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Quick coupling set

Abstract

A quick coupling set includes a socket and a mating plug. The socket has a rotation-restraining structure while the mating plug has a mating rotation-restraining structure. In the coupling of the socket and the mating plug, the rotation-restraining structure of the socket only allows the rotation-restraining structure of the mating plug to relatively rotate in a rotation direction, so as to complete the coupling of the socket and the mating plug.

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Primary Examiner: Troutman; Matthew*Assistant Examiner:* Kee; Fannie**Background/Summary****BACKGROUND OF THE INVENTION****1. Field of the Invention**

(1) The present disclosure relates to a quick coupling, and more particularly to a quick coupling with an anti-misconnection function.

2. Description of the Prior Art

(2) The connection operation of common quick couplings is simpler and faster than the operation of the traditional connectors that are engaged by means of screws, nuts, etc., and the quick couplings have been widely used in the connection of various fluid pipelines. Generally, in the same pipeline system, quick couplings of the same specification are often used, but there are still design requirements for the flow direction of the fluid in each pipeline of the pipeline system. For example, the coolant in the water-cooled plate needs to flow in a specific flow direction to achieve the expected heat exchange efficiency. If there is a misconnection, that is, the pipeline for supplying coolant is connected to the outlet of the water-cooled plate, and the pipeline for recovering the coolant is connected to the inlet of the water-cooled plate, the heat exchange efficiency of the water-cooled plate will be greatly reduced. Generally speaking, in order to avoid this situation, labels can be pasted on the quick couplings and the inlet and outlet of the water-cooled plate for operators to identify. However, this solution requires the operator to actively identify the labels. If the operator neglects to identify the labels, or the operating environment is insufficiently lit, misconnection may still occur.

SUMMARY OF THE INVENTION

(3) An objective of the present application is to provide a quick coupling set and its socket and plug. Through the structural match of rotation-restraining structures on the socket and plug, the effect of preventing misconnection can be achieved.

(4) A quick coupling set according to the present application includes a plug and a socket. The plug includes a plug body, a driving part, and a first rotation-restraining structure. The driving part and the first rotation-restraining structure are disposed on the plug body. The driving part is movably disposed on the plug body. The first rotation-restraining structure is disposed on the driving part. The socket includes a socket body and a second rotation-restraining structure disposed on the socket body. The first socket and first plug structurally match each other. The first rotation-restraining structure is restrained by the second rotation-restraining structure to rotate relative to the second rotation-restraining structure in a rotation direction. Therefore, the plug and the socket can ensure correct connection therebetween through the motion restraint between the first rotation-restraining structure and the second rotation-restraining structure. On the other hand, if the rotation-restraining structure of another plug is different from the first rotation-restraining structure, this rotation-restraining structure cannot rotate in the rotation direction relative to the second rotation-restraining structure even though the other plug is inserted into the socket; therefore, this plug is unable to make a firm and effective connection with the socket. In other words, the structural match of the first rotation-restraining structure and the second rotation-restraining structure has the effect of preventing misconnection.

(5) A plug according to the present application is used for connecting with a mating socket. The plug includes a plug body, a driving part, and a first rotation-restraining structure. The driving part is movably disposed on the plug body. The first rotation-restraining structure is disposed on the driving part. Therein, the first rotation-restraining structure is restrained by a second rotation-restraining structure of the mating socket to rotate relative to the second rotation-restraining structure in a rotation direction. Thereby, the plug can only be correctly inserted into the matching socket and rotate smoothly, so as to complete a firm and effective connection with the matching socket.

(6) A socket according to the present application is used for connecting with a mating plug. The socket includes a socket body and a second rotation-restraining structure disposed on the socket body. Therein, a first rotation-restraining structure of the mating plug is restrained by the second rotation-restraining structure to rotate relative to the second rotation-restraining structure in a rotation direction. Thereby, the socket can only allow the mating plug to be inserted into and rotate

smoothly, so as to complete a firm and effective connection with the mating plug.

