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IN-LINE FLUID COUPLING

Abstract

A fluid coupling for use with a reservoir of a water distribution system, such as a ganged reservoir system.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] The present application is a continuation-in-part of U.S. patent application Ser. No. 18/771,820, filed Jul. 12, 2024, which claims priority to U.S. Provisional Patent Application Ser. No. 63/526,558, filed Jul. 13, 2023, and the present application claims priority to U.S. Provisional Patent Application Ser. No. 63/639,348, filed Apr. 26, 2024, the disclosures of which are expressly incorporated by reference herein.

BACKGROUND AND SUMMARY OF THE DISCLOSURE

[0002] The present invention relates generally to water distribution systems and, more particularly, to a fluid coupling for use with reservoirs in such water distribution systems.

[0003] It is known to provide dispensers within refrigerators (or other appliances) in order to enhance user accessibility to ice and/or water. Typically, a water line is connected to the refrigerator in order to supply needed water for operation of the dispenser. Such dispensers often include a water tank within a fresh food compartment of the refrigerator to act as a reservoir such that a certain quantity of water can be chilled prior to being dispensed.

[0004] Conventional water tanks for appliance dispensers may be formed from a variety of known processes, such as blow molding of a polymer. An illustrative process is detailed in U.S. Pat. No. 7,850,898 to Rowley et al., the disclosure of which is expressly incorporated herein by reference, in which a heated extrudate is positioned in a mold followed by insertion of previously extrudated profiles a main body of the extrudate. The mold is closed and pressure applied through the inserted profiles to expand the main body of the extrudate to fill the mold cavity.

[0005] Various coupling arrangements are known for interconnecting water tanks and providing fluid connections to other fluid components in conventional water distribution systems. For example, an illustrative coupling system for a ganged reservoir system is shown in U.S. Pat. No. 11,358,851 to Gardner et al., the disclosure of which is expressly incorporated herein by reference.

[0006] As shown in FIG. **1**, a known reservoir system or assembly **10** illustratively includes a molded tank **12** formed of a polymer. Tubes **14** and **16**, also illustratively formed of a polymer, are operably coupled to opposing ends **18** and **20** of the tank **12**. Overmolds **22***a*, **22***b* and **24***a*, **24***b* are illustratively formed on opposing proximal and distal ends **26***a*, **26***b* and **28***a*, **28***b* of the tubes **14** and **16**, respectively.

[0007] More particularly, overmolds **22***a*, **22***b* on the proximal ends **26***a*, **26***b* of the tubes **14** and **16** are illustratively formed of a polymer and become chemically/heat bonded to the tank during forming of the tank **12**. As such, the overmolds **22***a*, **22***b* couple the tubes **14** and **16** to the tank **12**. Overmolds **24***a*, **24***b* fluidly couple distal ends **28***a*, **28***b* of the tubes **14** and **16** to a valve or other part of the reservoir system **10**. The overmolds **24***a*, **24***b* are illustratively formed of a polymer and typically require "full crosslinking". The tank **12** itself may be formed of a polymer that only requires "partial crosslinking".

[0008] For tubes **14** and **16** that include overmolds **22***a*, **22***b* and **24***a*, **24***b*, it is typically required to fully crosslink the tube **14**, **16** and the respective overmolds **24***a*, **24***b*, while shielding/blocking the tube **14**, **16** and/or the respective overmolds **22***a*, **22***b*. The tubes **14**, **16** and respective overmolds **22***a*, **22***b* are shielded so that a user can insert overmold **22***a*, **22***b*, or tube **14**, **16**, into the extrudate as the tank **12** is formed. Bonding between the tank **12** and the tube **14**, **16** and overmolds **22***a*, **22***b* needs to take place before crosslinking occurs to ensure a chemical/heat bond. Then the completed assembly **10** (tank **12**, tubes **14**, **16**, and overmolds **22**, **24**) may be crosslinked as a system to facilitate crosslinking of the tank **12**.

[0009] The requirement of a leak free connection/bond/joint at the interface of overmold **22***a*, **22***b* to the tank **12** dictates the above-noted shielding. As apparent, this makes the crosslinking process more difficult and requires additional tooling and slower processing of the reservoir system **10**. This results in overmolds **22***a*, **22***b* and **24***a*, **24***b* and tubes **14** and **16** receiving some crosslinking twice (before bonding to the tank **12**, and then again with the tank **12**).

[0010] As such, there remains a need for an efficient and cost effective fluid coupler, and related method of forming same, for a reservoir system.

[0011] According to an illustrative embodiment of the present disclosure, a reservoir system includes a first container portion having a first side wall with a first neck defining a first opening, and second container portion including a second side wall with a second neck defining a second opening. A first fitting includes a longitudinally extending first barbed projection received within the first opening of the first container portion, and a transversely extending male connector in fluid communication with the first barbed projection. A first tube includes a proximal end and a distal end, the first tube being fluidly coupled to the first fitting. A first overmold secures the proximal end of the first tube to the first fitting. A second fitting includes a longitudinally extending second barbed projection received within the second opening of the second container portion, and a transversely extending female connector in fluid communication with the second barbed projection. The male connector is received within the female connector to fluidly couple the first fitting with the second fitting. A second tube includes a proximal end and a distal end, the second end being fluidly coupled to the second fitting. A second overmold secures the proximal end of the second tube to the second fitting.

