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Piping system comprising pipe block

Abstract

A piping system including a pipe and a pipe block coupled to an end of the pipe. The pipe includes: a flange positioned at the end and protruding in a radially outward direction along an outer circumference of the pipe; and a coupling portion having a nipple that is inserted into the pipe block. The pipe block includes: an insertion hole into which the pipe is coupled; and a lip protruding from a surface in which the insertion hole is formed in a circumferential direction along an outer circumference of the insertion hole. An inner diameter of the lip is equal to or greater than an outer diameter of the flange, and when the pipe is coupled to the pipe block, the flange is positioned inside the lip and the lip is deformed in a radially inward direction of the pipe to grip and fix the pipe.

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATION
(1) The present application claims priority to Korean Patent Application No. 10-2023-0159417, filed on Nov. 16, 2023, the entire contents of which is incorporated herein for all purposes by this reference.
BACKGROUND OF THE INVENTION
Field of the Invention
(2) The present invention relates to a piping system, and more particularly, to a piping system including a pipe block.
Description of the Related Art
(3) A vehicle includes a piping system for transporting various fluids, such as a coolant, an engine lubricant, a refrigerant, and/or a transmission fluid. For example, the transmission fluid for a vehicle may be transported from a transmission through a transmission fluid piping system to a transmission fluid cooler, and circulated through a circulation circuit that returns to the transmission through the piping system to operate the transmission.
(4) The pipe system may include a pipe and a pipe block that couples to the pipe. The pipe block may be a member to which a plurality of pipes are coupled, fluid flows into and out of the plurality of pipes, and which fixes and supports the pipes.
SUMMARY OF THE INVENTION
(5) For coupling a pipe and a pipe block in a transmission fluid piping system, a joining method such as welding or brazing has been used in the related art. However, the welding or brazing requires a long process time and high cleanliness, and is vulnerable to defects due to factors such as an operator's error during joining, a poor maintenance of the cleanliness of an operation surface, and/or the introduction of impurities, leading to problems such as breakage or leakage of a piping joint.
(6) According to the present invention, a piping system may be provided in which defects in a coupling portion of a pipe and a pipe block are reduced, and a process time for coupling is reduced.
(7) There is provided a piping system including at least one pipe and a pipe block coupled to one end of the pipe, the pipe may include: a flange positioned at the end of the pipe and protruding in a radially outward direction of the pipe along an outer circumference of the pipe; and a coupling

portion having a nipple that is inserted into the pipe block, in which the pipe block may include: an insertion hole into which the pipe is insertively coupled; and a lip protruding from a surface in which the insertion hole is formed in a circumferential direction along an outer circumference of the insertion hole. An inner diameter of the lip may be equal to or greater than an outer diameter of the flange, and when the pipe is coupled to the pipe block, the flange may be positioned within the inner diameter of the lip and the lip is plastically deformed in a radially inward direction of the pipe to grip the flange and fix the pipe to the pipe block.
(8) According to various embodiments, the flange may include a first surface and a second surface positioned in an opposite direction of the first surface, and in which the pipe block may include a flange coupling surface positioned between the insertion hole and the lip along the outer circumference of the insertion hole and facing the first surface of the flange.
(9) According to various embodiments, the piping system may include a seal positioned between the first surface of the flange and the flange coupling surface and made of an elastic material.
(10) According to various embodiments, the flange may include a sealing edge protruding from the first surface along a radial direction of the flange, and in which the sealing edge may be pressed into the flange coupling surface to seal between the first surface and the flange coupling surface upon coupling of the pipe and the pipe block.
(11) According to various embodiments, the sealing edge may have a hardness that is higher than a hardness of the flange coupling surface.
(12) According to various embodiments, the flange may include a sealing protrusion protruding from the first surface along a radial direction of the flange, in which the pipe block may include a sealing groove formed along the radial direction in an area facing the sealing protrusion on the flange coupling surface, and a seal positioned between the first surface and the flange coupling surface of the flange, and in which, upon coupling of the pipe and the pipe block, the seal may be pressed by the sealing protrusion and at least partially inserted into the sealing groove to seal a portion between the first surface and the flange coupling surface.
(13) According to the present invention, while a pipe including a flange is inserted into a pipe block, a lip of the pipe block grips the flange of the pipe so that the pipe and the pipe block are coupled by caulking, thereby allowing the pipe to be easily coupled to the pipe block in a simplified process and providing a piping system with a reduced possibility of defects.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) In connection with the description of the drawings, the same or similar reference numerals may be used for the same or similar constituent elements.
(2) FIG. **1** is a perspective view schematically illustrating a piping system according to various embodiments.
(3) FIG. **2**A is a perspective view illustrating a pipe block according to various embodiments of the present invention.
(4) FIG. **2**B is a front view illustrating the pipe block according to various embodiments of the present invention.
(5) FIG. **2**C is a side view illustrating the pipe block according to various embodiments of the present invention.
(6) FIG. **2**D is a cross-sectional view illustrating the pipe block according to various embodiments of the present invention.
(7) FIG. **2**E is a cross-sectional view illustrating the pipe block according to various embodiments of the present invention.
(8) FIG. **3**A is a front view illustrating a first pipe according to various embodiments of the present

