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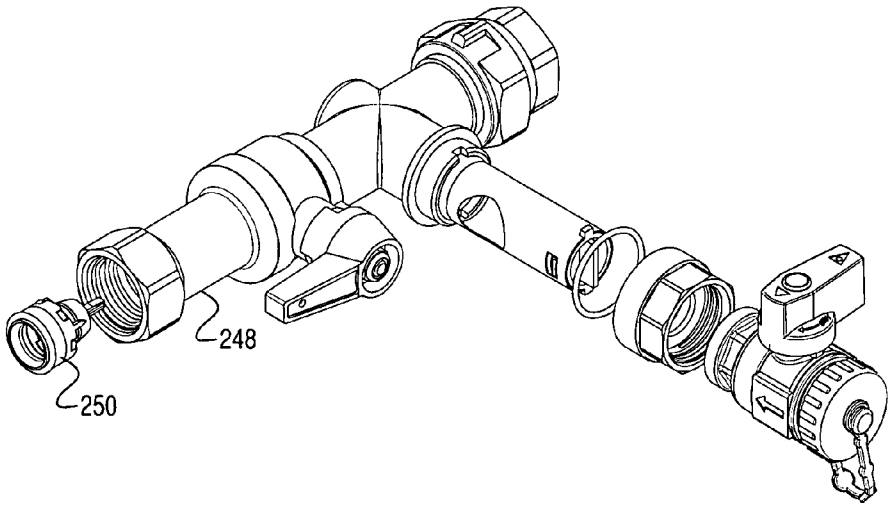
Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

[Continued on next page]

(54) Title: VALVES FOR USE WITH TANKLESS WATER HEATER

Fig. 11



(57) Abstract: Valve arrangements for use with a tankless water heater include a housing (120) with at least first (132), second (124) and third ports (122) with a valve member (156) provided within the first port. A valve member (162) is provided for the second port. A cold water valve arrangement may include a strainer (226) provided at the second port and a check valve provided at the first port. The valve arrangement may be used with various pipe connectors including a push pr push-fit connection (238) for the first port.

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VALVES FOR USE WITH TANKLESS WATER HEATER

FIELD OF THE INVENTION

[0001] The present invention relates to valves for use with tankless water heaters.

BACKGROUND OF THE INVENTION

[0002] Tankless water heaters are well known in the art and generally comprise a device which heats water "on demand" rather than in a predetermined quantity such as in a hot water tank. Accordingly, such devices are known in the art as "tankless" water heaters. Such tankless water heaters may use, for example, electricity to provide the source of heat (i.e., through resistance coils) or they may use the combustion of gas or any other suitable material as the source of heat. In addition, it is possible that the tankless water heater may also use some other source of heat for the device. In order to operate and periodically service such a tankless water heater, various valve arrangements are typically provided at both a cold water inlet and a hot water outlet for the tankless hot water heater.

[0003] In the prior art, such valve arrangements for use with tankless water heaters have been undesirable because of the significant number of different fittings that were generally assembled in the field (i.e., at the location of the tankless water heater). In the prior art devices roughly 10 separate fittings would be assembled for each valve arrangement for a tankless water heater. Such prior art valve arrangements were generally inefficient and inconvenient to install and did not provide for easy maintenance, repair and replacement. In addition, such prior art valve arrangements oftentimes would not provide ready access to the individual valves with the requirement that sometimes the valves were unusable with particular tankless water heater installations or the use of an adapter kit or other accommodation was required.

[0004] Various prior art valve arrangements, including some valve arrangements that are disclosed for use with tankless water heaters, are disclosed in United States Patent Nos. 4,177,832; 4,479,459; 4,655,078; 6,148,845; 6,186,169; 6,302,146; 6,655,412; 6,779,561; WO 03/001092; and WO 2005/031200. Various valve arrangements are also known in the art such as the Model PB-56 Purge and Balancing Valve of Watts Regulator Co., (IS-PB-56, Copyright 2000); the Isolator EXP of Webstone Company, Inc., (40653EXP September 9, 2005); the Series RPV Residential Purge, Drain and Balancing Valves of Watts Regulator Co. (ES-RPV, Copyright 2004). Also, the use of a filter in the cold water inlet is generally known, for example, from the instructions provided by various tankless water heater manufacturers. For example, the Rinnai tankless water heater installation instructions show a conical filter which is to be inserted at the connection of the cold water supply pipe to the cold water inlet of the tankless water heater.

[0005] Accordingly, the need remains for an arrangement for connecting a valve to piping or other fittings which overcomes the difficulties in the prior art.

[0006] Various arrangements for connecting non-threaded pipe ends and pipe fittings are known in the art, such as are shown in U.S. Patent No. 5,409,066 of McHugh and U.S. Patent No. 5,609,212 of McHugh. Similarly, various embodiments of push-fit connectors have long been known for joining pipe ends and tubing ends together, such as are shown in, for example, U.S. Patent No. 3,312,484 of Davenport, U.S. Patent No. 3,365,219 of Nicolaus, U.S. Patent No. 3,924,882 of Ellis, U.S. Patent No. 5,188,401 of Staniforth, U.S. Patent No. 5,593,186 of Harris, U.S. Patent Application Publication No. 2004/0090067 of Pridham, U.S. Patent Application Publication No. 2005/0084327 of Chelchowski et al., U.S. Patent Application Publication No. 2005/0104369 of Webb et al., UK Patent Application

Publication No. GB 2 280 006 of THD Manufacturing Limited, and UK Patent Application Publication No. GB 2 266 569 of F W Talbot & Company Limited. These patent publications are primarily concerned with connecting pipe ends together in a push-fit or quick connect arrangement.

[0007] Other push-fit connections for pipe ends are available from Cash Acme at the website: http://www.cashacme.com/sharkbite.html, under the trademark SharkBite Connection System. The SharkBite connections spin around the pipe and are removable with a specially designed tool which releases a teeth ring. Other push-fit connections which spin around the pipe are available from I-TAP under the trademark Itap-Fit at the website: http://www.itap.it. N-Vent sells push-fit connectors for pipe ends and valves with push-fit connectors which make a permanent, unmovable & non removable connection under the trademark PermaLynx at the website http://www.nventsolutions.com.

SUMMARY OF THE INVENTION

[0008] In various preferred embodiments of the present invention, a valve arrangement for use with a tankless water heater, comprises an integral valve housing which comprises an interior passageway in communication with a first port, a second port, and a third port. A first valve member is provided within the valve housing at the first port with the first valve member being selectively positioned to control communication with the interior passageway of the valve housing at the first port. A second valve member is provided within the valve housing at the second port with the second valve member being selectively positioned to control communication with the interior passageway of the valve housing at the second port.

[0009] In a preferred embodiment, the first port of the valve housing further comprises an integrally formed push-fit connection arrangement which comprises a teeth ring having a plurality of teeth directed generally radially inwardly and generally toward the interior passageway of the valve housing. The valve arrangement may further comprise an annular sealing member which is provided axially between the teeth ring and the valve housing. A first shoulder limits movement of the teeth ring toward the valve member and an annular ring is provided between the teeth ring and the first shoulder.

[0010] The valve housing may further comprise a second shoulder which is provided between the first shoulder and the valve member with the second shoulder having a smaller diameter than the first shoulder. The annular sealing member may be provided between the second shoulder and the annular ring with the valve housing further comprising a third shoulder provided between the second shoulder and the valve member. The third shoulder has a smaller diameter than the second shoulder with the third shoulder having a diameter corresponding to the outside diameter of a pipe to be received within the teeth ring. The sealing member, when not compressed, has an inside diameter which is smaller than the outside diameter of the pipe to be received within the teeth ring.

[0011] The valve arrangement may further comprise a teeth ring retainer which maintains the teeth ring positioned between the first shoulder and the teeth ring retainer and wherein rotation of the teeth ring relative to the valve housing is prevented. Preferably, the first port forms a cold water inlet for the tankless water heater or forms a hot water outlet for the tankless water heater. The valve housing may further comprise a fourth port with a pressure relief valve being provided at the fourth port.

[0012] In another preferred embodiment, a valve arrangement for use with a tankless water heater comprises an integral valve housing which comprises an interior passageway in communication with a first port, a second port, and a third port. A first valve member is provided within the valve housing at the first port with the first valve member being selectively positioned to control communication with the interior passageway of the valve housing at the first port. The first port forms a cold water inlet for the tankless water heater. A second valve member is provided at the second port with the second valve member being selectively positioned to control communication with the interior passageway of the valve housing at the second port. A strainer may be provided within the interior passageway of the valve housing adjacent the second port.