[0012] According to another illustrative embodiment of the present disclosure, a reservoir system includes a first container portion having a first side wall with a first neck defining a first opening, and second container portion having a second side wall with a second neck defining a second opening. A first fitting includes a longitudinally extending lower projection received within the first opening of the first container portion, a longitudinally extending upper projection in fluid communication with the lower projection, and a transversely extending male connector in fluid communication with the lower projection and the upper projection. A first tube includes a proximal end and a distal end, the first tube being fluidly coupled to the first fitting. A first overmold secures the proximal end of the first tube to the upper projection of the first fitting. A second fitting includes a longitudinally extending lower projection received within the second opening of the second container portion, a longitudinally extending upper projection in fluid communication with the lower projection, and a transversely extending female connector in fluid communication with the lower projection and the upper projection. The male connector is received within the female connector to fluidly couple the first fitting with the second fitting. A second tube includes a proximal end and a distal end, the second tube being fluidly coupled to the second fitting. A second overmold secures the proximal end of the second tube to the upper projection of the second fitting. A releasable retainer extends between the male connector and the female connector.

[0013] According to a further illustrative embodiment of the present disclosure, a fluid coupling for a reservoir system includes a first fitting including a longitudinally extending lower projection, a longitudinally extending upper projection, and a transversely extending male connector in fluid communication with the lower projection and the upper projection. The lower projection of the first fitting is a tubular projection including outwardly extending barbs. A second fitting includes a longitudinally extending lower projection, a longitudinally extending upper projection, and a transversely extending female connector in fluid communication with the lower projection and the upper projection. The male connector is received within the female connector to fluidly couple the first fitting with the second fitting. The lower projection of the second fitting is a tubular projection including outwardly extending barbs. A releasable retainer extends between the male connector and the female connector.

[0014] According to another illustrative embodiment of the present disclosure, a reservoir system includes a first container portion including a first side wall having a first neck defining a first opening, and a second container portion including a second side wall having a second neck defining a second opening. A first fitting portion includes a longitudinally extending lower projection received within the first opening of the first container portion, and a laterally extending side projection in fluid communication with the lower projection. A first tube includes a proximal end and a distal end, the first tube fluidly coupled to the first fitting portion. A second fitting

portion includes a longitudinally extending lower projection received within the second opening of the second container portion, and a laterally extending side projection in fluid communication with the lower projection. A second tube includes a proximal end and a distal end, the second tube fluidly coupled to the second fitting portion.
[0015] According to a further illustrative embodiment of the present disclosure, a fluid coupling for a reservoir system includes a first fitting portion having a longitudinally extending lower projection, and a laterally extending side projection, wherein the lower projection of the first fitting portion is a tubular projection including outwardly extending barbs. A second fitting portion includes a longitudinally extending lower projection, and a laterally extending side projection, wherein the lower projection of the second fitting portion is a tubular projection including outwardly extending barbs. A passageway extends between the first fitting portion and the second portion, wherein the passageway includes a reduced diameter portion. A standoff is positioned intermediate the first fitting portion and the second fitting portion, the standoff extending perpendicular to the lower projections of the first fitting portion and the second fitting portion, and extending perpendicular to the side projections of the first fitting portion and the second fitting portion.
[0016] Additional features and advantages of the present invention will become apparent to those skilled in the art upon consideration of the following detailed description of the illustrative embodiment exemplifying the best mode of carrying out the invention as presently perceived.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0017] A detailed description of the drawings particularly refers to the accompanying figures, in which:
[0018] FIG. **1** is a cross-sectional view of a prior art reservoir system;
[0019] FIG. **2** is a perspective view of an illustrative fluid coupling of the present disclosure supported within an upper portion of a reservoir;
[0020] FIG. **3** is a side elevational view of the illustrative fluid coupling of FIG. **2**;
[0021] FIG. **4** is an exploded perspective view of the illustrative fluid coupling of FIG. **2**;
[0022] FIG. **5** is a cross-sectional view taken along line **5-5** of FIG. **2**;
[0023] FIG. **6** is a detailed exploded perspective view of the connection between a male component and a female component of the fluid coupling of FIG. **2**;
[0024] FIG. **7** is a detailed perspective view similar to FIG. **6**, showing the male component partially received within the female component;
[0025] FIG. **8** is a detailed perspective view similar to FIG. **7**, showing the male component fully received within the female component in an unlocked mode;
[0026] FIG. **9** is a detailed perspective view similar to FIG. **8**, showing the male component fully received within the female component in a locked mode;
[0027] FIG. **10** is a cross-sectional view taken along line **10-10** of FIG. **8**, showing the male component fully received within the female component in the unlocked mode of FIG. **8**;
[0028] FIG. **11** is a cross-sectional view similar to FIG. **10**, showing the male component fully received within the female component in the locked mode of FIG. **9**;
[0029] FIG. **12** is a perspective view of a further illustrative fluid coupling of the present disclosure spaced apart, showing first and second tubes;
[0030] FIG. **13** is a cross-sectional view taken along line **13-13** of FIG. **12**;
[0031] FIG. **14** is a cross-sectional view taken along line **14-14** of FIG. **12**;
[0032] FIG. **15** is a detailed cross-sectional view of a further illustrative embodiment of FIG. **13**;
[0033] FIG. **16** is a perspective view of another illustrative fluid coupling of the present disclosure,

showing a quick-connect fitting secured thereto; and

[0034] FIG. **17** is an exploded perspective view of the illustrative fluid coupling and quick-connect fitting of FIG. **16**.