invention.
(9) FIG. **3**B is a cross-sectional view illustrating coupling of the pipe and pipe block of the piping system according to various embodiments of the present invention.
(10) FIG. **3**C is an enlarged cross-sectional view illustrating coupling of the pipe and pipe block of the piping system according to various embodiments of the present invention.
(11) FIG. **3**D is side view illustrating the first pipe of FIGS. **3**A-**3**C according to various embodiments of the present invention.
(12) FIG. **4**A is a side view illustrating the first pipe according to various embodiments of the present invention.
(13) FIG. **4**B is a cross-sectional view illustrating a seal according to various embodiments of the present invention.
(14) FIG. **4**C is an enlarged cross-sectional view illustrating coupling of the first pipe and the pipe block of the piping system according to various embodiments of the present invention.
(15) FIG. **4**D is a perspective view illustrating a seal according to various embodiments of the present invention.
(16) FIG. **5**A is a side view illustrating the pipe and an o-ring according to various embodiments of the present invention.
(17) FIG. **5**B is an enlarged cross-sectional view illustrating coupling of the pipe and pipe block of the piping system according to various embodiments of the present invention.
(18) FIGS. **6**A to **6**C are enlarged cross-sectional views illustrating coupling of the first pipe and the pipe block according to various embodiments.

DETAILED DESCRIPTION OF THE INVENTION

(19) Hereinafter, exemplary embodiments according to the present invention will be described in detail with reference to the accompanying drawings. Embodiments of the present invention are provided to more completely explain the present invention to those skilled in the art. The following embodiments may be modified in various forms, and the scope of the present invention is not limited to the following embodiments. The embodiments are provided to make the present invention more thorough and complete, and to completely convey the spirit of the present invention to those skilled in the art. Further, detailed descriptions of publicly-known functions and configurations, which may obscure the subject matter of the present invention, can be omitted.
(20) In these drawings, for example, the sizes and shapes of members may be exaggerated for convenience and clarity of description, and variations in the illustrated shapes may be expected in actual implementation. Therefore, it should not be interpreted that the embodiments of the present invention are limited to particular shapes of regions illustrated in the present specification. In addition, the term “and/or” used in the present specification includes any one, one or more, or all the combinations of listed related items.
(21) The terms used in the present specification are for explaining the embodiments, not for limiting the scope of the present invention. In addition, the singular expressions used in the present specification may include the plural form unless the context clearly indicates otherwise. In addition, the terms “comprise (include)” and/or “comprising (including)” used in the present specification are intended to specify the presence of the mentioned shapes, numbers, steps, operations, members, elements, and/or groups thereof, but do not exclude presence or addition of other shapes, numbers, steps, operations, members, elements, and/or groups thereof.
(22) In the present specification, a reference to a layer formed “on” a substrate or a different layer may refer to a layer formed immediately above the substrate or the different layer, or may refer to an intermediate layer formed on the substrate or the different layer, or to a layer formed on intermediate layers. In addition, a structure or shape disposed “adjacent” to a different shape may have a portion that overlaps or is disposed underneath the adjacent shape, to those skilled in the art.
(23) In the present specification, relative terms such as “below,” “above,” “upper,” “lower,” “horizontal,” or “vertical” may be used to describe the relationship of one constituent member,