[0013] Preferably, the strainer comprises wire mesh which is provided within the interior passageway of the valve housing between the inlet and the third port. Preferably, the second valve member may be disconnected to the second port and the strainer may be removed from the interior passageway of the valve housing when the second valve is disconnected from the second port.

[0014] The valve housing may be adapted so as to provide a cylindrical chamber with the strainer being provided within the cylindrical chamber. The strainer may be generally cylindrical in shape. The strainer preferably has an opening in a sidewall of the strainer corresponding to a cross sectional configuration of the interior passageway at the first port, with the opening in the sidewall of the strainer being aligned with the first port of the valve housing when the strainer is provided within the valve housing. A guide member may be provided at a first end of the strainer with the guide member having at least one radially

extending tab which is selectively received within a corresponding slot provided at the second port to align the opening of the strainer with the first port of the valve housing.

[0015] The first port of the valve housing preferably further comprises an integrally formed push-fit connection arrangement comprising a teeth ring having a plurality of teeth directed generally radially inwardly and generally toward the interior passageway of the valve housing. Preferably the valve arrangement further comprises an annular sealing member which is provided axially between the teeth ring and the valve housing. A first shoulder limits movement of the teeth ring toward the valve member, with an annular ring being provided between the teeth ring and the first shoulder. Preferably, the valve housing further comprises a second shoulder which is provided between the first shoulder and the valve member with the second shoulder having a smaller diameter than the first shoulder. An annular sealing member may be provided between the second shoulder and the annular ring, with the valve housing further comprising a third shoulder provided between the second shoulder and the valve member with the third shoulder having a smaller diameter than the second shoulder. The third shoulder has a diameter corresponding to the outside diameter of a pipe to be received within the teeth ring with the sealing member, when not compressed, having an inside diameter which is smaller than the outside diameter of the pipe to be received within the teeth ring. Preferably, the valve arrangement further comprises a teeth ring retainer which maintains the teeth ring positioned between the first shoulder and the teeth ring retainer and wherein rotation of the teeth ring relative to the valve housing is prevented.

[0016] Preferably, the valve arrangement further comprises a check valve which is provided generally at the first outlet. Preferably, the check valve is provided upstream of the valve member of the first outlet of the valve housing.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

[0017] The present invention will appear more clearly from the following detailed description of several embodiments illustrated in the enclosed figures in which:

[0018] Fig. 1 is a schematic view of a tankless water heater and valve arrangement according to the present invention;

[0019] Fig. 2 is a side view of a valve arrangement of Fig. 1;

[0020] Fig. 3 is a side view of another valve arrangement of Fig. 1;

[0021] Fig. 4 is a cross-sectional view of the valve of Fig. 2;

[0022] Fig. 5 is a cross-sectional view of the valve of Fig. 3;

[0023] Fig. 6 is a side view of another valve arrangement according to the present invention;

[0024] Fig. 7 is an expanded view of the valve arrangement of Fig. 6;

[0025] Fig. 8 is a side view of another valve arrangement according to the present invention;

[0026] Fig. 9 is an expanded view of the valve arrangement of Fig. 8;

[0027] Fig. 10 is a side view of another valve arrangement according to the present invention;

[0028] Fig. 11 is an expanded view of the valve arrangement of Fig. 10; and,

[0029] Fig. 12 is a cross-sectional view of the valve arrangement of Fig. 10.

DETAILED DESCRIPTION OF THE INVENTION

[0030] With reference to Fig. 1, a representative tankless water heater 100 is shown with the tankless water heater being provided, for example, behind a removable panel 102 within a recessed housing or compartment. The removable panel 102 is provided with a plurality of holes in order to provide ventilation for the tankless water heater. The tankless water heater typically uses electric resistance heating or the combustion of natural gas or other fuel to provide a source of heat (not shown).

[0031] Typically, the tankless water heater 100 is provided within a rectangular housing 101. The tankless water heater is provided with water to be heated through a cold water supply pipe 108. A cold water valve arrangement 104 according to the present invention is provided between the tankless water heater and the cold water supply pipe 108. A hot water supply valve arrangement 106 according to the present invention is provided between the tankless water heater and the hot water supply pipe 110.

[0032] With reference now to Fig. 2, the hot water supply valve arrangement 106 includes an integral housing 120 which forms an interior passageway that is in communication with a first port 132, a second port 124, and a third port 122. In the preferred embodiment, the housing 120 is generally T-shaped with the first port 132 and the third port 122 aligned with one another and the second port 124 oriented generally perpendicular to the first and third ports. A first valve 134 is provided at the first port 132. A second valve 130 is provided at the second port 124. The second valve 130 has an inlet of the valve in communication with the second port of the valve housing and an outlet which is preferably provided with threads. The second valve 130 is normally closed but may be opened as desired in order to flush or to drain the tankless water heater. Because the second valve 130 is normally closed, a screw

cap 126 is preferably provided for the second valve 130 in order to prevent dirt or other undesirable material from entering the second valve and to protect the threads of the second valve outlet. In addition, the screw cap 126 tends to prevent the second valve from leaking. The screw cap 126 is preferably connected to the second valve 130 by a chain or strap 128. In addition, the hot water valve arrangement 106 preferably includes a fourth port 136 which may be provided with a pressure relief valve. The fourth port 136 is in fluid communication with the first, second and third ports of the valve housing 120. The third port 122 is preferably provided with an integrated union adapter in order to facilitate a direct connection to the hot water outlet of the tankless water heater.

[0033] With reference now to Fig. 3, the cold water valve arrangement 104 includes an integral housing 140 which forms an interior passageway that is in communication with a first port 152, a second port 147, and a third port 142. In the preferred embodiment, the housing 140 (like the housing 120) is generally T-shaped with the first port 152 and the third port 142 aligned with one another and the second port 147 oriented generally perpendicular to the first and third ports. A first valve 150 is provided at the first port 152. A second valve 148 is provided at the second port 147. The second valve 148 has an inlet of the valve in communication with the second port of the valve housing and an outlet which is preferably provided with threads. The second valve 148 is normally closed but may be opened as desired in order to flush or to drain the tankless water heater. Because the second valve 148 is normally closed, a screw cap 144 is preferably provided for the second valve 148 in order to prevent dirt or other undesirable material from entering the second valve and to protect the threads of the second valve outlet. In addition, the screw cap 144 tends to prevent the second valve from leaking. The screw cap 144 is preferably connected to the second valve 148 by a

chain or strap 146. The third port 142 is preferably provided with an integrated union adapter in order to facilitate a direct connection to the cold water inlet of the tankless water heater.

[0034] In both the hot water valve arrangement 106 and the cold water valve arrangement 104, the first port may be provided with a threaded connection (FIPT), with a copper sweat connection, with a push or push-fit connection (especially with the CimPUSH technology and as described in ASSE 1061) or with a CimPRESS connection which uses a cold copper crimp connection. The valve arrangements 104, 106 are preferably made of heavy-duty forged brass and the valve arrangements have color coded handles (blue for the cold water valve arrangement and red for the hot water valve arrangement) in order to facilitate correct installation.

[0035] With reference now to Fig. 4, the first valve 134 of the hot water valve arrangement 106 is provided with a first valve member 156 which is selectively positioned by a handle actuator 159 which rotates a valve stem 160 that is sealed by packing or O-rings 158. The valve stem 160 is keyed into the valve member 156 in order to selectively rotate the valve member 156 (as the handle 159 is rotated) in order to control communication with the interior passageway of the valve housing at the first port. The valve member 156 may be selectively moved between a first position in which the first port 132 is open and a second position in which the first port 132 is closed.

[0036] Similarly, the second port 124 has a valve member 162 which is selectively positioned by a handle actuator which rotates a valve stem that is sealed by packing or O-rings. The valve stem of the valve member 162 is likewise keyed into the valve member 162 in order to selectively rotate the valve member 162 (as the handle is rotated) in order to control communication with the interior passageway of the valve housing at the second port.

The valve member 162 may be selectively moved between a first position in which the second port 124 is open and a second position in which the first port 124 is closed.

[0037] If the first port 132 of the hot water valve arrangement 106 is provided with an integrally formed push-fit connection, a teeth ring is provided (see Fig. 9) having a plurality of teeth directed generally radially inwardly and generally toward the interior passageway of said valve housing. An annular sealing member is provided axially between the teeth ring and the valve housing with a first shoulder limiting movement of the teeth ring toward the valve member. An annular ring is provided between the teeth ring and the first shoulder. A second shoulder is provided between the first shoulder and the valve member with the second shoulder having a smaller diameter than the first shoulder. An annular sealing member is provided between the second shoulder and the annular ring with the valve housing further comprising a third shoulder provided between the second shoulder and the valve member. The third shoulder has a smaller diameter than the second shoulder and the third shoulder has a diameter corresponding to the outside diameter of a pipe to be received within the teeth ring. The sealing member, when not compressed, has an inside diameter which is smaller than the outside diameter of the pipe (such as, the hot water pipe 110) to be received within the teeth ring. Preferably, a teeth ring retainer maintains the teeth ring positioned between the first shoulder and the teeth ring retainer and rotation of the teeth ring relative to the valve housing is prevented.

