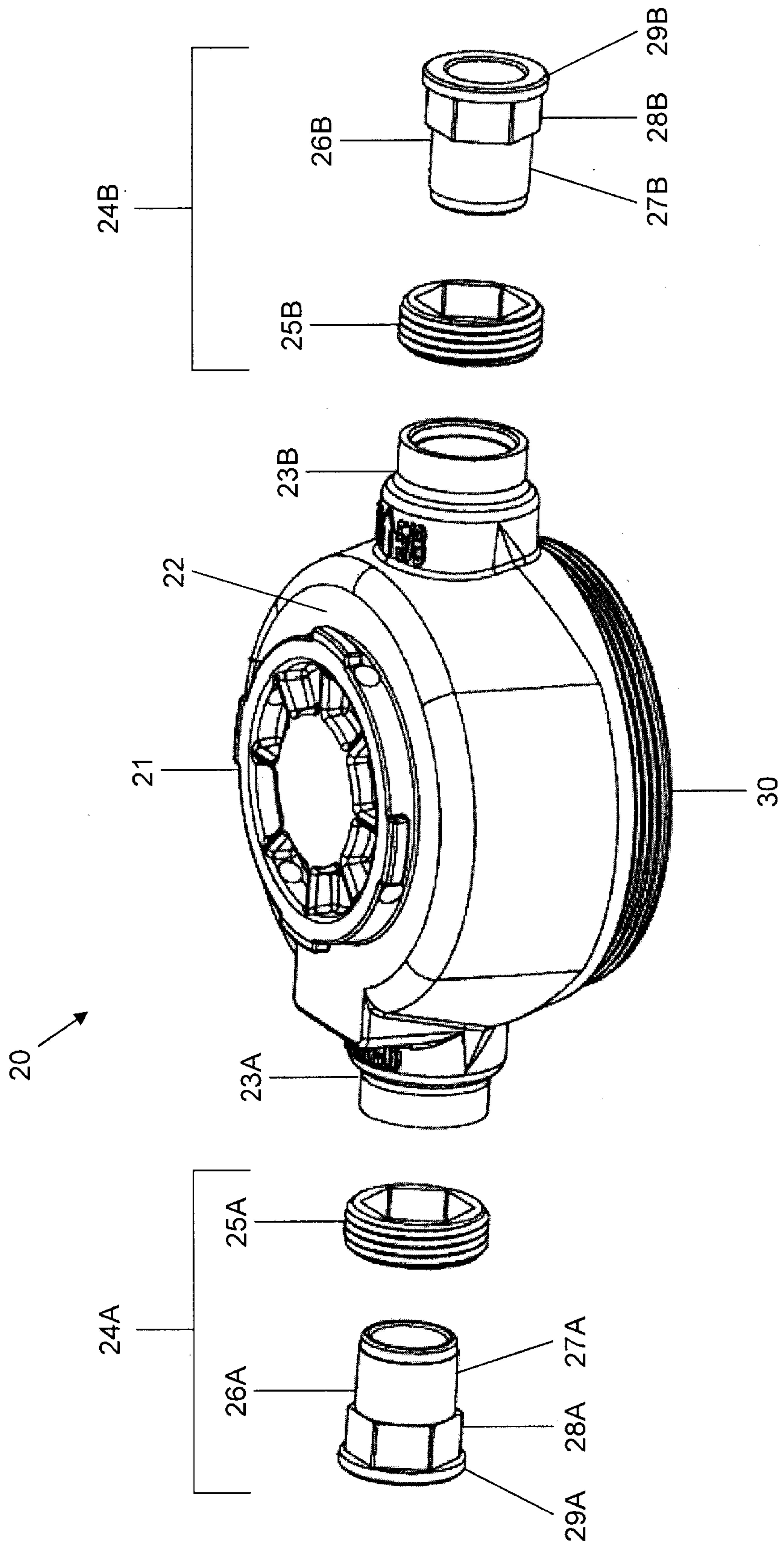


FIG. 2