layer, or area to another constituent member, layer, or area, as illustrated in the drawings. It should be understood that these terms include not only the orientation indicated in the drawings, but also other orientations of the elements.
(24) FIG. **1** is a perspective view schematically illustrating a piping system **1** according to various embodiments.
(25) With reference to FIG. **1**, the piping system **1** according to various embodiments of the present invention may include a pipe **10** and a pipe block **200**. The pipe **10** includes at least one pipe wall that defines an internal space of the pipe **10** through which a fluid, for example a brake fluid, a lubricant, a coolant, and/or a transmission fluid of a vehicle, is transported. The pipe wall may be a single wall or multiple walls with a plurality of layers. A material of the pipe wall may include a polymer, a metal, and/or a composite. The pipe **10** may be part of a circulation circuit that circulates fluid. For example, the pipe **10** that transports the transmission fluid of the vehicle may be part of a cooling circuit that has one end coupled to the transmission and the other end connected to a cooler to cool the transmission fluid. In various embodiments, the piping system **1** may include a plurality of pipes (e.g., a first pipe **10***a* and a second pipe **10***b*). One of the first pipe **10***a* and the second pipe **10***b* may be a pipe that transports fluid to the cooler, and the other may be a pipe that transports fluid from the cooler to another constituent element of the piping system **1**.
(26) The pipe block **200** may be a portion coupled to the pipe **10** to connect the plurality of pipes **10**, support the pipe **10**, and/or distribute fluid flowing through the pipe **10**. In various embodiments, a material of the pipe block **200** may include the same or similar material as the material of the pipe wall of the pipe **10**. The detailed constitution of the pipe block **200** will be described below.
(27) FIG. **2**A is a perspective view illustrating the pipe block **200** according to various embodiments of the present invention.
(28) FIG. **2**B is a front view illustrating the pipe block **200** according to various embodiments of the present invention.
(29) FIG. **2**C is a side view illustrating the pipe block **200** according to various embodiments of the present invention.
(30) FIG. **2**D is a cross-sectional view illustrating the pipe block **200** according to various embodiments of the present invention.
(31) FIG. **2**E is a cross-sectional view illustrating the pipe block **200** according to various embodiments of the present invention.
(32) A cross-section in FIG. **2**D is a cross sectional surface in a direction taken along line A-A′ in FIG. **2**A.
(33) A cross-section in FIG. **2**E is a cross sectional surface in a direction taken along line B-B′ in FIG. **2**B.
(34) With reference to FIGS. **2**A to **2**D, the pipe block **200** may include an inflow portion **210** and an outflow portion **220**. The inflow portion **210** may be a portion to which the pipe **10** (e.g., the first pipe **10***a*) is insertively coupled to allow fluid to flow into the pipe block **200**. The outflow portion **220** may be a portion for fluid that has flowed into the pipe block **200** through the inflow portion **210** to flow out to a separate pipe (not illustrated) or another constituent element of the pipe system.
(35) The inflow portion **210** may include a lip **212**, a flange coupling surface **213**, and an insertion hole **211**. The lip **212** may be a portion that grips a flange **110** of a coupling portion **100** of the pipe **10** (e.g., the first pipe **10***a*) to couple the coupling portion **100** to the pipe block **200**, as described below.
(36) The lip **212** may be a member protruding from a surface of the pipe block **200** at a periphery of the insertion hole **211** along an outer circumference of the insertion hole **211**. The flange coupling surface **213** may be a portion of the surface of the pipe block **200** that directly or indirectly faces the flange **110** of the coupling portion **100** described below. The lip **212** may be