DETAILED DESCRIPTION OF THE DRAWINGS

[0035] The embodiments of the invention described herein are not intended to be exhaustive or to limit the invention to the precise form disclosed. Rather, the embodiments selected for description have been chosen to enable one skilled in the art to practice the invention.

[0036] As used herein, the term "overmold" means the process of injection molding a second polymer over a first polymer, wherein the first and second polymers may or may not be the same. An overmold having a specific geometry may be necessary to attach a tube to a fitting, a valve, another tube, a diverter, a manifold, a fixture, a T connector, a Y connector or other plumbing or appliance connection. In one illustrative embodiment, the composition of the second (e.g., overmolded) polymer will be such that it will be capable of at least some melt fusion with the composition of the first polymer (e.g., the polymeric tube or fitting). There are several means by which this may be affected. One of the simplest procedures is to insure that at least a component of the first polymer and that of the second polymer is the same. Alternatively, it would be possible to ensure that at least a portion of the polymer composition of the first polymer and that of the second polymer is sufficiently similar or compatible so as to permit the melt fusion or blending or alloying to occur at least in the interfacial region between the exterior of the first polymer fitting and the interior region of the second polymer. Another manner in which to state this would be to indicate that at least a portion of the polymer compositions of the first polymer and the second polymer are miscible. In contrast, the chemical composition of the polymers may be relatively incompatible, thereby not resulting in a material-to-material bond after the injection overmolding process.

[0037] In some examples, the reservoir, or any of the components defined herein, may be made from high density polyethylene which is crosslinked, although the process described herein can be used with tubes or fittings made from any crosslinked polymers. Such polymers may include, but are not limited to, nylon, EVA, PVC, metallocine, polypropylene, polyethylene, silicone, rubber and EPDM. Crosslinked polyethylene, also known as PEX, contains crosslinked bonds in the polymer structure changing the thermoplastic into a thermoset. Crosslinking may be accomplished during or after extrusion depending on the method of crosslinking. The required degree of crosslinking for crosslinking polyethylene tubing, according to ASTM Standard F 876, is between 65-89%. However, the present process contemplates that certain components may be partially crosslinked. In one illustrative example, such components may only be crosslinked to 40%. There are three classifications of PEX, referred to as PEX-A, PEX-B, and PEX-C. PEX-A is made by peroxide (Engel) method. In the PEX-A method, peroxide blending with the polymer performs crosslinking above the crystal melting temperature. The polymer is typically kept at high temperature and pressure for long periods of time during the extrusion process. PEX-B is formed by the silane method, also referred to as the "moisture cure" method. In the PEX-B method, silane blended with the polymer induces crosslinking during secondary post-extrusion processes, producing crosslinks between a crosslinking agent. The process is accelerated with heat and moisture. The crosslinked bonds are formed through silanol condensation between two grafted vinyltrimethoxysilane units. PEX-C is produced by application of an electron beam using high energy electrons to split the carbon-hydrogen bonds and facilitate crosslinking.

[0038] Crosslinking imparts shape memory properties to polymers. Shape memory materials have the ability to return from a deformed state (e.g. temporary shape) to their original crosslinked shape (e.g. permanent shape), typically induced by an external stimulus or trigger, such as a temperature change. Alternatively or in addition to temperature, shape memory effects can be triggered by an electric field, magnetic field, light, or a change in pH, or even the passage of time. Shape memory polymers include thermoplastic and thermoset (covalently crosslinked) polymeric materials.

[0039] Shape memory materials are stimuli-responsive materials. They have the capability of changing their shape upon application of an external stimulus. A change in shape caused by a change in temperature is typically called a thermally induced shape memory effect. The procedure for using shape memory typically involves conventionally processing a polymer to receive its permanent shape, such as by molding the polymer in a desired shape and crosslinking the polymer defining its permanent crosslinked shape. Afterward, the polymer is deformed and the intended temporary shape is fixed. This process is often called programming. The programming process may consist of heating the sample, deforming, and cooling the sample, or drawing the sample at a low temperature. The permanent crosslinked shape is now stored while the sample shows the temporary shape. Heating the shape memory polymer above a transition temperature induces the shape memory effect providing internal forces urging the crosslinked polymer toward its permanent or crosslinked shape. Alternatively or in addition to the application of an external stimulus, it is possible to apply an internal stimulus (e.g., the passage of time) to achieve a similar, if not identical result.

[0040] A chemical crosslinked network may be formed by low doses of irradiation.

[0041] Polyethylene chains are oriented upon the application of mechanical stress above the melting temperature of polyethylene crystallites, which can be in the range between 60° C. and 130° C. Materials that are most often used for the production of shape memory linear polymers by ionizing radiation include high density polyethylene, low density polyethylene and copolymers of polyethylene and poly (vinyl acetate). After shaping, for example, by extrusion or compression molding, the polymer is covalently crosslinked by means of ionizing radiation, for example, by highly accelerated electrons. The energy and dose of the radiation are adjusted to the geometry of the sample to reach a sufficiently high degree of crosslinking, and hence sufficient fixation of the permanent shape.