(7) These and other objectives of the present invention will no doubt become obvious to those of ordinary skill in the art after reading the following detailed description of the preferred embodiment that is illustrated in the various figures and drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

- (1) FIG. 1 is a schematic diagram illustrating a first quick coupling set of a first embodiment according to the present application.
- (2) FIG. 2 is a partially-exploded view of a first plug in FIG. 1 in another view point.
- (3) FIG. 3 is a partially-exploded view of a first socket in FIG. 1.
- (4) FIG. 4 is a schematic diagram illustrating the first quick coupling set in FIG. 1 when the first plug just contacts the first socket.
- (5) FIG. 5 is a sectional view of the first quick coupling set along the line X-X in FIG. 4.
- (6) FIG. 6 is a schematic diagram illustrating the first quick coupling set in FIG. 4 when a first driving part of the first plug pushes a first retaining ring of the first socket to an unlocked position.
- (7) FIG. 7 is a sectional view of the first quick coupling set along the line Y-Y in FIG. 6.
- (8) FIG. 8 is a sectional view of the first quick coupling set along the line Z-Z in FIG. 6.
- (9) FIG. 9 is a schematic diagram illustrating the first quick coupling set in FIG. 6 after the first driving part of the first plug is rotated.
- (10) FIG. 10 is a schematic diagram illustrating the first quick coupling set in FIG. 1 after the coupling of the first plug with the first socket is completed.
- (11) FIG. 11 is a sectional view of the first quick coupling set along the line W-W in FIG. 10.
- (12) FIG. 12 is a schematic diagram illustrating a second quick coupling set of a second embodiment according to the present application.
- (13) FIG. 13 is a sectional view of the second quick coupling set in FIG. 12 when a second driving part of a second plug pushes a second retaining ring of a second socket to an unlocked position; therein, the cutting plane is equivalent to the line Z-Z in FIG. 6.
- (14) FIG. 14 is a schematic diagram illustrating a third quick coupling set of a third embodiment according to the present application.
- (15) FIG. 15 is a flow chart of the coupling operation between plugs and sockets in the third quick coupling set of FIG. 14.

DETAILED DESCRIPTION

(16) In the following embodiments, ordinal terms, such as first, second, . . . etc., can be used to describe various elements, but the elements are not limited by the definitions of ordinal terms. The ordinal terms are used to distinguish elements in the specification. The ordinal terms of the elements in the claims are arranged in the order of the claims, which may be different from the ordinal terms of the elements in the specification. Thus, the first element described in the following description may be the second element in the claims.

(17) Please refer to FIG. 1 to FIG. 4. A first quick coupling set 1 of a first embodiment according to the present application includes a first plug 12 and a first socket 14 matching the first plug 12. For the convenience of explanation and simplification of the drawings, the structures of the first plug 12 and the first socket 14 are simply shown in the figures, and in practice can be modified according to the implementation situation, such as structures for sealing, connecting with pipes, etc., which will not be described in addition. In the first embodiment, the first plug 12 includes a first plug body 120 and a first plug engagement structure 122 disposed on the first plug body 120. The first socket 14 includes a first socket body 140 and a first socket engagement structure 142 disposed on the first socket body 140. The first socket engagement structure 142 and the first plug

engagement structure **122** structurally match each other. The first plug **12** and the first socket **14** are coupled by the engagement of the first socket engagement structure **142** with the first plug engagement structure **122**. Therein, the first plug engagement structure **122** includes a first locking structure **1222**, a first driving part **1224**, a first rotation-restraining structure **1226**, and a first limitation structure **1228**. The first plug body **120** has a first fluid passage **120a**. The first locking structure **1222** is disposed on the first plug body **120**. The first driving part **1224** is movably disposed on the first plug body **120**. The first rotation-restraining structure **1226** is disposed on the first driving part **1224**. The first limitation structure **1228** is disposed on the first plug body **120** and the first driving part **1224** for limiting rotation or axially sliding of the first driving part **1224** relative to the first plug body **120**. The first socket engagement structure **142** includes a second locking structure **1422** and a second rotation-restraining structure **1424**. The first socket body **140** has a second fluid passage **140a**. The second locking structure **1422** is disposed on the first socket body **140** and includes a first retaining ring **14222**. The first retaining ring **14222** is movably disposed on the first socket body **140**. The position of the first retaining ring **14222** relative to the first socket body **140** determines whether the second locking structure **1422** is in a locked state or an unlocked state. The second rotation-restraining structure **1424** is disposed on the first retaining ring **14222**. The first plug **12** and the first socket **14** are firmly and effectively coupled by the engagement of the first locking structure **1222** with the second locking structure **1422**.