positioned at a periphery of the flange coupling surface **213**, and the insertion hole **211** may be formed at a center of the flange coupling surface **213**.
(37) The insertion hole **211** may be an insertion hole formed from the surface of the pipe block **200** into an interior of the pipe block **200** for a nipple **102** of the coupling portion **100** described below to be inserted.
(38) The insertion hole **211** may be connected to a flow path of the outflow portion **220** inside the pipe block **200**. Therefore, the fluid that flows into the pipe block **200** from the nipple **102** of the pipe **10** may flow out of the outflow portion **220**.
(39) In various embodiments, the pipe block **200** may include a fixing hole **230**. The fixing hole **230** may be a portion that couples with a bolt, a rivet, or similar fastening means to fix the pipe block **200** to a fixing means, such as a mount or a bracket (not illustrated).
(40) With reference to FIGS. **2**D and **2**E, in various embodiments, the pipe block **200** may include a pipe insertion portion **290**. The pipe insertion portion **290** may be, for example, a recessed portion or a through-hole formed for the pipe (e.g., the second pipe **10***b*) to be insertively fixed. In various embodiments, the second pipe **10***b* may have a bending portion **109**, and the pipe insertion portion **290** may have an internal shape at least partially corresponding to the bending portion **109** such that at least a portion of the bending portion **109** is insertively fixed. The second pipe **10***b* may be effectively fixed to the pipe insertion portion **290** by the structure described above.
(41) FIG. **3**A is a front view illustrating the first pipe **10***a* according to various embodiments of the present invention.
(42) FIG. **3**B is a cross-sectional view illustrating coupling of the pipe **10** and pipe block **200** of the piping system **1** according to various embodiments of the present invention.
(43) FIG. **3**C is an enlarged cross-sectional view illustrating coupling of the pipe **10** and pipe block **200** of the piping system **1** according to various embodiments of the present invention.
(44) FIG. **3**C is an enlarged view of an X portion in FIG. **3**B.
(45) FIG. **3**D is side view illustrating a first pipe according to various embodiments of the present invention.
(46) With reference to FIG. **3**A and FIG. **3**D, the pipe **10** (e.g., the first pipe **10***a*) may include a main body of the first pipe **10***a* and the coupling portion **100** positioned at one end of the main body of the first pipe **10***a*. The coupling portion **100** may be a portion that couples one end of the first pipe **10***a* to the pipe block **200**.
(47) In various embodiments, the coupling portion **100** may include a sleeve **101**, the nipple **102**, and the flange **110**. The sleeve **101** may be a member that couples the coupling portion **100** to an end portion of the first pipe **10***a*. In various embodiments, the sleeve **101** may include the same or similar material as the first pipe **10***a*. Various known coupling methods may be used to couple the sleeve **101** with the first pipe **10***a*, such as shrink-fitting, crimping, welding, and/or brazing. The nipple **102** may be a portion that is inserted into an insertion hole of the nipple **102** of the pipe block **200** to introduce fluid into the pipe block **200**.
(48) The flange **110** may be a portion that protrudes in a radial direction from a center of a hose, along an outer circumference of the sleeve **101**. A diameter of the flange **110** may be equal to or less than an inner diameter of the lip **212** of a nut of the first pipe **10***a*. An outer diameter of the flange **110** and the inner diameter of the lip **212** may have a suitable level of clearance for the flange **110** to be insertively assembled into the inner diameter of the lip **212**, as described below. The flange **110** may have a first surface **111**, which is a surface facing a direction in which an end of the hose is positioned (e.g., in the direction of the x-axis in the drawing), and a second surface **112** positioned opposite to the first surface **111**.
(49) With reference to FIGS. **3**B and **3**C, the coupling portion **100** may be inserted into and coupled to the pipe block **200**. The nipple **102** is inserted into the insertion hole of the nipple **102**, the first surface **111** of the flange **110** faces the flange coupling surface **213** of the pipe block **200**, and the lip **212** of the pipe block **200** is plastically deformed toward the second surface **112** of the flange