[0038] With reference now to Fig. 5, the first valve 150 of the cold water valve arrangement 104 is provided with a first valve member 166 which is selectively positioned by a handle actuator 169 which rotates a valve stem 170 that is sealed by packing or O-rings 168. The valve stem 170 is keyed into the valve member 166 in order to selectively rotate the valve

member 166 (as the handle 169 is rotated) in order to control communication with the interior passageway of the valve housing at the first port. The valve member 166 may be selectively moved between a first position in which the first port 152 is open and a second position in which the first port 152 is closed. A valve stem retainer maintains the valve stem in engagement with the slot of the valve member. A pair of O-rings may preferably be provided within recesses around the valve stem to prevent leakage between the valve stem and the valve stem retainer.

[0039] Similarly, the second port 147 has a valve member 164 which is selectively positioned by a handle actuator which rotates a valve stem that is sealed by packing or O-rings. The valve stem of the valve member 164 is likewise keyed into the valve member 164 in order to selectively rotate the valve member 164 (as the handle is rotated) in order to control communication with the interior passageway of the valve housing at the second port. The valve member 164 may be selectively moved between a first position in which the second port 147 is open and a second position in which the first port 147 is closed. The first port 152 of the cold water valve arrangement 104 may be provided with an integrally formed push-fit connection such as described above in connection with Fig. 9.

[0040] Although in the embodiment of Figs. 4 and 5, the valve members 156, 162, 164 and 166 are shown as ball valve members, the valves arrangements according to the present invention could include plug valves or cylindrical valves or any other type of valves for use with piping or tubing, as readily apparent to one skilled in the art. In both of the valve arrangements 104 and 106, the valve members are received within integral portions of the respective integrated valve housing (120, 140). In this way, the valve arrangement may be more compact and therefore more readily useable in housings and other compartments for

tankless water heaters. Also, the potential for leaks is reduced by the integral housing of the valve arrangements.

[0041] With reference now to Fig. 6, another cold water valve arrangement 208 according to the present invention includes an integral housing 204 which forms an interior passageway that is in communication with a first port 218, a second port 210, and a third port 206. In the preferred embodiment, the housing 204 (like the housing 120) is generally T-shaped with the first port 218 and the third port 206 aligned with one another and the second port 210 oriented generally perpendicular to the first and third ports. A first valve 216 is provided at the first port 218 within the integral housing. A second valve 212 is provided at the second port 210 but as a separable device. The second valve 212 has an inlet of the valve in communication with the second port of the valve housing and an outlet which is preferably provided with threads. The second valve 212 is normally closed but may be opened as desired in order to flush or to drain the tankless water heater. Because the second valve 212 is normally closed, a screw cap 214 is preferably provided for the second valve 212 in order to prevent dirt or other undesirable material from entering the second valve and to protect the threads of the second valve outlet. In addition, the screw cap 214 tends to prevent the second valve from leaking. The screw cap 214 is preferably connected to the second valve 212 by a chain or strap. The third port 206 is preferably provided with an integrated union adapter in order to facilitate a direct connection to the cold water inlet of the tankless water heater.

[0042] The housing 204 differs significantly from the housing 140 (of the embodiment of Fig. 3) by having the additional tubular portion 236 provided in alignment with the second port 210. In addition, the second port 210 is somewhat elongated as compared with the second port 147 of the embodiment of Fig. 3 in order to accommodate a strainer as discussed

more fully below. Also, the strainer is removable from the housing through the second port 210 and so the second valve 212 is releasably connected to the second port 210.

[0043] With reference now to Fig. 7, the strainer 226 is formed of wire mesh or other suitable straining material that can filter significantly sized particles from the cold water supply line 108. The strainer 226 is generally cylindrical in shape and has a round opening 234 which corresponds to the cross sectional shape of the interior passageway of the housing adjacent the first port 218. The second port is provided with a threaded coupling 230 which is provided with a recess or notch 232.

[0044] An O-ring 224 is provided on the threaded coupling 230 and then a collar 222 is threaded onto the coupling 230. Before the collar 222 is threaded onto the coupling 230, the cylindrical strainer 226 is inserted into the second port and received within the additional tubular portion 236 of the valve housing. An annular member is provided in the strainer at the outermost end in order to maintain the cylindrical shape of the strainer and also to facilitate alignment of the strainer opening 234 with the first port. The annular member includes one or more tabs 228 that extend radially outwardly and are received within the corresponding recess in the coupling 230.

[0045] The valve 212 comprises a suitable conventional valve which is then attached to the collar 222 such as by a threaded coupling to enable selective removal of the valve 212 as desired. In this way, the strainer may be periodically removed from the valve housing and cleaned of debris and particles. The valve 212 may be provided with a cap 214 that is connected to the valve by a strap 220 as discussed above.

[0046] As discussed in connection with the valves of Figs. 2 and 3, in the cold water valve arrangement 208, the first port 218 may be provided with a threaded connection, with a sweat

connection, with a push or push-fit connection or with a press connection, as desired. The valve arrangements 208 is preferably made of heavy-duty forged brass and has blue colored handles to indicate that it is a cold water valve arrangement in order to facilitate correct installation.

[0047] With reference now to Fig. 8, a cold water valve arrangement such as is shown in Fig. 6 is provided with a push or push fit connection 238 for the first port.

With reference to Fig. 9, a teeth ring 244 is provided having a plurality of teeth directed generally radially inwardly and generally toward the interior passageway of said valve housing. An annular sealing member 240 is provided axially between the teeth ring and the valve housing with a first shoulder 301 limiting movement of the teeth ring toward the valve member. An annular ring 242 is provided between the teeth ring and the first shoulder. A second shoulder 303 is provided between the first shoulder 301 and the valve member with the second shoulder 303 having a smaller diameter than the first shoulder 301. The annular sealing member 240 is provided between the second shoulder 303 and the annular ring 242 with the valve housing further comprising a third shoulder 305 provided between the second shoulder 303 and the valve member. The third shoulder 305 has a smaller diameter than the second shoulder 303 and the third shoulder 305 has a diameter corresponding to the outside diameter of a pipe to be received within the teeth ring. The sealing member 240, when not compressed, has an inside diameter which is smaller than the outside diameter of the pipe (such as, the cold water pipe 108) to be received within the teeth ring.

[0048] Preferably, a teeth ring retainer maintains the teeth ring positioned between the first shoulder and the teeth ring retainer and rotation of the teeth ring relative to the valve housing is prevented such as by one or more tabs which extend radially outwardly from the teeth ring

and which engage a corresponding slot in the first port 238. An annular retainer member 246 maintains the teeth ring 244 and the annular ring 242 and the sealing member 240 in proper orientation in the first port 238. The teeth ring retainer member 246 has an inner diameter which is slightly larger than the outside diameter of the pipe or fitting to be received. The teeth ring retainer 246 has a radial ring portion which abuts the teeth ring. An axial portion of the teeth ring retainer extends toward the valve member and directs the teeth radially inwardly and generally toward the ball valve member. The axially extending innermost portion of the teeth ring retainer also prevents the teeth from bending away from the ball valve member, i.e., if the pipe or fitting is being pulled out of the ball valve retainer.

[0049] The ring may have a radial slit and be slightly compressed during assembly so as to be positioned beneath the shoulder of the ball valve member retainer. The ring is then released so as to increase its outside diameter and thereby maintain its position beneath the shoulder.

[0050] The teeth ring 244 preferably includes an annular ring and a plurality of teeth directed radially inwardly of the ring. The annular ring has a plurality of tabs provided about the outer perimeter of the annular ring. In the preferred embodiment of the teeth ring, there are four tabs spaced apart by 90°. Each of the tabs projects only slightly beyond the outer circumference of the annular ring.

[0051] In the preferred embodiment of the teeth ring, the individual teeth have generally parallel sides rather than the tapered sides as shown in earlier figures. However, whether the sides are tapered or parallel is generally a matter of design choice and a result of the manufacturing process. It is generally understood that making a teeth ring in which the individual teeth have parallel sides is easier and perhaps less expensive that making teeth

with tapered sides. In addition, there is some indication that teeth with parallel sides may have better grip performance when the teeth ring is under tension due to a relatively stronger surface where the tension stress is distributed over the teeth ring.