(18) In the first embodiment, the first socket **14** is installed on a structural wall **4** (shown schematically as a rectangular block in the figures). The first retaining ring **14222** is sleeved on the first socket body **140** and can move between a locking position (referring to FIG. 4 or FIG. 5, in which the second locking structure **1422** is at the locked state) and an unlocked position (referring to FIG. 6 and FIG. 7, in which the second locking structure **1422** is at the unlocked state) on the first socket body **140**. The first locking structure **1222** is a recess, which is realized by an annular groove formed on the outside of the first plug body **120**. The second locking structure **1422** further includes at least one locating part **14224** (realized by four locating balls in this embodiment). The first socket body **140** correspondingly forms at least one sliding slot **140b** for the locating part **14224** to slide therein. When the locating part **14224** enters the recess and the first retaining ring **14222** is located at the locking position, the first retaining ring **14222** will constrain the locating part **14224** to remain stuck in the recess, so that the first locking structure **1222** and the second locking structure **1422** are firmly engaged with each other. In practice, the engagement of the first locking structure **1222** with the second locking structure **1422** can also be realized by other engagement structures, which will not be described in addition.

(19) The first limitation structure **1228** includes a first limiting post **12282** and a first limiting slot **12284**. The first limiting post **12282** is disposed on the first plug body **120**. The first limiting slot **12284** is disposed on the first driving part **1224**. The first limiting post **12282** relatively slides in the first limiting slot **12284** to limit rotation or axially sliding of the first driving part **1224** relative to the first plug body **120**. That is, the interaction between the first limiting post **12282** and the first limiting slot **12284** is used to limit rotation or axially sliding of the first driving part **1224** relative to the first plug body **120**. Therein, the first plug body **120** as a whole is slightly cylindrical, and has an axis **120b** (indicated by a chain line in FIG. 1 and FIG. 2). The first fluid passage **120a** extends along the axis **120b**. The first limiting slot **12284** includes an axial slot section **12284a** (extending parallel to the axis **120b**) and a transverse slot section **12284b** (extending perpendicular to the axis **120b**) connecting with the axial slot section **12284a**. When the first limiting post **12282** relatively slides in the axial slot section **12284a**, the first driving part **1224** limitedly moves parallel to the axis **120b** (i.e., axially slides relative to the first plug body **120**); when the first limiting post **12282** relatively slides in the transverse slot section **12284b**, the first driving part **1224** limitedly rotates about the axis **120b** (i.e., rotates relative to the first plug body **120**).

(20) Through the interaction between the first rotation-restraining structure **1226** and the second rotation-restraining structure **1424**, the first rotation-restraining structure **1226** and the second

rotation-restraining structure **1424** can be relatively rotated in a single direction. In the first embodiment, the first rotation-restraining structure **1226** is a ratchet, disposed on the outer side of the first driving part **1224**; the second rotation-restraining structure **1424** is a pawl, pivotally connected to the inner side of the first retaining ring **14222**. Through the interaction between the pawl and the ratchet, the first rotation-restraining structure **1226** is restrained by the second rotation-restraining structure **1424** to rotate relative to the second rotation-restraining structure **1424** in a first rotation direction R1 (indicated by an arrow in FIG. 1) (i.e., the first rotation-restraining structure **1226** can only be rotated in single one direction). Therein, it is practicable to use a restoring part **1424a** (e.g. a spring) against the pawl so as to make the pawl keep catching the ratchet.

(21) In the first quick coupling set **1**, the first plug **12** is operable to couple with the first socket **14**, so that the first locking structure **1222** and the second locking structure **1422** are engaged with each other and the first fluid passage **120a** and the second fluid passage **140a** are connected to each other. In practice, if an operator needs to insert the first plug **12** into the first socket **14**, as shown by FIG. 1, the operator can first move the first plug **12** close to the first socket **14** in a first insertion direction D1 (indicated by an arrow in the figures), so that the first driving part **1224** contacts the first retaining ring **14222** (as shown by FIG. 4 and FIG. 5). At this moment, the first retaining ring **14222** is located at the locking position.