110. Accordingly, the coupling portion **100** of the first pipe **10***a* may be fixed and coupled to the pipe block **200** by pressing the flange **110** against the direction in which the first pipe **10***a* is inserted (e.g., in the direction of the x-axis in the drawing). This method of coupling of the first pipe **10***a* by plastic deformation may be referred to as caulking.
(50) The plastic deformation of the lip **212** may be performed by striking the lip **212** using a die of a shape corresponding to the lip **212**, or by tightening the lip **212** from the outside inward with respect to a radial direction of the lip **212**. In various embodiments, the lip **212** may include a metal and/or alloy material (e.g., aluminum, brass, and/or mild steel) suitable for plastic deformation.
(51) FIG. **4**A is a side view illustrating the first pipe **10***a* according to various embodiments of the present invention.
(52) FIG. **4**B is a cross-sectional view illustrating a seal **300** according to various embodiments of the present invention.
(53) FIG. **4**C is an enlarged cross-sectional view illustrating coupling of the pipe **10** and pipe block **200** of the piping system **1** according to various embodiments of the present invention.
(54) FIG. **4**D is a perspective view illustrating a seal according to various embodiments of the present invention.
(55) With reference to FIGS. **4**A, **4**B, and **4**D, the pipe system **1** may include a seal **300**. The seal **300** may include, for example, a simple seal **300***a* illustrated in FIG. **4**D or a complex seal **300***b* illustrated in in FIG. **4**B. The simple seal **300***a* may be a seal made substantially and entirely of an elastic material (e.g., rubber, NBR, TPU, and/or silicone). The complex seal **300***b* may be a seal including a first ring **301** including an elastic material and a second ring **302** including a material having a higher hardness compared to the first ring (e.g., metal), in which the second ring **302** is fixed against the first ring **301** and constituted to support the second ring **302**.
(56) With reference to FIG. **4**C, the seal **300** may be positioned between the flange **110** of the pipe **10** (e.g., the first pipe **10***a*) and the flange coupling surface **213** of the pipe block **200**. The seal **300** may be disposed to enclose an outer circumference of the coupling portion **100** of the first pipe **10***a* along the flange **110** and the flange coupling surface **213**. The seal **300** may be tightly in contact with the first surface **111** of the flange **110** and the flange coupling surface **213** of the pipe block **200** by an operation that plastically deforms the lip **212** upon coupling of the first pipe **10***a* and the pipe block **200**.
(57) Since the lip **212** is plastically deformed so that the seal **300** is tightly in contact with the first surface **111** of the flange **110** and the flange coupling surface **213** of the pipe block **200** to seal a space between the two surfaces, according to the present invention, the outflow of fluid between the pipe and the pipe block can be effectively blocked without the need for a joining treatment such as welding, soldering, or brazing. In addition, the risk of fluid leakage due to failure of the above-mentioned joint treatment (e.g., microscopic gaps or cracks due to poor welds) is reduced. In addition, since the sealing between the pipe **10***a* and the pipe block **200** is achieved by a simple operation such as caulking, the productivity of an assembly operation for the pipe system **1** may be improved compared to fastening a separate pipe fastening member (or pipe fitting).
(58) FIG. **5**A is a side view illustrating the pipe **10** and an o-ring **300***c* according to various embodiments of the present invention.
(59) FIG. **5**B is an enlarged cross-sectional view illustrating coupling of the pipe **10** and pipe block **200** of the piping system **1** according to various embodiments of the present invention.
(60) With reference to FIGS. **5**A and **5**B, the pipe system **1** may include an o-ring **300***c*. The o-ring **300***c* may be one example of the seal **300**. The o-ring **300***c* may be, for example, a member of an elastic material formed in a toroidal shape with a circular cross-section. In various embodiments, the pipe **10** (e.g., the first pipe **10***a*) may include an o-ring seating groove **1011** formed for the o-ring **300***c* to be seated in. The o-ring seating groove may be formed, for example, along a circumferential surface of the nipple **102** in a lateral direction.
(61) In various embodiments, when the coupling portion **100** of the first pipe **10***a* is inserted into