[0052] In the preferred embodiment, the teeth ring 244 is produced by stamping a metal sheet but other methods of production that result is a suitable teeth ring are within the scope of the present invention. The annular ring of the teeth ring provides a correct or desired alignment of the gripping teeth initially about the pipe. The annular ring also permits the provision of the tabs about the perimeter of the teeth ring.

[0053] During assembly of a valve with the teeth ring, the flat tabs provided about the outer perimeter of the teeth ring are pushed against the valve sidewall. The flat tabs are configured to engage the valve sidewall so as to eliminate or significantly reduce the possibility of valve rotation relative to the pipe end being gripped by the teeth ring. The flat tabs are preferably pushed into the sidewall of the valve during assembly of the teeth ring in the valve housing and the tabs preferably engage the sidewall of the valve before the pipe end is inserted.

[0054] The piping that is received by the push or push-fit connectors (if provided) at the first port of the hot water valve arrangements or the cold water valve arrangements are preferably copper, but may also be CTS, PVC or CPVC depending upon the applicable local codes. The valve arrangements according to the present invention may also be used with pipe or tubing of polybutylene or PeX (cross-linked polyethylene) but the use of PeX tubing may require the use of an adapter which is provided within the PeX tubing to stiffen the end of the PeX tubing received by the inlet or the outlet. The adapter (not shown) comprises an annular ring which has an outside diameter corresponding to the inside diameter of the

uncompressed PeX tubing. The adapter prevents the PeX tubing from being unduly compressed by the teeth ring of the press-fit connection arrangement.

[0055] With reference now to Fig. 10, another cold water valve arrangement 250 according to the present invention and similar to that of Fig. 6 is shown. In this embodiment, the inlet 248 of the valve 216 is elongated (see Fig. 11) in order to accommodate a one way valve assembly 250. With reference to Fig. 12, the one way valve assembly 250 includes a stem 252 and a sealing member 254 which is slidably retained on the stem 252. The sealing member 254 may selectively abut an annular member 256 in the event that the water within the valve housing is flowing or tending to flow out of the first port 218 (rather than into the first port 218 as normally occurs).

[0056] In use, cold water valve arrangement 104 is provided between the cold water supply pipe 108 and the cold water inlet of the tankless water heater. The valve at the first port is open in order to supply cold water to the tankless water heater through the third port. The second port is normally closed by the second valve member. Similarly, the hot water valve arrangement 106 is connected between the hot water outlet of the tankless water heater and the hot water supply pipe 110. The valve at the first port is open in order to allow hot water to flow through the valve arrangement as desired. The valve at the second port is normally closed. When it is desired to flush or drain the tankless water heater, the valve members at the first ports of the cold water valve arrangement and the hot water valve arrangement are closed and the valves at the respective second ports are opened. The water in the tankess water heater may be drained (by removing the threaded caps) and opening the valves at the second ports). The second valve of the cold water valve arrangement may then be connected to a hose or other source of water to flush the tankless water heater. When the tankless water

heater has been sufficiently flushed, the valves at the second ports may be closed and the valves at the first ports opened to allow normal operation of the tankless water heater. If a strainer is provided and if the strainer needs to be cleaned, the valve at the second port of the cold water valve arrangement may be removed from the second port and the strainer then removed and cleaned or flushed. The strainer is then replaced and the tab or tabs of the strainer assembly are aligned with the coupling member of the second port to align the strainer hole with the first port. The second valve is then replaced or reconnected to the second port. Finally, the threaded caps which had been removed from the second valves during draining and flushing are reattached to the outlets of the second valve arrangements.

[0057] The principles, preferred embodiments and mode of operation of the present invention have been described in the foregoing specification. However, the invention which is intended to be protected is not to be construed as limited to the particular embodiments disclosed. The embodiments are therefore to be regarded as illustrative rather than as restrictive. Variations and changes may be made without departing from the spirit of the present invention. Accordingly, it is expressly intended that all such equivalents, variations and changes which fall within the spirit and scope of the present invention as defined in the claims be embraced thereby.

WHAT IS CLAIMED IS:

1. A valve arrangement for use with a tankless water heater, comprising:

an integral valve housing comprising an interior passageway in communication with a first port, a second port, and a third port;

a first valve member provided within the integral valve housing at said first port, the first valve member being selectively positioned to control communication with said interior passageway of said valve housing at said first port;

a second valve member provided within the integral valve housing at said second port, the second valve member being selectively positioned to control communication with said interior passageway of said valve housing at said second port.

2. The valve arrangement of claim 1, wherein said first port of said valve housing further comprises an integrally formed push-fit connection arrangement comprising a teeth ring having a plurality of teeth directed generally radially inwardly and generally toward the interior passageway of said valve housing.

3. The valve arrangement of claim 2, further comprising:

an annular sealing member provided axially between said teeth ring and said valve housing;

a first shoulder which limits movement of the teeth ring toward the valve member,

an annular ring, said annular ring being provided between the teeth ring and the first shoulder.

4. The valve arrangement of claim 3, wherein said valve housing further comprises a second shoulder provided between the first shoulder and the valve member, said second shoulder having a smaller diameter than said first shoulder.

5. The valve arrangement of claim 4 wherein said annular sealing member is provided between said second shoulder and said annular ring, said valve housing further comprising a third shoulder, said third shoulder being provided between said second shoulder and said valve member, said third shoulder having a smaller diameter than said second shoulder, said third shoulder having a diameter corresponding to the outside diameter of a pipe to be received within the teeth ring, said sealing member, when not compressed, having an inside diameter which is smaller than the outside diameter of said pipe to be received within the teeth ring.

6. The valve arrangement of claim 3 further comprising a teeth ring retainer which maintains the teeth ring positioned between the first shoulder and the teeth ring retainer and wherein rotation of the teeth ring relative to the valve housing is prevented.

7. The valve arrangement of claim 1 wherein said first port forms a cold water inlet for said tankless water heater.

8. The valve arrangement of claim 1 wherein said first port forms a hot water outlet for said tankless water heater.

9. The valve arrangement of claim 8 wherein said valve housing further comprises a fourth port, a pressure relief valve being provided at said fourth port.

10. A valve arrangement for use with a tankless water heater, comprising:

an integral valve housing comprising an interior passageway in communication with a first port, a second port, and a third port;

a first valve member provided within the integral valve housing at said first port, the first valve member being selectively positioned to control communication with said interior passageway of said valve housing at said first port, said first port forming a cold water inlet for said tankless water heater;

a second valve member provided at said second port, the second valve member being selectively positioned to control communication with said interior passageway of said valve housing at said second port;

a strainer provided within said interior passageway of said valve housing adjacent said second port.

11. The valve arrangement of claim 10 wherein said strainer comprises wire mesh provided within said interior passageway of said valve housing between said inlet and said third port.

12. The valve arrangement of claim 11 wherein said second valve member may be disconnected from said second port and wherein said strainer may be removed from said interior passageway of said valve housing when said second valve is disconnected from said second port.

13. The valve arrangement of claim 12 wherein said valve housing is adapted so as to provide a cylindrical chamber, said strainer being provided within said cylindrical chamber.

14. The valve arrangement of claim 13 wherein said strainer is generally cylindrical in shape.

15. The valve arrangement of claim 14 wherein said strainer has an opening in a sidewall of said strainer corresponding to a cross sectional configuration of said interior

passageway at said first port, said opening in said sidewall of said strainer being aligned with said first port of said valve housing when said strainer is provided within said valve housing.

16. The valve arrangement of claim 5 wherein a guide member is provided at a first end of said strainer, said guide member having at least one radially extending tab which is selectively received within a corresponding slot provided at said second port to align the opening of said strainer with said first port of said valve housing.

17. The valve arrangement of claim 10, wherein said first port of said valve housing further comprises an integrally formed push-fit connection arrangement comprising a teeth ring having a plurality of teeth directed generally radially inwardly and generally toward the interior passageway of said valve housing.

18. The valve arrangement of claim 10, further comprising:

an annular sealing member provided axially between said teeth ring and said valve housing;

a first shoulder which limits movement of the teeth ring toward the valve member,

an annular ring, said annular ring being provided between the teeth ring and the first shoulder.

19. The valve arrangement of claim 15, wherein said valve housing further comprises a second shoulder provided between the first shoulder and the valve member, said second shoulder having a smaller diameter than said first shoulder.

20. The valve arrangement of claim 16 wherein said annular sealing member is provided between said second shoulder and said annular ring, said valve housing further comprising a third shoulder, said third shoulder being provided between said second shoulder and said valve member, said third shoulder having a smaller diameter than said second

shoulder, said third shoulder having a diameter corresponding to the outside diameter of a pipe to be received within the teeth ring, said sealing member, when not compressed, having an inside diameter which is smaller than the outside diameter of said pipe to be received within the teeth ring.