[0042] Another example of chemical crosslinking includes heating poly (vinyl chloride) under a vacuum resulting in the elimination of hydrogen chloride in a thermal dehydrocholorination reaction. The material can be subsequently crosslinked in an HCl atmosphere. The polymer network obtained shows a shape memory effect. Y et another example is crosslinked poly[ethylene-co-(vinyl acetate)] produced by treating the radical initiator dicumyl peroxide with linear poly[ethylene-co-(vinyl acetate)] in a thermally induced crosslinking process. Materials with different degrees of crosslinking are obtained depending on the initiator concentration, the crosslinking temperature and the curing time. Covalently crosslinked copolymers made form stearyl acrylate, methacrylate, and N,N′-methylenebisacrylamide as a crosslinker.

[0043] Additionally shape memory polymers include polyurethanes, polyurethanes with ionic or mesogenic components, block copolymers consisting of polyethyleneterephthalate and polyethyleneoxide, block copolymers containing polystyrene and poly(1,4-butadiene), and an ABA triblock copolymer made from poly(2-methyl-2-oxazoline) and a poly(tetrahydrofuran). Further examples include block copolymers made of polyethylene terephthalate and polyethylene oxide, block copolymers made of polystyrene and poly(l,4-butadiene) as well as ABA triblock copolymers made from poly(tetrahydrofuran) and poly(2-methyl-2-oxazoline). Other thermoplastic polymers which exhibit shape memory characteristics include polynorbornene, and polyethylene grated with nylon-6 that has been produced for example, in a reactive blending process of polyethylene with nylon-6 by adding maleic anhydride and dicumyl peroxide.

[0044] Referring now to FIGS. **2-4**, an illustrative fluid reservoir system **100** is shown as including to a fluid coupling **102** of the present disclosure. The illustrative reservoir system **100** includes a fluid reservoir, such as a serpentine container or tank **104** including a first container portion **106**, a second container portion **108**, and a lower intermediate container portion **110** extending between, and below, the first and second container portions **106** and **108**. The first container portion **106** includes a first side wall **112** having a first neck **114** defining a first opening **116**. Similarly, the second container portion **108** includes a second side wall **118** having a second neck **120** defining a second opening **122**.

[0045] In certain illustrative embodiments, the first neck **114** is formed integral with the first container portion **106**, and the second neck **120** is formed integral with the second container portion **108**. As such, the first and second side walls **112** and **118** define the first and second openings **116** and **122**, respectively. In other illustrative embodiments, a first inset tube **121** may be received within the first neck **114**, and a second inset tube **123** may be received within the second neck **120** (FIG. **4**). More particularly, the first side wall **112** may be molded over the first inset tube **121** to define the first opening **116**, and the second side wall **118** may be molded over the second inset tube **123** to define the second opening **122**. The inset tubes **121** and **123** may help maintain a consistent inner diameter, circular cross-sectional shape and smooth inner surface.
[0046] The intermediate container portion **110** also includes a side wall **124** operably coupled to the first and second side walls **112** and **118** to define a chamber **126** in fluid communication with the first and second openings **116** and **122** (FIG. **5**). As further detailed herein, the tank **104** may be molded from a polymer, such as a polyethylene.
[0047] With reference to FIGS. **4** and **5**, the illustrative fluid coupling **102** includes a first (e.g., male) fitting **130** releasably and fluidly coupled to a second (e.g., female) fitting **132**. The first fitting **130** illustratively includes a longitudinally extending first projection **134** received within the first opening **116** of the first container portion **106**. In the orientation shown in FIGS. **2-5**, the first projection **134** extends downwardly. The first projection **134** illustratively includes a tubular member **136** defining a longitudinal axis **138** and having a plurality of outwardly extending barbs **140**. The first projection **134** is received within the first opening **116** of the first container portion **106**, wherein the barbs **140** engage with the first neck **114**.
[0048] A longitudinally extending second projection **142** is illustratively axially aligned along the longitudinal axis **138** with the first projection **134** and is in fluid communication therewith. In the orientation shown in FIGS. **2-5**, the second projection **142** extends upwardly. The second projection **142** illustratively includes a tubular member **144** including a plurality of outwardly extending barbs **146**.
[0049] A transversely extending male connector **148** is illustratively in fluid communication with both the upwardly first and second projections **136** and **142**. The male connector **148** illustratively includes a tubular member **150** defining a transverse axis **152** extending perpendicular to the longitudinal axis **138**. Annular projections **154** may extend radially outwardly from the tubular member **150**. As further detailed herein, the first fitting **130** is illustratively formed of a polymer, such as a polyethylene. However, the structure of the first fitting **130** facilitates the use of materials other than a polymer, such as metal.
[0050] The second fitting **132** illustratively includes a longitudinally extending first projection **156** received within the second opening **122** of the second container portion **108**. In the orientation shown in FIGS. **2-5**, the first projection **156** extends downwardly. The first projection **156** illustratively includes a tubular member **158** defining a longitudinal axis **160** and having a plurality of outwardly extending barbs **162**. The first projection **156** is received within the second opening **122** of the second container portion **108**, wherein the barbs **162** engage with the second neck **120**.
[0051] A longitudinally extending second projection **164** is illustratively axially aligned along the longitudinal axis **160** with the first projection **156** and is in fluid communication therewith. In the orientation shown, the second projection **164** extends upwardly. The second projection **164** illustratively includes a tubular member **166** including a plurality of outwardly extending barbs **168**.
[0052] A transversely extending female connector **170** is illustratively in fluid
[0053] communication with both the first and second projections **156** and **164**. The female connector **170** includes a side wall **171** and is releasably coupled with the male connector **148** to define a fluid coupler **172** providing fluid communication between the first fitting **130** and the second fitting **132**. A cylindrical handle **173** is illustratively supported above the female connector **170** and is configured to facilitate manipulation of the second fitting **132** relative to the first fitting

130. An annular seal **175**, illustratively formed of an elastomer, is illustratively received between the tubular member **150** and the side wall **171** to provide a fluid seal between the male connector **148** and the female connector **170**.