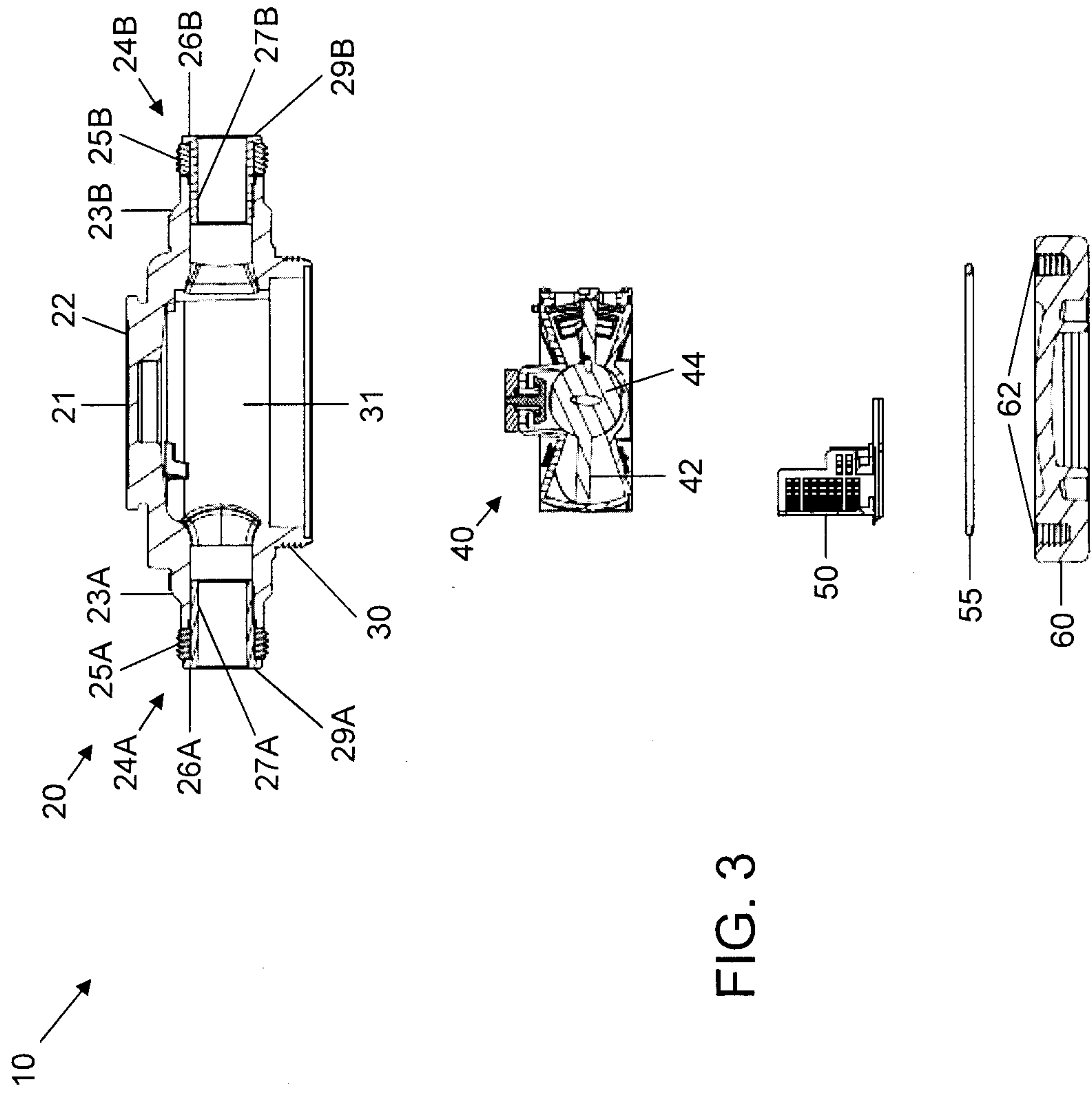
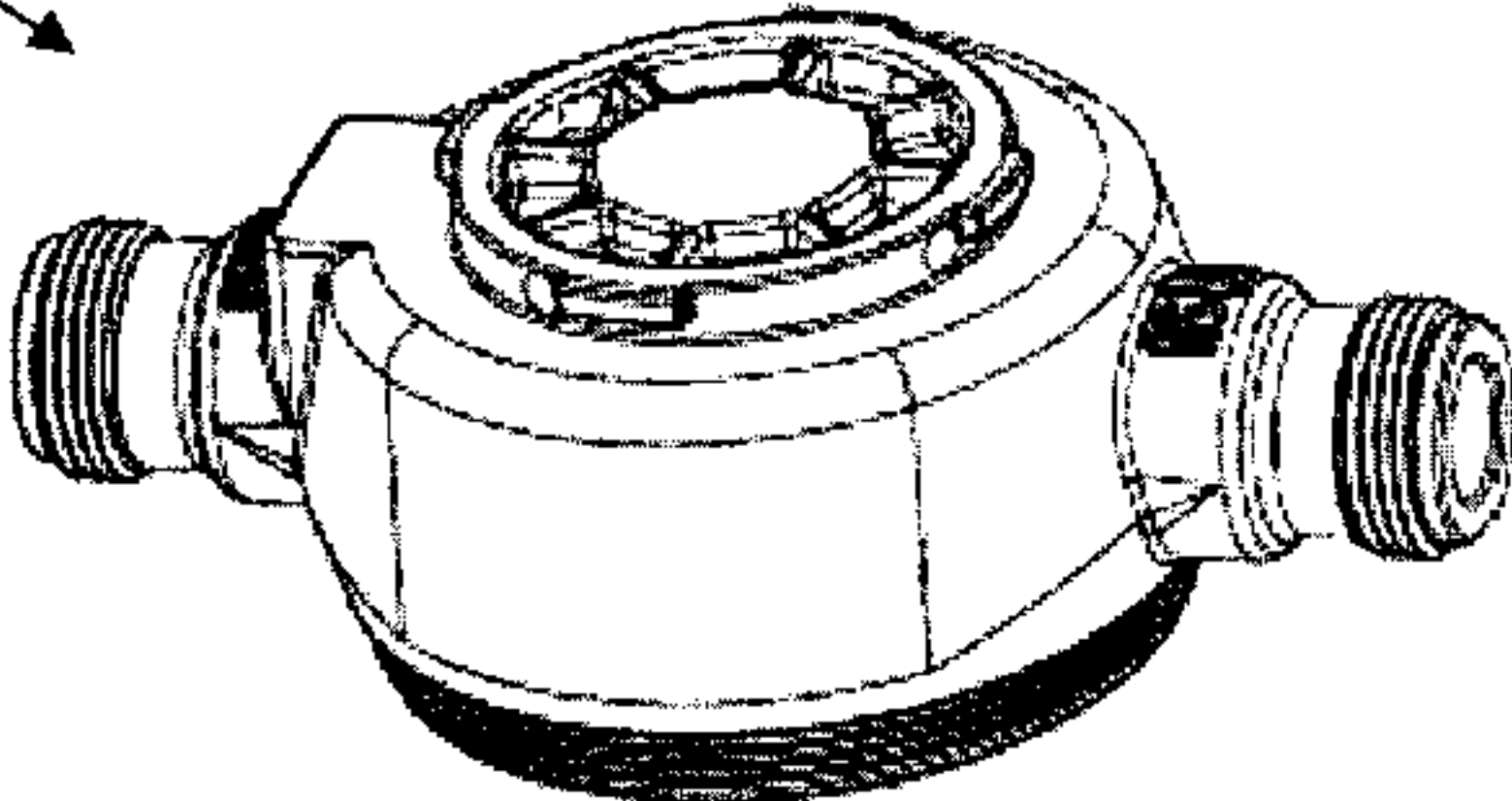