21. The valve arrangement of claim 17 further comprising a teeth ring retainer which maintains the teeth ring positioned between the first shoulder and the teeth ring retainer and wherein rotation of the teeth ring relative to the valve housing is prevented.

22. The valve arrangement of claim 10 further comprising a check valve provided generally at said first outlet.

23. The valve arrangement of claim 11 wherein said check valve is provided upstream of said first valve member.

Fig. 1

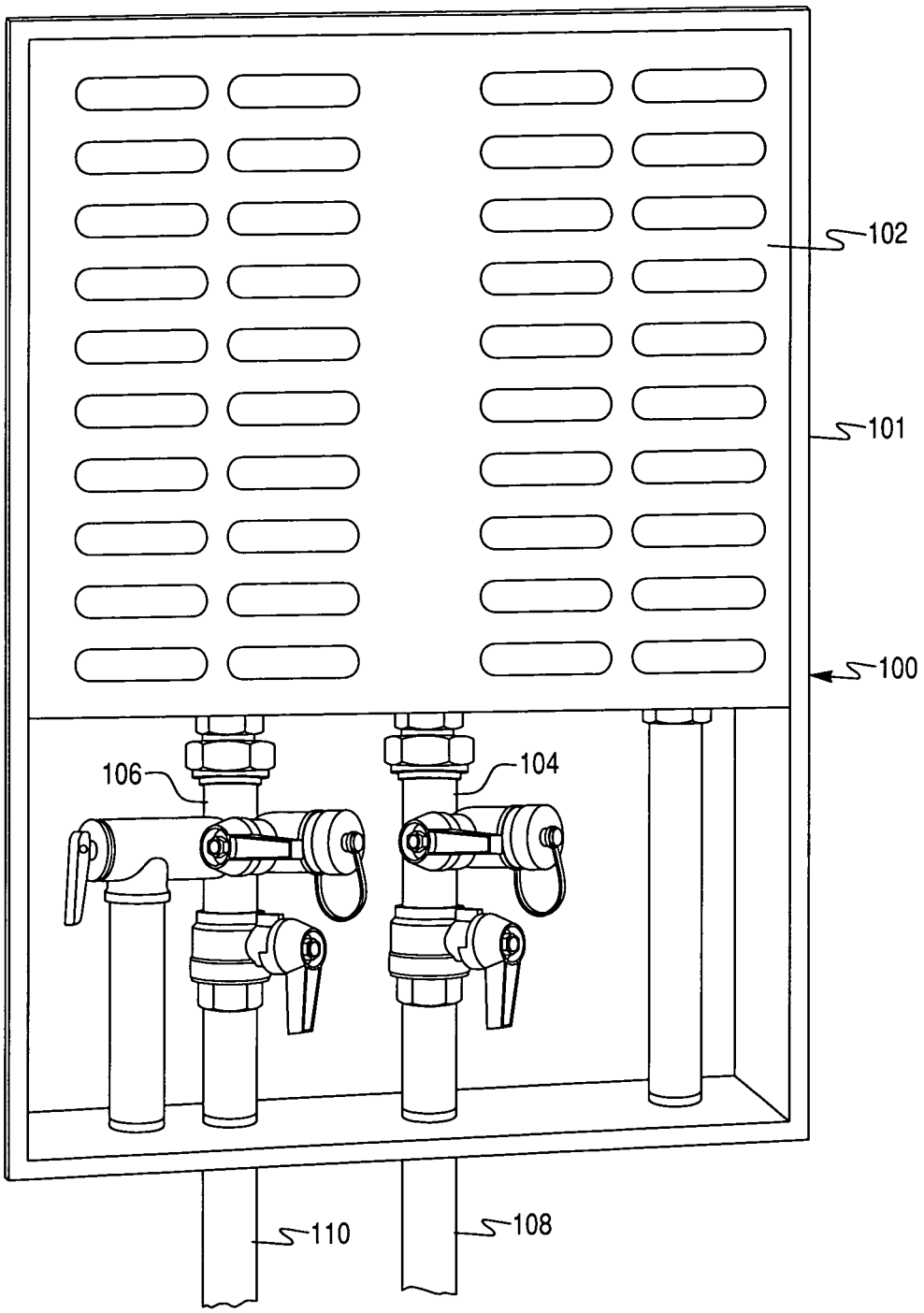

Fig. 3

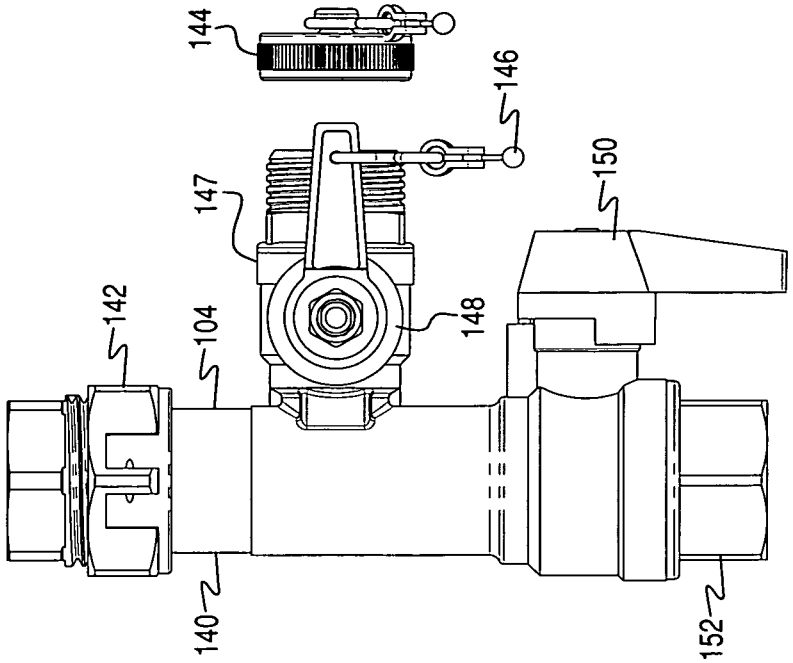
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Fig. 2

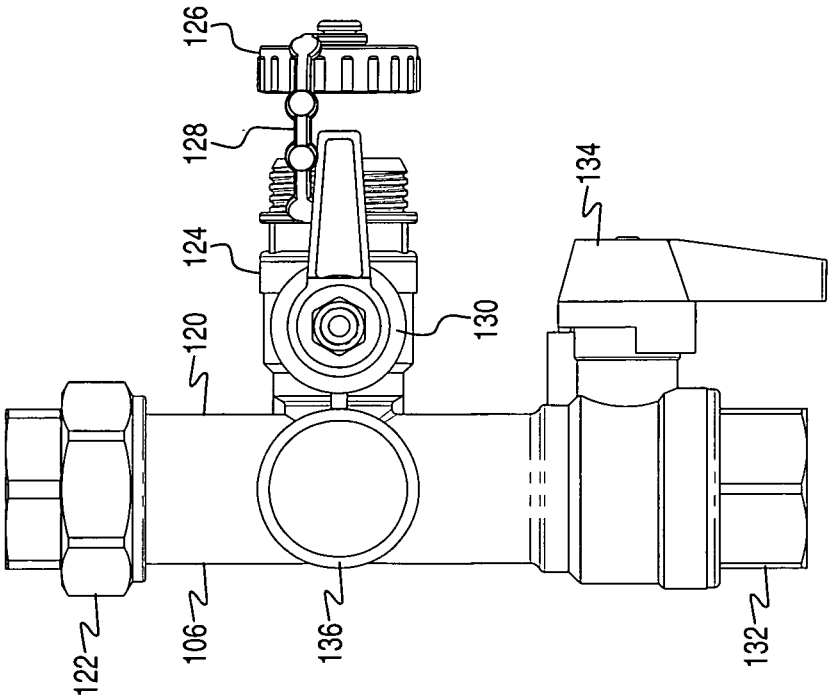
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Fig. 5