[0054] As further detailed herein, the second fitting **132** is illustratively formed of a polymer, such as a polythelyne. However, the structure of the second fitting **132** facilitates the use of materials other than a polymer, such as metal. Illustratively, a retainer **174** releasably secures the male connector **148** with the female connector **170**.

[0055] With further reference to FIGS. **2-5**, a first tube **176** includes a side wall **178** extending between a proximal end **180** and a distal end **182**. The first tube **176** is illustratively formed of a polymer, such as a polyethylene. The proximal end **180** of the first tube **176** is fluidly coupled to the first fitting **130** via the upwardly extending second projection **142**. A first overmold **184** illustratively secures the proximal end **180** of the first tube **176** to the first fitting **130**. Illustratively, the side wall **178** of the first tube **176** is captured between the barbs **140** and the overmold **184**. More particularly, the first overmold **184** is formed on the outer surface of the first tube **176** and provide additional reinforcement (i.e., thicken the side wall) of the first tube **176**.

[0056] As shown in FIG. **2**, a fitting **186** is illustratively formed via overmolding on the distal end **182** of the first tube **176**. The fitting **186** may be configured to fluidly couple to other components of the reservoir system **100** (e.g., additional tanks, valves, etc.). Illustratively, the fitting **186** is fully cross-linked.

[0057] Similarly, a second tube **196** includes a side wall **198** extending between a proximal end **200** and a distal end **202**. The second tube **196** is illustratively formed of a polymer, such as a polyethylene. The proximal end **200** of the second tube **196** is fluidly coupled to the second fitting **132** via the upwardly extending second projection **164**. A second overmold **204** illustratively secures the proximal end **198** of the second tube **196** to the second fitting **132**. Illustratively, the side wall **198** of the second tube **196** is captured between the barbs **162** and the overmold **204**. More particularly, the second overmold **204** is formed on the outer surface of the second tube **196** and provide additional reinforcement (i.e., thicken the side wall) of the second tube **196**.

[0058] As detailed above, the first overmold **184** cooperates with the barbs **146** of the projection **142** to couple the first tube **176** to the first fitting **130**, and the second overmold **204** cooperates with the barbs **168** of the projection **164** to couple with the second tube **196** to the second fitting **132**. In other illustrative embodiments, different couplers may be substituted for the cooperating overmolds **184**, **204** and barbs **146**, **168**, such as quick connect (e.g., bayonet) couplers, ultrasonic welding, adhesives, etc. For example, an illustrative quick-connect fitting is detailed in U.S. Patent Application Publication No. 2022/0333723 to Gardner et al., the disclosure of which is expressly incorporated herein by reference.

[0059] As shown in FIG. **2**, a fitting **206** is illustratively formed via overmolding on the distal end **202** of the second tube **196**. The fitting **206** may be configured to fluidly couple to other components of the reservoir system **100** (e.g., additional tanks, valves, etc.). Illustratively, the fitting **206** is fully cross-linked.

[0060] The fluid coupler **172** includes the first (e.g., male) connector **148** and the second (e.g., female) connector **170**. The coupler **172** mechanically and fluidly couples together the male and female connectors **148** and **170**.

[0061] With reference to FIGS. **6-11**, the fluid connector **172** illustratively includes the retainer **174** in the form of a quarter turn fitting similar to a bayonet style coupling. The retainer **174** is movable between an unlocked mode (FIGS. **8** and **10**) and a locked mode (FIGS. **9** and **11**).

[0062] The illustrative retainer **174** includes diametrically opposed protrusions or locking tabs **208** supported by the male connector **148** and extending radially outwardly therefrom. The locking tabs **208** are slidably received within axial slots **210** formed within an inner surface of the female connector **170**. A proximal end **212** of each slot **210** is open, while a distal end **214** of each slot **210** is connected to an arcuate locking slot **216**. A retaining lip **218** is configured to engage the tabs **208** for axially securing the male connector **148** with the female connector **170**.

[0063] For higher pressure applications, multiple connectors **148** and **170**, and cooperating annular seals **175** may be utilized.

[0064] During assembly of the coupling **102**, the first (e.g., male) fitting **130** is rotationally offset by approximately 90 degrees from the second (e.g., female) fitting **132**, as shown in FIG. **6**. The male connector **148** is then inserted into the female connector **170** wherein the locking tabs **208** are inserted into the slots **210**, as shown in FIG. **7**. With reference to FIG. **8**, the male connector **148** is then axially moved into the female connector **170** such that the locking tabs **208** slide within the slots **210**. Next, the male connector **148** is rotated by approximately 90 degrees relative to the female connector **170** such that the tabs **208** rotate within the locking slots **210** from the unlocked position (FIGS. **8** and **10**) into the locked position (FIGS. **9** and **11**). In the locked position as shown in FIG. **9**, the locking tabs **208** engage with the retaining lip **218** to axially retain the male connector **148** within the female connector **170**, thereby securing the first fitting **130** to the second fitting **132** and defining the fluid coupling **102**.