(22) Then, the operator can make the first driving part **1224** push the first retaining ring **14222** in the first insertion direction D1 until the first retaining ring **14222** reaches the unlocking position, so that the first rotation-restraining structure **1226** is engaged with the second rotation-restraining structure **1424** and the first fluid passage **120a** is connected with the second fluid passage **140a**, as shown by FIG. 6 to FIG. 8. Therein, the first retaining ring **14222** has a relief slot **14222a** (e.g., an annular recess on the inner side surface) at its inner side, for the locating part **14224** to retreat to avoid structural interference with the first plug body **120** during the movement of the first retaining ring **14222** in the first insertion direction D1. Furthermore, the first rotation-restraining structure **1226** is located at a front end of the first driving part **1224**. When the first driving part **1224** just contacts the first retaining ring **14222**, the first rotation-restraining structure **1226** has entered the inner side of the first retaining ring **14222** and engaged with the second rotation-restraining structure **1424** (i.e., the pawl catches the ratchet), as shown by FIG. 5. In practice, it is practicable to design the structure of the first quick coupling set **1** so that the first rotation-restraining structure **1226** is not engaged with the second rotation-restraining structure **1424** until the first retaining ring **14222** reaches the unlocking position, which will not be described in addition. Furthermore, as shown by FIG. 8, through the interaction between the pawl and the ratchet, the first rotation-restraining structure **1226** can only be rotated counterclockwise relative to the second rotation-restraining structure **1424** (i.e., rotated in the first rotation direction R1).

(23) Then, the operator can rotate the first driving part **1224** to make the first rotation-restraining structure **1226** rotate relative to the second rotation-restraining structure **1424** in the first rotation direction R1 (in which, at this moment, the first limiting post **12282** relatively slides in the transverse slot section **12284b**), until the first limitation structure **1228** allows the first driving part **1224** to axially slide relative to the first plug body **120** (i.e., the first limiting post **12282** enters the axial slot section **12284a**), as shown by FIG. 9. Then, the first retaining ring **14222** moves together with the first driving part **1224** in the direction opposite to the first insertion direction D1, until the first retaining ring **14222** reaches the locking position, as shown by FIG. 10 and FIG. 11. At this moment, the first retaining ring **14222** will constrain the locating part **14224** to remain stuck in the recess (i.e. the first locking structure **1222**), so that the first locking structure **1222** and the second locking structure **1422** are firmly engaged with each other, and then the coupling of the first plug **12** with the first socket **14** is completed, so that the fluid passage **120a** and the second fluid passage **140a** are connected to each other.

(24) In addition, as shown by FIG. 3 and FIG. 4, in the first embodiment, the second locking

structure **1422** further includes a restoring part **14226** (e.g. a spring), connected to the first socket body **140** and the first retaining ring **14222** for driving the first retaining ring **14222** to move toward the locking position. Thereby, in the movement of the first driving part **1224** from the position shown as FIG. **9** to the position shown as FIG. **10** (or FIG. **11**), the first retaining ring **14222** can automatically abut against the first driving part **1224** and move together with the first driving part **1224** (in the direction opposite to the first insertion direction **D1**) under the reset effect of the restoring part **14226**. Therefore, in the operation of coupling the first plug **12** with the first socket **14**, the operator can perform the operation with one hand, which facilitates the coupling operation. For example, when the first driving part **1224** is located at the position shown as FIG. **9**, the operator can only move the first driving part **1224** (in the direction opposite to the first insertion direction **D1**), or directly release the first driving part **1224**, both of which can make the first retaining ring **14222** and the first driving part **1224** move together in the direction opposite to the first insertion direction **D1**, so as to complete the coupling of the first plug **12** with the first socket **14**.