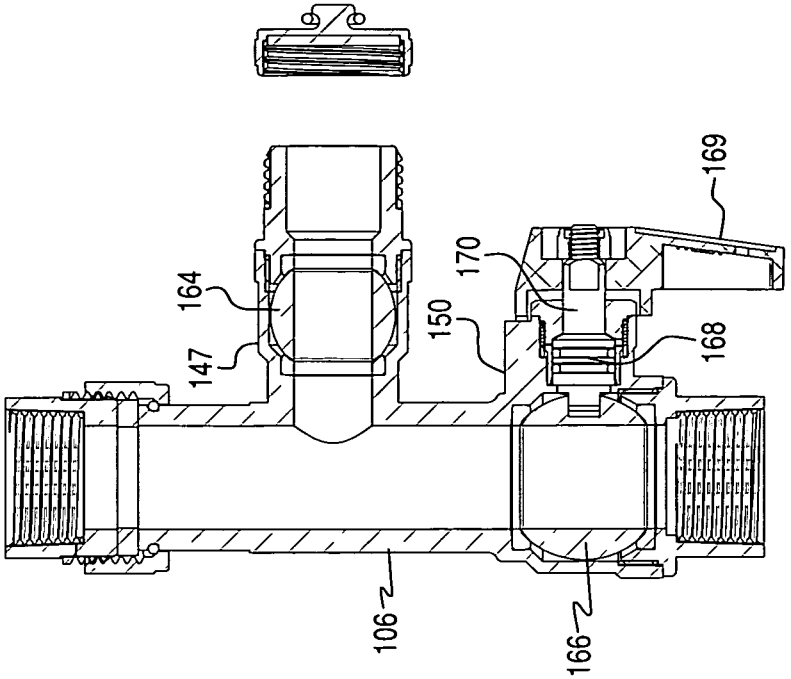
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Fig. 4

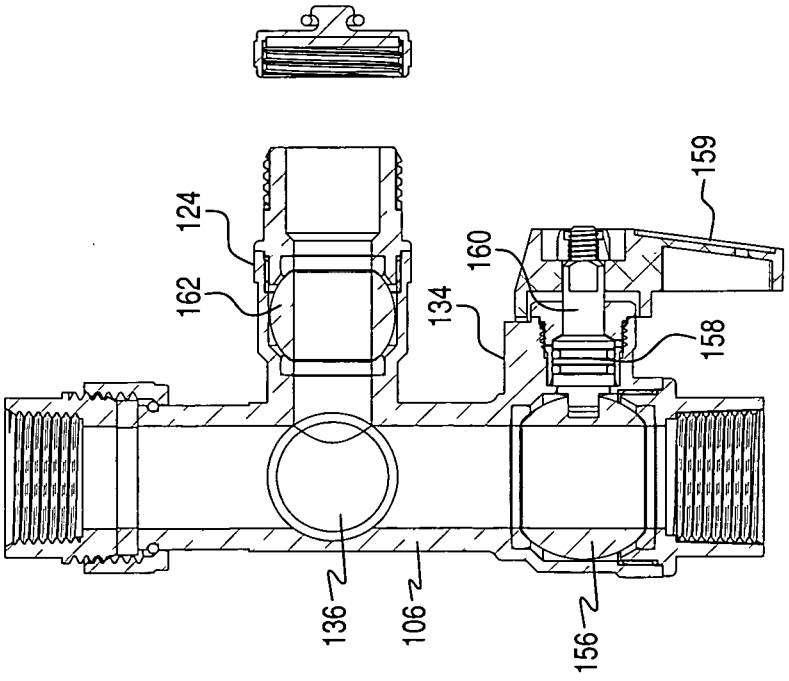
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Fig. 6