[0065] The reservoir system **100** provides for more efficient full crosslinking of the connecting tubes and the respective overmolds. The tanks may be crosslinked more efficiently since they do not have tube assemblies attached and taking up space and entangling themselves.

[0066] With reference now to FIGS. **12-14**, a further illustrative fluid coupling **302** is shown for use with a fluid reservoir, such as the serpentine container or tank **104** detailed above. The fluid coupling **302** illustratively includes a body **304** including a first fitting portion **306** fluidly coupled to a second fitting portion **308**. Illustratively, the first fitting portion **306** and the second fitting portion **308** may be integrally molded from a polymer. In one illustrative embodiment, the body **304** may be formed of a cross-linked polyethylene (PEX).

[0067] The first fitting portion **306** illustratively includes a longitudinally extending lower projection **310**, and a laterally extending side projection **312**. Illustratively, the lower projection **310** extends vertically downward from a center support **313**, while the side projection **312** extends horizontally outward from the center support **313**. The lower projection **310** is a tubular projection including a cylindrical side wall **314** defining a passageway **316** having an external opening **318**, illustratively an outlet. Illustratively, a plurality of outwardly extending barbs **320** are supported by the side wall **314**. Other types of couplers may be substituted for the barbs **320**, such as quick connect (e.g., bayonet) couplers, ultrasonic welding, adhesives, etc. A stop, illustratively an annular flange **321**, extends outwardly from the side wall **314**.

[0068] Similarly, the side projection **312** is a tubular projection including a side wall **322** defining a passageway **324** having an external opening **326**, illustratively defining an inlet, such as a connector. A connector, such as a plurality of outwardly extending barbs **328**, is illustratively supported by the side wall **322**. As further described herein, the barbs **328** may be replaced with other types of connectors. The passageway **316** of the lower projection **306** is in fluid communication with the passageway **324** of the side projection **312**. A stop, illustratively an annular flange **329**, extends outwardly from the side wall **322**.

[0069] The second fitting portion **308** illustratively includes a longitudinally extending lower projection **330**, and a laterally extending side projection **332**. The lower projection **330** is a tubular projection including a cylindrical side wall **334** defining a passageway **336** having an external opening **338**, illustratively an inlet. Illustratively, a plurality of outwardly extending barbs **340** are supported by the side wall **334**. Other types of couplers may be substituted for the barbs **340**, such as quick connect (e.g., bayonet) couplers, ultrasonic welding, adhesives, etc. A stop, illustratively an annular flange **341**, extends outwardly from the side wall **334**.

[0070] Similarly, the side projection **332** is a tubular projection including a side wall **342** defining a passageway **344** having an external opening **346**, illustratively defining an outlet. Illustratively, a connector, such as a plurality of outwardly extending barbs **348**, is supported by the side wall **342**. As further detailed herein, the barbs **348** may be replaced with other types of connectors. A stop, illustratively an annular flange **349**, extends outwardly from the side wall **342**. The passageway **336** of the lower projection **330** is in fluid communication with the passageway **344** of the side projection **322**.

[0071] A passageway **350** illustratively extends within the center support **313** between the first fitting portion **306** and the second fitting portion **308**. More particularly, the passageway **350** is illustratively in fluid communication with the passageways **316** and **324** of the projections **310** and **312** of the first fitting portion **306**, and with the passageways **336** and **344** of the projections **330** and **332** of the second fitting portion **308**. A reduced diameter portion or opening **352** is formed within the passageway **350**. The reduced diameter portion or opening **352** may allow air to slowly escape from the tank **104** upon filling with water. By allowing air to escape via the opening **352**, the full volume of the reservoir tank **104** is available to contain water that can be cooled (in the case of the reservoir **104** within a refrigerator, for example).

[0072] An outwardly extending standoff **354** is illustratively defined by the body **304**. In an illustrative embodiment, the standoff **354** includes a cylindrical side wall **356** defining a center opening **358** for receiving a fastener (not shown), illustratively for attaching the tank **104** to the inside back of a refrigerator. In other illustrative embodiments, the standoff **354** may be eliminated or replaced with other securement devices, such as a tab for securing with a nylon tie or strap. While the illustrative fluid coupling **302** is configured for attachment to a refrigerator, it should be appreciated that other uses may be substituted therefor.

[0073] With reference to FIGS. **2-6** and **12-14**, the fluid coupling **302** further includes the first tube **176** having proximal end **180** and distal end **182**, the first tube **176** being fluidly coupled to the first fitting portion **306**. More particularly, the proximal end **180** of the first tube **176** is fluidly coupled to the first fitting portion **306** via the side projection **312**. The flange **329** provides a stop for the proximal end **180** of the first tube **176**. First overmold **184** illustratively secures the proximal end of the first tube to the side projection **312** of the first fitting portion **306**. Illustratively, the side wall **178** of the first tube **176** is captured between the barbs **328** and the overmold **184**. More particularly, the first overmold **184** is formed on the outer surface of the first tube **176** and provide additional reinforcement (i.e., thicken the side wall) of the first tube **176**.