(25) Furthermore, as shown by FIG. **2**, in the first embodiment, the first limiting slot **12284** is L-shaped, which is convenient for the first limiting post **12282** to be positioned relative to the first limiting slot **12284** during the rotation of the first driving part **1224**. For example, the first limiting post **12282** relatively slides from a closed end of the transverse slot section **12284b** to another end of the transverse slot section **12284b**, that is, entering the axial slot section **12284a**, which facilitates a blind operation of the operator (i.e., the operator does not need to visually confirm the rotation status of the first driving part **1224** when rotating the first driving part **1224**). Furthermore, the first limiting slot **12284** is a through slot, formed on the first driving part **1224**. The first limiting post **12282** is fixed on the first plug body **120** and exposed from the through slot. Therefore, at least one indication mark can be disposed on the first plug body **120** or the first driving part **1224** to indicate the relative position of the first limiting post **12282** and the first driving part **1224**. Thereby, the first limiting slot **12284** can selectively expose one of the indication marks according to the position of the first limiting post **12282** relative to the first limiting slot **12284**. In the first embodiment, two marks **120c** and **120d** of different colors (indicated by different grid lines in the figures) are formed on the first plug body **120** as the indication marks. For example, as shown by FIG. **4**, before the first plug **12** is coupled with the first socket **14**, the operator can see the mark **120c** through the first limiting slot **12284**. As shown by FIG. **10**, after the first plug **12** is coupled with the first socket **14**, the operator can see the mark **120d** through the first limiting slot **12284**. In practice, it is practicable to form marks (such as nicks, marks, or colored nicks or marks) beside the first driving part **1224** and first limiting slot **12284**, which can also indicate to the operator where the first limiting post **12282** is located relative to the first limiting slot **12284**.

(26) Furthermore, as shown by FIG. **1** and FIG. **2**, the first limiting slot **12284** is disposed on the first driving part **1224** and the first limiting post **12282** is disposed on the first plug body **120**, so as to limit the rotation and axially sliding of the first driving part **1224** relative to the first plug body **120**. In practice, it is practicable to dispose the first limiting slot **12284** on the first plug body **120** and dispose the first limiting post **12282** on the first driving part **1224**, which can also the limitation to the rotation and axially sliding of the first driving part **1224** relative to the first plug body **120**, which will not be described in addition.

(27) In addition, as shown by FIG. **1**, the ratchet of the first rotation-restraining structure **1226** is disposed on the outer side of the first driving part **1224** (similar to an external gear in structural logic), and the pawl of the second rotation-restraining structure **1424** is disposed on the inner side of the first retaining ring **14222** correspondingly. In practice, the ratchet of the first rotation-restraining structure **1226** can be changed to be disposed on the inner side of the first driving part **1224** (similar to an internal gear in structural logic), and the pawl of the second rotation-restraining structure **1424** can be disposed on the first retaining ring **14222** or the first socket body **140**

correspondingly (for example, the first socket body **140** can be structurally designed so that when the first retaining ring **14222** is located at the locking position, there is a portion of the structure still protruding from the first retaining ring **14222**, so that the pawl can be disposed on this portion of the structure and engage with the ratchet). In this case, the interaction between the ratchet and the pawl can also limit the first rotation-restraining structure **1226** and the second rotation-restraining structure **1424** to relatively rotate in one single direction. Furthermore, in practice, the first rotation-restraining structure **1226** can be changed to be realized by a pawl, and the second rotation-restraining structure **1424** is realized by a ratchet correspondingly. In this case, the interaction between the ratchet and the pawl can also limit the first rotation-restraining structure **1226** and the second rotation-restraining structure **1424** to relatively rotate in one single direction.

(28) As discussed above, in the first quick coupling set **1** according to the first embodiment, the first rotation-restraining structure **1226** of the first plug **12** structurally matches the second rotation-restraining structure **1424** of the socket **14**, so in principle, the first plug **12** can only be firmly and effectively coupled to the first socket **14**, and vice versa. Therefore, the structural match of the first rotation-restraining structure **1226** and the second rotation-restraining structure **1424** has the effect of preventing misconnection.

(29) Please refer to FIG. **12**. A first quick coupling set **2** of a second embodiment according to the present application includes a second plug **22** and a second socket **24** matching the second plug **22**. For simplification of description, the second plug **22** and the second socket **24** are structurally similar to the first plug **12** and the first socket **14**, respectively. For other descriptions of the second plug **22** and the second socket **24**, please refer to the relevant descriptions and corresponding figures about the components of the first plug **12** and the first socket **14** and variants thereof, which will not be described in addition.