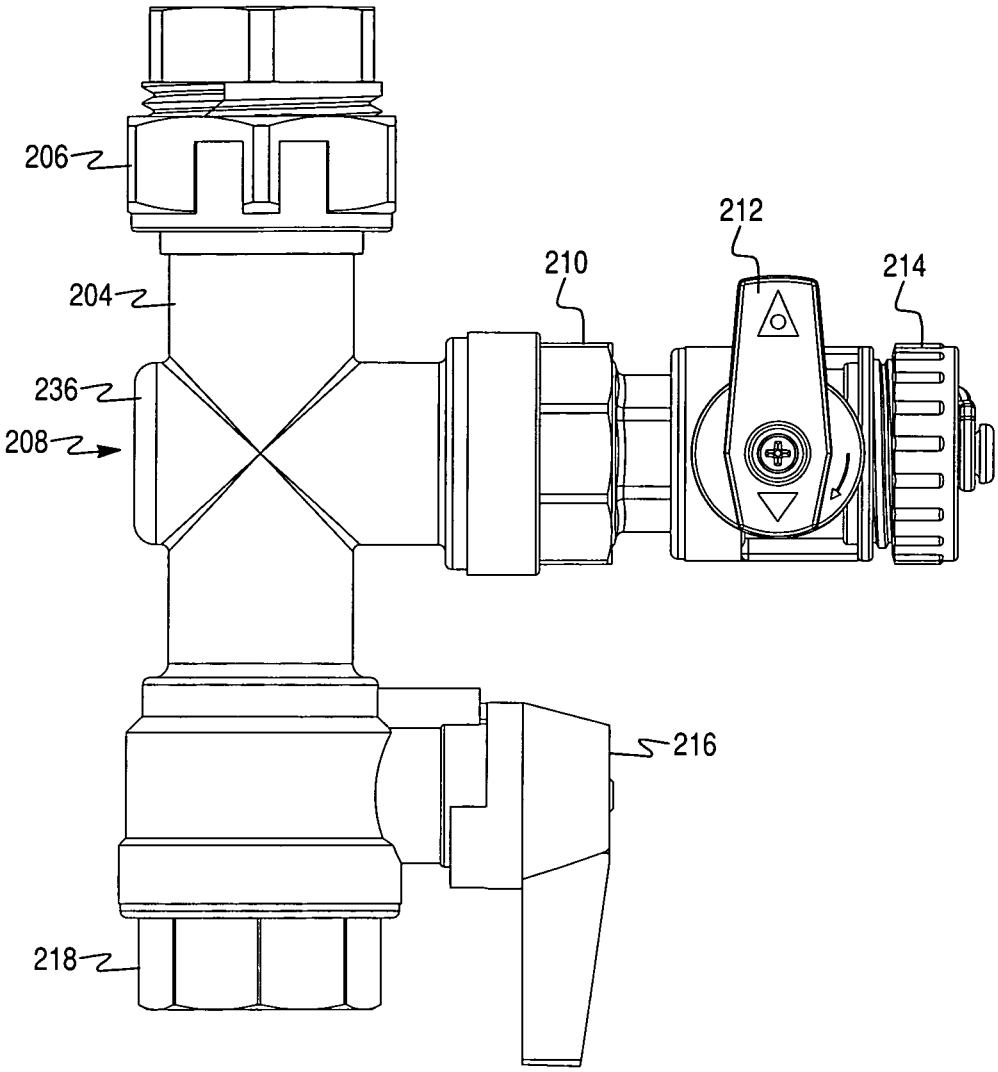


Fig. 7

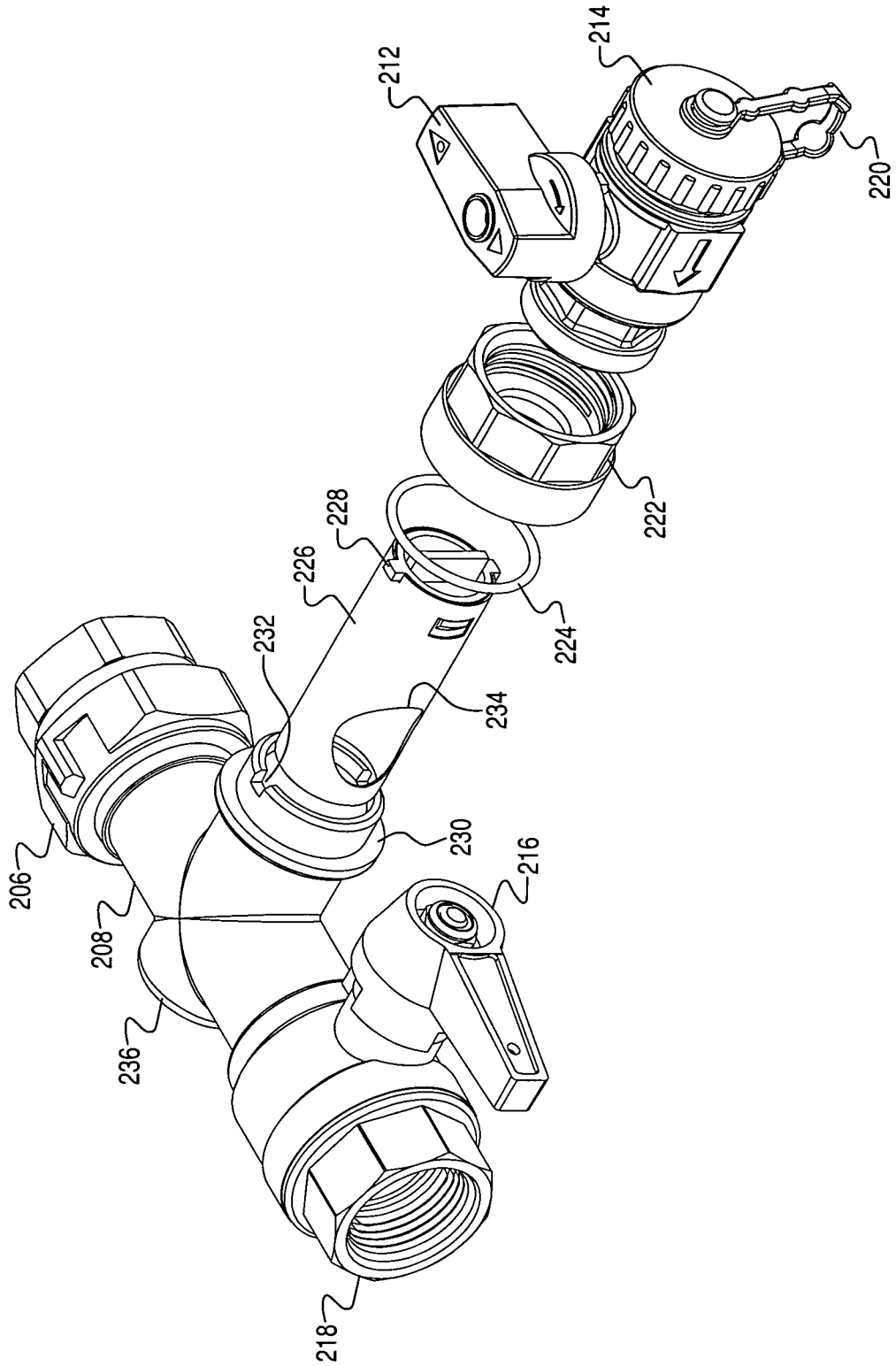


Fig. 8

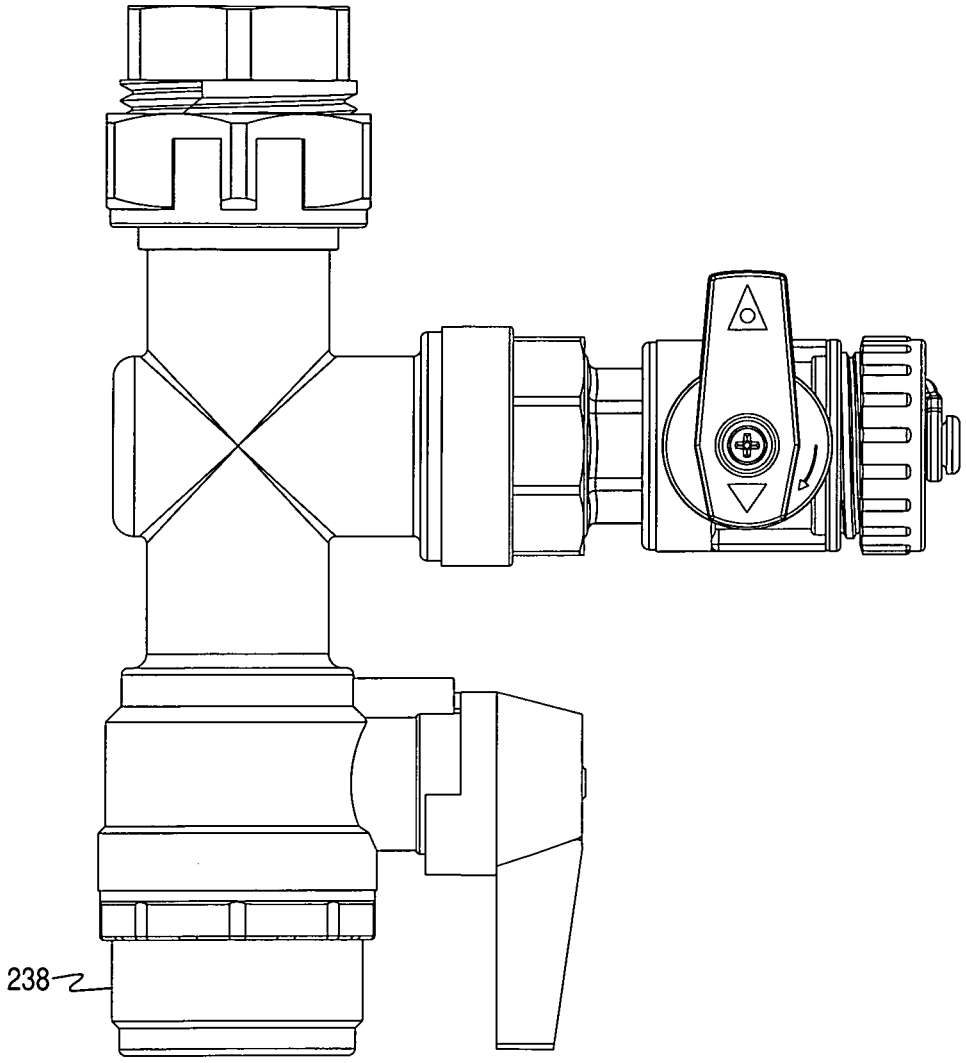


Fig. 9

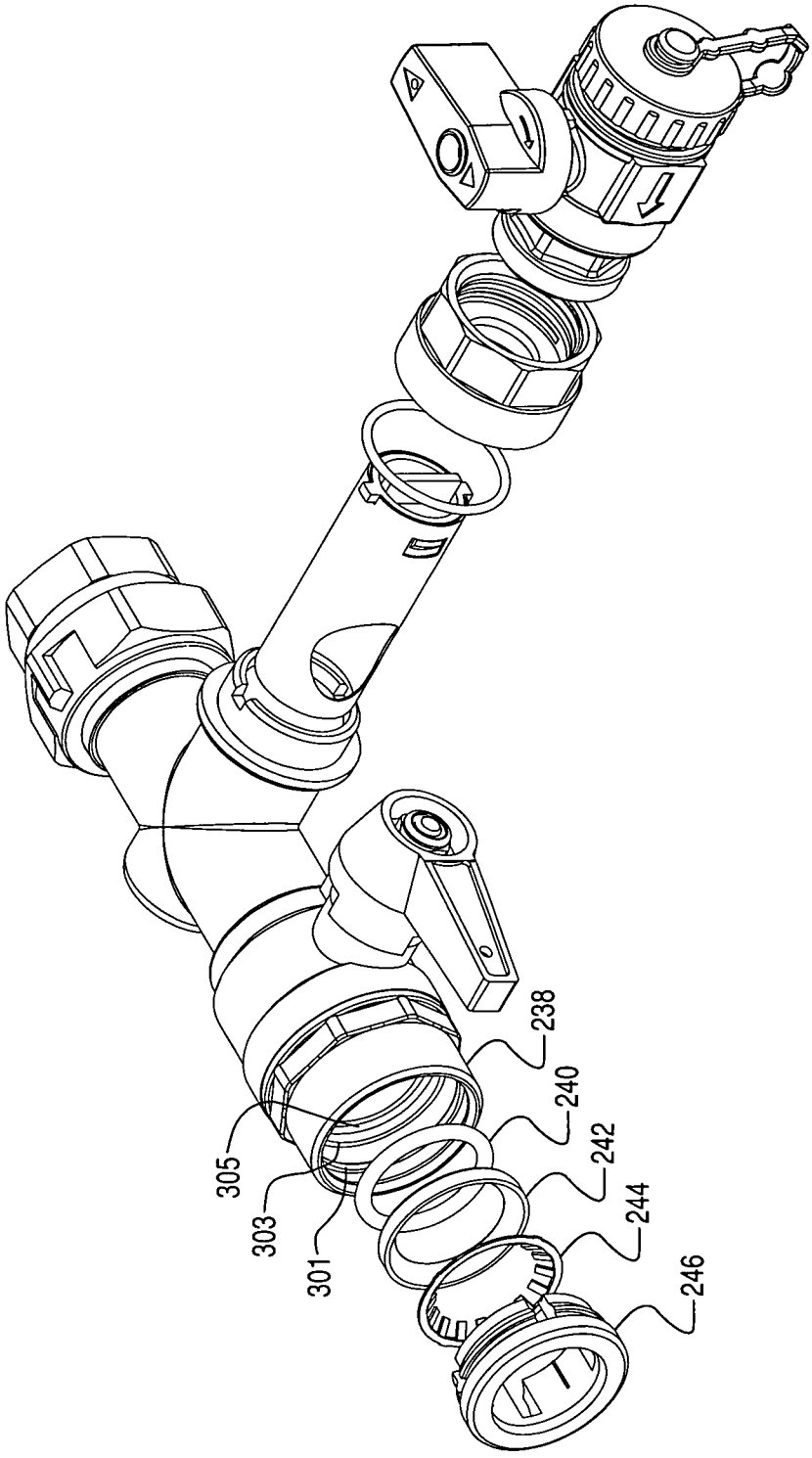


Fig. 10

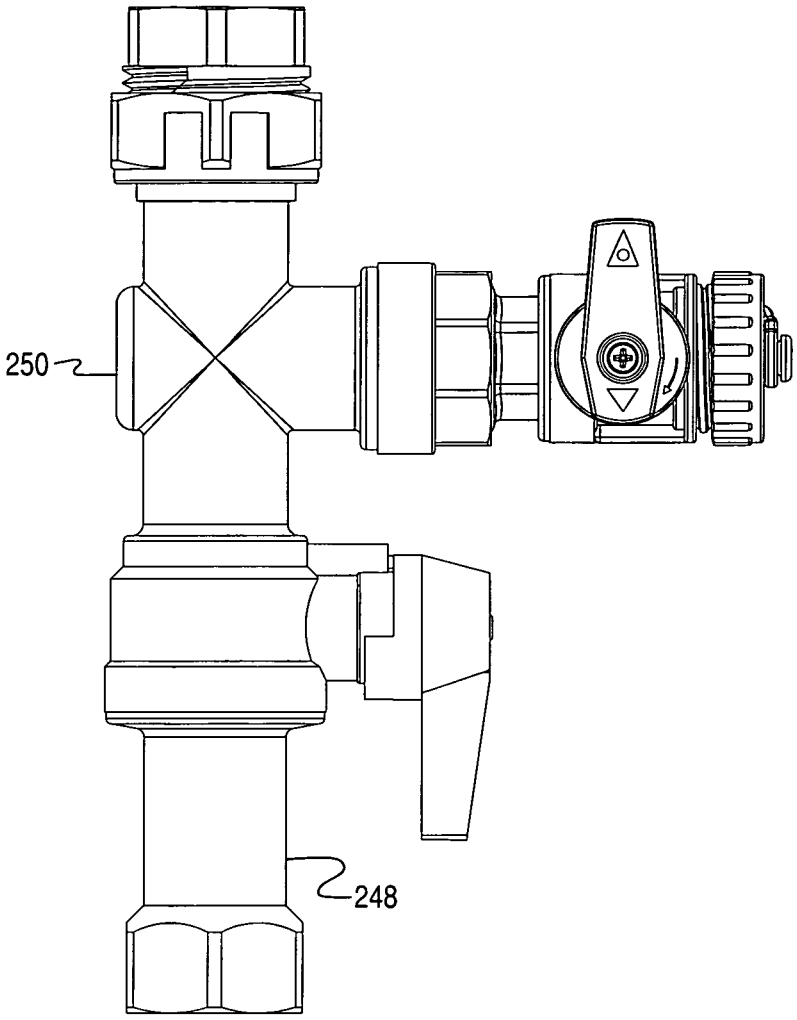


Fig. 12

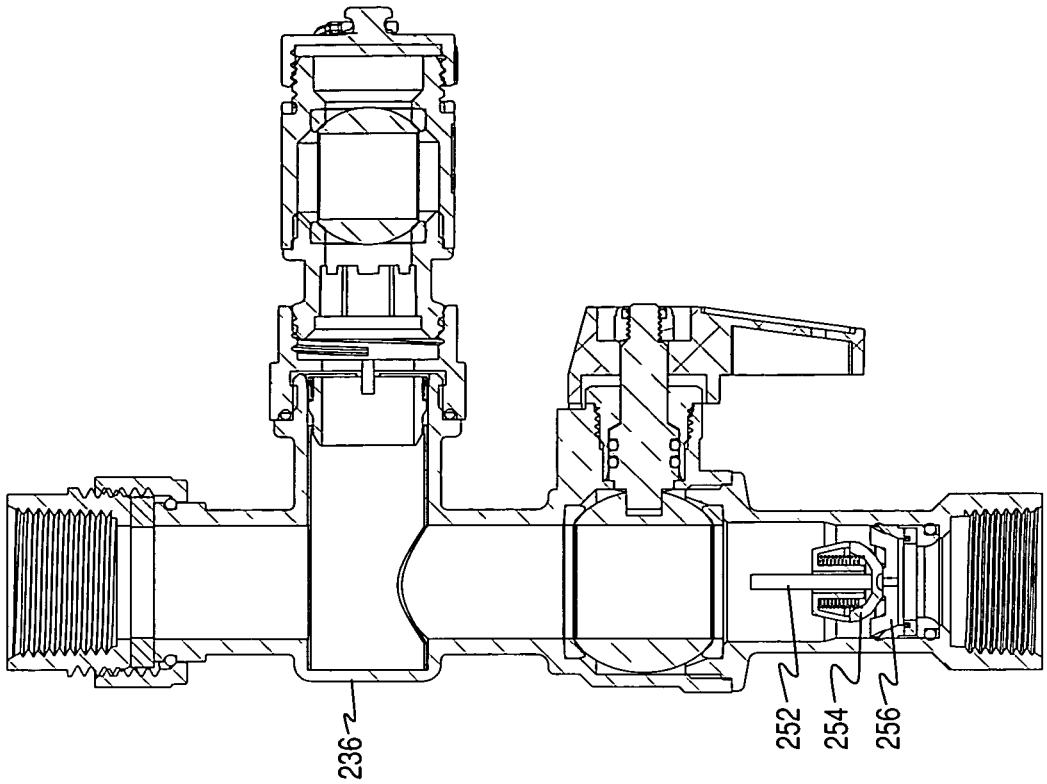
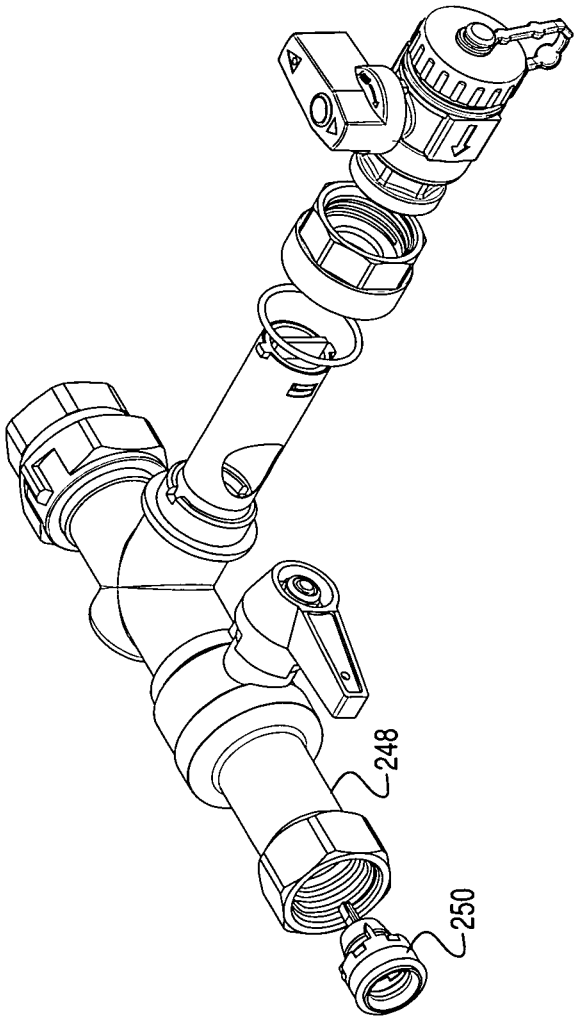


Fig. 11



INTERNATIONAL SEARCH REPORT

International application No
PCT/US2008/007528

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16L11/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F16K F16L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 535 215 A (SAMUEL JONES AND COMPANY ENGIN; CHARLES HENRY PHILLIPS) 2 April 1941 (1941-04-02)	1,10
Y	page 3, line 26 - line 53; figure 2	2-6, 17-20
Y	WO 2005/114031 A (ADVANCED FLUID CONNECTIONS PLC [GB]; GLAZE ALAN RICHARD [GB]; WEBB STE) 1 December 2005 (2005-12-01) page 6, paragraph 1 - page 9, paragraph 1; figures 1-6 page 11, line 12 - line 14	2-6, 17-20

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 October 2008	21/10/2008

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2008/007528

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 535215 A	02-04-1941	NONE	
WO 2005114031 A	01-12-2005	AT 400767 T	15-07-2008
		EP 1756462 A2	28-02-2007
		US 2007075542 A1	05-04-2007