[0074] The fluid coupling **302** also includes the second tube **196** having proximal end **200** and distal end **202**, the second tube **196** being fluidly coupled to the second fitting portion **308**. More particularly, the proximal end **200** of the second tube **196** is fluidly coupled to the second fitting portion **308** via the side projection **322**. The flange **349** provides a stop for the proximal end **200** of the second tube **196**. Second overmold **204** illustratively secures the proximal end of the second tube **196** to the side projection **322** of the second fitting portion **308**. Illustratively, the side wall **198** of the second tube **196** is captured between the barbs **348** and the overmold **204**. More particularly, the second overmold **204** is formed on the outer surface of the second tube **196** and provide additional reinforcement (i.e., thicken the side wall) of the second tube **196**.

[0075] It may be appreciated that the coupler defined by the barbs **328** and cooperating overmold **184** may be substituted by other types of couplers, such as quick connect (e.g., bayonet) couplers, ultrasonic welding, adhesives, etc. Similarly, the barbs **348** and cooperating overmold **204** may be substituted by other types of couplers, such as quick connect (e.g., bayonet) couplers, ultrasonic welding, adhesives, etc.

[0076] With further reference to FIGS. **2** and **13**, the reduced diameter opening **352** between the inlet **326** and the outlet **346** may also be utilized to control the mixing of water directly from the inlet **326** and from the reservoir tank **104**. In a refrigerator application of the reservoir system **100**, the temperature of the water provided to the outlet **346** may be controlled by mixing water via the opening **352**. A deflector **360** may be configured to direct water from the inlet **326** initially to the outlet **318** until the reservoir tank **104** is adequately filled. Water then passes directly from the inlet **326** through the reduced diameter opening **352** between the passageways **344** and **350** to mix with water from the tank **104** through the opening **338** before exiting through the outlet **346**. In other words, the reduced diameter opening **352** provides for the metering of water which may help control the temperature of water exiting through the outlet **346**.

[0077] As shown in FIGS. **13** and **15**, the reduced diameter opening **352** may be molded with the body **304** (either integrally or overmolded). In other illustrative embodiments, the reduced diameter opening **352** may be defined by an insert. For example, an elastomeric washer **362** having a reduced diameter opening **352** may be received with an annular opening **364** defined within the body **304** between the passageways **344** and **350**.

[0078] It should be appreciated that the illustrative embodiment fluid coupling **102** of the fluid reservoir system **100** shown in FIG. **5** may also include a reduced diameter portion similar to reduced diameter opening **352**. For example, the tubular member **150** of the male connector **148** may include a reduced diameter portion in order to allow air to exit the reservoir tank **104**, as well as control water temperature at the outlet defined by the tubular member **166**.

[0079] FIGS. **16** and **17** show a further illustrative fluid coupling **402** for use with a fluid reservoir, such as the serpentine container or tank **104** detailed above. The fluid coupling **402** includes many similar features as the fluid coupling **302**. As such, in the following description similar components are identified with like reference numbers.

[0080] The fluid coupling **402** illustratively includes a body **404** including a first fitting portion **406** fluidly coupled to a second fitting portion **408**. Illustratively, the first fitting portion **406** and the second fitting portion **408** may be integrally molded from a polymer. In one illustrative embodiment, the body **404** may be formed of a cross-linked polyethylene (PEX).

[0081] The first fitting portion **406** illustratively includes a side projection **412** extending laterally from the center support **313**. Similarly, the second fitting portion **408** illustratively includes a side projection **432** extending laterally from the center support **313** in an opposite direction from the side projection **412**.

[0082] The side projection **412** is a tubular projection including a side wall **422** defining the passageway **324** having the external opening **326**, illustratively defining an inlet. An annular groove **428** is configured to releasably couple with a pair of movable arms **429** of a quick connect fitting **430**. The quick connect fitting **430** may be of the type disclosed in U.S. Pat. No. 11,898,676 to Gardner et al., the disclosure of which is expressly incorporated herein by reference.

[0083] The side projection **432** is a tubular projection including a side wall **442** defining the passageway **344** having the external opening **346**, illustratively defining an outlet. An annular groove **448** is configured to couple with a pair of movable arms **429** of a quick connect fitting **430** in a manner similar to the side projection **412**.

[0084] Each of the side projections **412** and **432** may support a seal, such as an o-ring **450**, to sealingly engage with respective quick connect fitting **430**. Illustratively, the o-rings **450** may be received within annular grooves **452** formed within the side walls **422** and **442** of the side projections **412** and **432**, respectively.

[0085] As detailed above, illustrative embodiment fittings **130**, **132**, **306**, **308**, **406**, **408** include projections **142**, **164**, **322**, **332**, **422**, **432** having various features (e.g., barbs **146**, **168**, **328**, **348**, and/or grooves **428**, **448**) to facilitate fluid coupling with respective tubes **176**, **196**. It should be appreciated that the projections **142**, **164**, **322**, **332**, **422**, **432** may include different features for coupling with different fluid connectors or fittings. For example, features of a connection fitting of the type detailed in U.S. Pat. No. 10,760,716 to Currey et al., the disclosure of which is expressly incorporated herein by reference, may be included with any of the projections **142**, **164**, **322**, **332**, **422**, **432**.