(30) In the second embodiment, the second plug **22** is installed on a structural wall **4'** and includes a second plug body **220** and a second plug engagement structure **222** disposed on the second plug body **220**. The second plug body **220** is structurally identical to the first plug body **120**. The second plug engagement structure **222** includes a third locking structure **2222**, a second driving part **2224**, a third rotation-restraining structure **2226**, and a second limitation structure **2228**. The second plug body **220** has a third fluid passage **220a**. The third locking structure **2222** is disposed on the second plug body **220**. The second driving part **2224** is movably disposed on the second plug body **220**. The third rotation-restraining structure **2226** is disposed on the second driving part **2224**. The second limitation structure **2228** is disposed on the second plug body **220** and the second driving part **2224** for limiting axially sliding or rotation of the second driving part **2224** relative to the second plug body **220**. Therein, the second limitation structure **2228** includes a second limiting post **22282** and a second limiting slot **22284**, disposed on the second plug body **220** and the second driving part **2224**, respectively.

(31) The second socket **24** includes a second socket body **240** and a second socket engagement structure **242** disposed on the second socket body **240**. The second socket body **240** is structurally identical to the first socket body **140**. The second socket engagement structure **242** structurally matches the second plug engagement structure **222**. The second socket engagement structure **242** includes a fourth locking structure **2422** and a fourth rotation-restraining structure **2424**. The second socket body **240** has a fourth fluid passage **240a**. The fourth locking structure **2422** is disposed on the second socket body **240** and includes a second retaining ring **24222** and at least one locating part **24224**. The second retaining ring **24222** is movably disposed on the second socket body **240**. The position of the second retaining ring **24222** relative to the second socket body **240** determines whether the fourth locking structure **2422** is in a locked state or an unlocked state. The fourth rotation-restraining structure **2424** is disposed on the second retaining ring **24222**. Similarly, the second plug **22** can be inserted into the second socket **24** in a second insertion direction **D2** (indicated by an arrow in the figure), and the second plug **22** can be firmly and effectively coupled with the second socket **24** through the engagement of the third locking structure **2222** and the

fourth locking structure **2422**.

(32) As shown by FIG. **12** and FIG. **13**, the main difference between the second plug **22** and the first plug **12** is that the third rotation-restraining structure **2226** (also realized by a ratchet) of the second plug **22** and the first rotation-restraining structure **1226** (i.e. the ratchet) of the first plug **12** are different in the tooth shape direction. Correspondingly, the main difference between the second socket **24** and the first socket **14** is that the fourth rotation-restraining structure **2424** (also realized by a pawl) of the second socket **24** and the second rotation-restraining structure **1424** (i.e. the pawl) of the first socket **14** are configured in different orientations. Therefore, the third rotation-restraining structure **2226** is restrained by the fourth rotation-restraining structure **2424** to rotate relative to the fourth rotation-restraining structure **2424** in a second rotation direction R2 (indicated by an arrow in the figure) (i.e., the third rotation-restraining structure **2226** can only be rotated in single one direction), so as to couple the second plug **22** with the second socket **24**, so that the third fluid channel **220a** is connected with the fourth fluid channel **240a**. In addition, in the second plug **22**, the second limiting slot **22284** of the second limitation structure **2228** is also L-shaped, but is configured in the opposite direction to the first limiting slot **12284** of the first limitation structure **1228**, for matching the rotation direction of the third rotation-restraining structure **2226** relative to the fourth rotation-restraining structure **2424**. Therein, the first rotation direction R1 and the second rotation direction R2 are different.

(33) Please refer to FIG. **8** and FIG. **13** together. The pawl of the fourth rotation-restraining structure **2424** and the pawl of the second rotation-restraining structure **1424** are configured in different orientations, so in principle, even if the ratchet of the third rotation-restraining structure **2226** is inserted into the first socket **14** and meshed with the pawl of the second rotation-restraining structure **1424**, the third rotation-restraining structure **2226** still cannot rotate relative to the second rotation-restraining structure **1424** in the first rotation direction R1 like the first rotation-restraining structure **1226**. This structural feature makes the second plug **22** unable to be effectively coupled with the first socket **14** correctly, thus preventing misconnection. Similarly, the first plug **12** also cannot be coupled with the second socket **24**, which can also prevent misconnection.