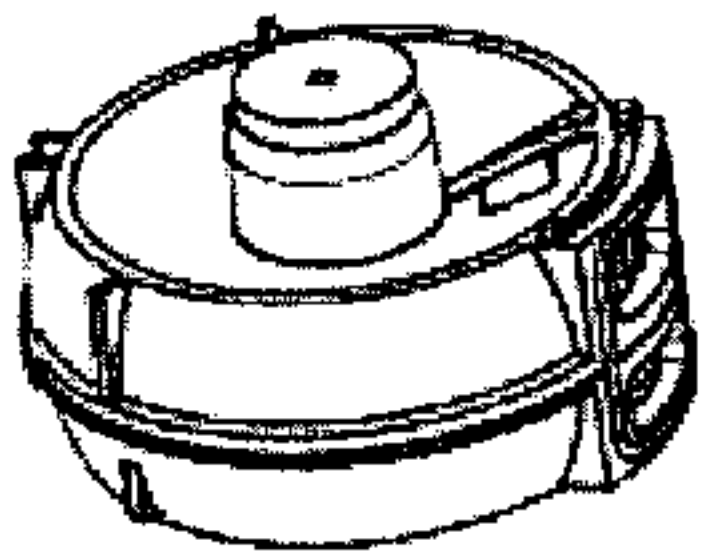
FIG. 3

10

20



40



50

55

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