[0086] Although the invention has been described in detail with reference to certain preferred embodiments, variations and modifications exist within the spirit and scope of the invention as described and defined in the following claims.

Claims

1. A reservoir system comprising: a first container portion including a first side wall having a first neck defining a first opening; a second container portion including a second side wall having a second neck defining a second opening; a first fitting portion including a longitudinally extending lower projection received within the first opening of the first container portion, and a laterally extending side projection in fluid communication with the lower projection; a first tube including a proximal end and a distal end, the first tube fluidly coupled to the first fitting portion; a second fitting portion including a longitudinally extending lower projection received within the second opening of the second container portion, and a laterally extending side projection in fluid communication with the lower projection; and a second tube including a proximal end and a distal end, the second tube fluidly coupled to the second fitting portion.
2. The reservoir system of claim 1, wherein the first fitting portion is integral with the second fitting portion.
3. The reservoir system of claim 1, further comprising: a first overmold securing the proximal end of the first tube to the side projection of the first fitting portion; and a second overmold securing the proximal end of the second tube to the side projection of the second fitting portion.
4. The reservoir system of claim 1, further comprising a passageway extending between the first fitting portion and the second fitting portion, wherein the passageway includes a reduced diameter portion.
5. The reservoir system of claim 4, wherein the reduced diameter portion is defined by an insert washer.
6. The reservoir system of claim 4, wherein the reduced diameter portion is configured to control the mixing of water between an inlet of the first fitting portion and an inlet of the second fitting portion from the second container portion provided to an outlet of the second fitting portion.
7. The reservoir system of claim 1, further comprising a standoff positioned intermediate the first fitting portion and the second fitting portion, the standoff extending perpendicular to the lower projections of the first fitting portion and the second fitting portion, and extending perpendicular to the side projections of the first fitting portion and the second fitting portion.
8. The reservoir system of claim 1, wherein the lower projection of the first fitting portion is a tubular projection including outwardly extending barbs, and the lower projection of the second fitting portion is a tubular projection including outwardly extending barbs.
9. The reservoir system of claim 8, wherein the side projection of the first fitting portion is a tubular projection including outwardly extending barbs, and the side projection of the second fitting portion is a tubular projection including outwardly extending barbs.
10. The reservoir system of claim 1, wherein: the first container portion is an upper portion of a first container; and the second container portion is an upper portion of a second container positioned in spaced relation to the first container.
11. The reservoir system of claim 1, wherein a single container defines the first container portion and the second container portion.
12. The reservoir system of claim 1, wherein: the first overmold comprises a first collar concentrically received around the proximal end of the first tube; and the second overmold comprises a second collar concentrically received around the proximal end of the second tube.
13. The reservoir system of claim 12, wherein: the first tube is captured between the side projection of the first fitting portion and the first collar; and the second tube is captured between the side projection of the second fitting portion and the second collar.
14. The reservoir system of claim 1, wherein the first fitting portion and the second fitting portion are formed of a polymer.
15. The reservoir system of claim 14, wherein the polymer of the first fitting portion and the second

fitting portion are formed of a cross-linked polyethylene.

16. A fluid coupling for a reservoir system, the fluid coupler comprising: a first fitting portion including a longitudinally extending lower projection, and a laterally extending side projection; wherein the lower projection of the first fitting portion is a tubular projection including outwardly extending barbs; a second fitting portion including a longitudinally extending lower projection, and a laterally extending side projection; wherein the lower projection of the second fitting portion is a tubular projection including outwardly extending barbs; a passageway extending between the first fitting portion and the second fitting portion, wherein the passageway includes a reduced diameter portion; and a standoff positioned intermediate the first fitting portion and the second fitting portion, the standoff extending perpendicular to the lower projections of the first fitting portion and the second fitting portion, and extending perpendicular to the side projections of the first fitting portion and the second fitting portion.

17. The fluid coupling of claim 16, wherein the side projection of the first fitting portion is a tubular projection including outwardly extending barbs, and the side projection of the second fitting portion is a tubular projection including outwardly extending barbs.

18. The fluid coupling of claim 16, further comprising: a first tube including a proximal end and a distal end, the first tube fluidly coupled to the first fitting portion; a first overmold securing the proximal end of the first tube to upper projection of the first fitting portion; a second tube including a proximal end and a distal end, the second tube fluidly coupled to the second fitting portion; and a second overmold securing the proximal end of the second tube to the upper projection of the second fitting portion.

19. The fluid coupling of claim 16, wherein: the first overmold comprises a first collar concentrically received around the proximal end of the first tube; the first tube is captured between the upper projection and the first collar; the second overmold comprises a second collar concentrically received around the proximal end of the second tube; and the second tube is captured between the upper projection and the second collar.

20. The fluid coupling of claim 16, wherein the first fitting portion and the second fitting portion are formed of a polymer.

21. The fluid coupling of claim 20, wherein the polymer of the first fitting portion and the second fitting portion are formed of a cross-linked polyethylene.

22. The reservoir system of claim 16, wherein the reduced diameter portion is defined by an insert washer.

23. The reservoir system of claim 16, wherein the reduced diameter portion is configured to control the mixing of water between an inlet of the first fitting portion and an inlet of the second fitting portion from the second container portion provided to an outlet of the second fitting portion.