(34) Please refer to FIG. **14**. A third quick coupling set **3** of a third embodiment according to the present application includes the above-mentioned first quick coupling set **1** and second quick coupling set **2**. For example, the third quick coupling set **3** can be used in a server cooling system. Therein, the first socket **14** and the second socket **24** are installed on a structural wall **4"** of a cooling distribution unit (CDU) and serve as an outlet and an inlet, respectively. The first plug **12** and the second plug **22** are respectively connected to the inlet and outlet of a water-cooled plate through pipes. According to the previous description, through the rotation restraint effect among the rotation-restraining structures **1226**, **1424**, **2226** and **2424**, the first plug **12** can only be firmly and effectively connected with the first socket **14**, the second plug **22** can only be firmly and effectively connected with the second socket **24**, so the misconnection in the prior art can be avoided.

(35) In practical applications, the operation for coupling the first plug **12** (inlet) and the second plug **22** (outlet) with the first socket **14** (outlet) and the second socket **24** (inlet) in the third quick coupling set **3** can be performed according to the flow chart shown in FIG. **15**. As shown by the step **S100**, one of the plugs is taken to start coupling with one of the socket. As shown by the step **S102**, the operator can apply force to the plug with one hand to retract the retaining ring to the unlocked position. Then, as shown by the step **S104**, the operator rotates the driving part of the plug. As shown by the step **S106**, the operator needs to determine whether the driving part can be rotated. If NO, it means that the plug does not match the socket and they cannot be coupled with each other firmly and effectively. The flow returns to the step **S100**. The other of the plugs is taken and the steps **S102**, **S104** and **S106** are repeated. If YES, the retaining ring of the socket is moved back to the locking position, as shown by the step **S108**; at this moment, the coupling of the plug with the socket is completed, and the operator can observe the corresponding indication mark (e.g.

the mark 120d) from the limiting slot on the plug. The coupling of other plugs is carried out according to the above flow chart until the coupling of all plugs is completed.

(36) Those skilled in the art will readily observe that numerous modifications and alterations of the device and method may be made while retaining the teachings of the invention. Accordingly, the above disclosure should be construed as limited only by the metes and bounds of the appended claims.

Claims

1. A quick coupling set, comprising: a first plug, the first plug comprising a first plug body, a first driving part, and a first rotation-restraining structure, the first driving part and the first rotation-restraining structure being disposed on the first plug body, the first driving part being movably disposed on the first plug body, the first rotation-restraining structure being disposed on the first driving part, the first plug comprising a limitation structure, the limitation structure comprises a limiting post and a limiting slot, one of the limiting post and the limiting slot being disposed on the first driving part, the other of the limiting post and the limiting slot being disposed on the first plug body, the limiting post relatively sliding in the limiting slot to limit rotation or axially sliding of the first driving part relative to the first plug body; and a first socket, the first socket comprising a first socket body and a second rotation-restraining structure disposed on the first socket body, the first socket and first plug structurally fitting each other, the first rotation-restraining structure being restrained by the second rotation-restraining structure to rotate relative to the second rotation-restraining structure in a first rotation direction.
2. The quick coupling set according to claim 1, wherein the limiting slot comprises an axial slot section and a transverse slot section connecting with the axial slot section, the limiting post slides relative to the axial slot section so that the first driving part is limited to axially slide relative to the first plug body, and the limiting post slides relative to the transverse slot section so that the first driving part is limited to rotate relative to the first plug body.
3. The quick coupling set according to claim 2, wherein the limiting slot is L-shaped.
4. The quick coupling set according to claim 1, wherein the limiting slot is a through slot formed on the first driving part, the limiting post is fixed on the first plug body and exposed from the through slot, and two indication marks are disposed on the first plug body or the first driving part to indicate a relative position of the limiting post and the limiting slot.
5. The quick coupling set according to claim 4, wherein the two indication marks are two different colored marks, formed on the first plug body, and the limiting slot exposes one of the two indication marks according to a position of the limiting post relative to the limiting slot.
6. The quick coupling set according to claim 1, wherein one of the first rotation-restraining structure and the second rotation-restraining structure comprises a ratchet, and the other of the first rotation-restraining structure and the second rotation-restraining structure comprises a pawl.
7. The quick coupling set according to claim 1, further comprising: a second plug, the second plug comprising a second plug body, a second driving part, and a third rotation-restraining structure, the second driving part and the third rotation-restraining structure being disposed on the second plug body, the second driving part being movably disposed on the second plug body, the third rotation-restraining structure being disposed on the second driving part, the second plug body being identical in structure to the first plug body; and a second socket, the second socket comprising a second socket body and a fourth rotation-restraining structure disposed on the second socket body, the second socket body being identical in structure to the first socket body, the second socket and second plug structurally fitting each other, the third rotation-restraining structure being restrained by the fourth rotation-restraining structure to rotate relative to the fourth rotation-restraining structure in a second rotation direction; wherein the first rotation direction is the opposite to the second rotation direction.