the pipe block **200**, the o-ring **300***c* may be tightly in contact with an inner wall of the insertion hole **211** to seal a portion between the insertion hole **211** and a surface of the nipple **102**. The lip **212** may be plastically deformed by the caulking to fix the coupling portion **100**, thereby preventing or reducing the state of sealing described above from being broken by the o-ring **300***c* due to wiggling of the nipple **102**.
(62) FIGS. **6**A to **6**C are enlarged cross-sectional views illustrating coupling of the first pipe **10***a* and the pipe block **200** according to various embodiments.
(63) FIGS. **6**B and **6**C are enlarged cross-sectional views of a Y area in FIG. **6**A.
(64) With reference to FIGS. **6**A to **6**C, the flange **110** may include a sealing edge **113**. The sealing edge **113** may protrude from the first surface **111** of the flange **110** and be positioned along a radial direction of the first surface **111** of the flange **110**. Upon coupling of the first pipe **10***a* and the pipe block **200**, the sealing edge **113** may be pressed into the flange coupling surface **213**. In various embodiments, the sealing edge **113** has a higher hardness than the flange coupling surface **213**, such that the sealing edge **113** may be pressed into the flange coupling surface **213**. A portion between the first surface **111** of the flange **110** and the flange coupling surface **213** may be effectively sealed by the sealing edge **113** being pressed into the flange coupling surface **213**.
(65) With reference to FIG. **6**C, the flange **110** may include a sealing protrusion **114**, and the flange coupling surface **213** may include a sealing groove **214** formed in an area corresponding to the sealing protrusion **114**. The sealing protrusion **114** may protrude from the first surface **111** of the flange **110**, and be positioned along the radial direction of the first surface **111** of the flange **110**. The seal **300** may be positioned between the first surface **111** of the flange **110** and the flange coupling surface **213**.
(66) Upon coupling of the first pipe **10***a* and the pipe block **200**, the sealing protrusion **114** may press the seal **300** against the sealing groove **214**. The seal **300** may be at least partially inserted into the sealing groove **214** by the pressing of the sealing protrusion **114**. The seal **300** may be plastically deformed and/or elastically deformed by the pressing of the sealing protrusion **114**. A material of the plastically deformable seal **300** may include, for example, copper, aluminum, or a metal having the similar ductility as the copper and aluminum, and/or a polymer resin. Since the seal **300** is deformed by the pressing of the sealing protrusion **114** and inserted into the sealing groove **214**, the seal **300** can be tightly in contact with the sealing protrusion **114** and the surface of the sealing groove **214**. Therefore, a portion between the first surface **111** of the flange **110** in which the sealing protrusion **114** is formed and the flange coupling surface **213** can be effectively sealed.
(67) Further, the embodiments disclosed in the present document disclosed in the present specification and illustrated in the drawings are provided as particular examples for easily explaining the technical contents according to the embodiment disclosed in the present document and helping understand the embodiment disclosed in the present document, but not intended to limit the scope of the embodiment disclosed in the present document. Accordingly, the scope of the various embodiments disclosed in the present document should be interpreted as including all alterations or modifications derived from the technical spirit of the various embodiments disclosed in the present document in addition to the embodiments disclosed herein.
(68) TABLE-US-00001 Description of Reference Numerals 1: Piping system 10: Pipe 100: Coupling portion 101: Sleeve 102: Nipple 110: Flange 111: First surface 112: Second surface 113: Sealing Edge 114: Sealing protrusion 200: Pipe block 210: Inflow portion 211: Insertion hole 212: Lip 213: Flange coupling surface 214: Sealing groove 220: Outflow portion 230: Fixing hole 300: Seal

Claims

1. A piping system comprising: a first pipe; a second pipe; and a pipe block coupled to the first pipe and the second pipe, wherein the first pipe comprises: a flange positioned at an end portion of the first pipe, protruding in a radially outward direction of the first pipe along an outer circumference of the first pipe, and a coupling portion having a nipple that is inserted into the pipe block, an o-ring seating groove formed along a circumferential surface of the nipple in a lateral direction, wherein the flange comprises a first surface and a second surface positioned in an opposite direction of the first surface, and wherein the second pipe comprises: a bending portion with a curvature; and wherein the pipe block comprises: a pipe insertion portion coupled to the second pipe; an insertion hole into which the first pipe is insertively coupled; a lip protruding from a surface in which the insertion hole is formed in a circumferential direction along an outer circumference of the insertion hole, a flange coupling surface positioned between the insertion hole and the lip along the outer circumference of the insertion hole and facing the first surface of the flange, and wherein an inner diameter of the lip is equal to or greater than an outer diameter of the flange, wherein, when the first pipe is coupled to the pipe block, the flange is positioned within the inner diameter of the lip, and the lip is plastically deformed toward the second surface of the flange to caulk the flange, so that the first pipe is fixed to the pipe block, wherein a seal, positioned between the first surface of the flange and the flange coupling surface seals between the first surface of the flange and the flange coupling surface and made of a first elastic material and the first pipe is fixed to the pipe block; wherein an o-ring, seated in the o-ring seating groove, is in tight contact with an inner wall of the insertion hole so that that the o-ring seals between the insertion hole and a surface of the nipple, wherein the pipe insertion portion has a curvature corresponding to the curvature of the bending portion to fix the second pipe to the pipe insertion portion, wherein the seal comprises a first ring comprising the first elastic material and a second ring comprising a material having a hardness greater than a hardness of the first ring, and wherein the o-ring comprises a second elastic material.
2. The piping system of claim 1, wherein the flange comprises a sealing protrusion protruding from the first surface along a radial direction of the flange, wherein the pipe block comprises a sealing groove formed along the radial direction in an area facing the sealing protrusion on the flange coupling surface, and wherein, upon coupling of the first pipe and the pipe block, the seal is pressed by the sealing protrusion and at least partially inserted into the sealing groove to seal a portion between the first surface and the flange coupling surface.