8. A quick coupling set, comprising: a first plug, the first plug comprising a first plug body, a first driving part, and a first rotation-restraining structure, the first driving part and the first rotation-restraining structure being disposed on the first plug body, the first driving part being movably disposed on the first plug body, the first rotation-restraining structure being disposed on the first driving part, the first plug comprising a limitation structure, the limitation structure comprising a limiting post and a limiting slot, one of the limiting post and the limiting slot being disposed on the first driving part, the other of the limiting post and the limiting slot being disposed on the first plug body, the limiting post relatively sliding in the limiting slot to limit rotation or axially sliding of the first driving part relative to the first plug body; and a first socket, the first socket comprising a first socket body, a retaining ring movably disposed on the first socket body, and a second rotation-restraining structure disposed on a radially inner side of the retaining ring, the first socket and first plug structurally fitting each other, the first rotation-restraining structure being restrained by the second rotation-restraining structure to rotate relative to the second rotation-restraining structure in a first rotation direction.

9. The quick coupling set according to claim 8, wherein the limiting slot comprises an axial slot section and a transverse slot section connecting with the axial slot section, the limiting post slides relative to the axial slot section so that the first driving part is limited to axially slide relative to the first plug body, and the limiting post slides relative to the transverse slot section so that the first driving part is limited to rotate relative to the first plug body.

10. The quick coupling set according to claim 9, wherein the limiting slot is L-shaped.

11. The quick coupling set according to claim 8, wherein the limiting slot is a through slot formed on the first driving part, the limiting post is fixed on the first plug body and exposed from the through slot, and two indication marks are disposed on the first plug body or the first driving part to indicate a relative position of the limiting post and the limiting slot.

12. The quick coupling set according to claim 11, wherein the two indication marks are two different colored marks, formed on the first plug body, and the limiting slot exposes one of the two indication marks according to a position of the limiting post relative to the limiting slot.

13. The quick coupling set according to claim 8, wherein one of the first rotation-restraining structure and the second rotation-restraining structure comprises a ratchet, and the other of the first rotation-restraining structure and the second rotation-restraining structure comprises a pawl.

14. A quick coupling set, comprising: a first plug, the first plug comprising a first plug body, a first driving part, and a first rotation-restraining structure, the first driving part and the first rotation-restraining structure being disposed on the first plug body, the first driving part being movably disposed on the first plug body, the first rotation-restraining structure being disposed on the first driving part; a first socket, the first socket comprising a first socket body, a retaining ring movably disposed on the first socket body, and a second rotation-restraining structure disposed on a radially inner side of the retaining ring, the first socket and first plug structurally fitting each other, the first rotation-restraining structure being restrained by the second rotation-restraining structure to rotate relative to the second rotation-restraining structure in a first rotation direction; a second plug, the second plug comprising a second plug body, a second driving part, and a third rotation-restraining structure, the second driving part and the third rotation-restraining structure being disposed on the second plug body, the second driving part being movably disposed on the second plug body, the third rotation-restraining structure being disposed on the second driving part, the second plug body being identical in structure to the first plug body; and a second socket, the second socket comprising a second socket body and a fourth rotation-restraining structure disposed on the second socket body, the second socket body being identical in structure to the first socket body, the second socket and second plug structurally fitting each other, the third rotation-restraining structure being restrained by the fourth rotation-restraining structure to rotate relative to the fourth rotation-restraining structure in a second rotation direction; wherein the first rotation direction is the opposite to the second rotation direction.

