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Control valve

Abstract

Disclosed is a control valve. The control valve comprises a sealing member, and the sealing member comprises an elastic pad and a sealing piece which have an integral structure. The control valve is provided with a rotation suppression portion, the rotation suppression portion is integrally formed with or fixedly connected to or in position-limiting connection with the inner surface of a valve body member, and the rotation suppression portion works in conjunction with the sealing member, so as to prevent the elastic pad from rotating with respect to a side wall portion and prevent movement of the sealing member with respect to the side wall portion.

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Background/Summary

(1) This disclosure is a national phase application of PCT international patent application PCT/CN2021/120577, filed on Sep. 26, 2021 which claims the priority to Chinese Patent Application No. 202110065261.1, titled “VALVE DEVICE”, filed with the China National Intellectual Property Administration on Jan. 18, 2021, the entire disclosure of which are incorporated herein by reference.

FIELD

(2) The present disclosure relates to the technical field of fluid control, and in particular to a control valve.

BACKGROUND

(3) Some systems need to use a multi-passage control valve to control a flow path. For example, a motor vehicle may generally have multiple control valves in order to conduct controlling at present. In a multi-passage control valve, a sealing member and an elastic pad with separate structures are used for realizing sealing and sliding-fit with a valve core.

SUMMARY

(4) In order to provide a control valve, the following technical solution is provided according to the present disclosure: a control valve includes a valve body component and a valve core component, the control valve has a valve chamber, at least most of the valve core component is located in the valve chamber, the valve core component is driven to be rotatable; the valve body component includes a side wall portion, the side wall portion is a peripheral wall or at least a part of the peripheral wall of the valve chamber, the valve body component is provided with a communication hole, the control valve further includes a sealing component, the sealing component is located between the side wall portion and the valve core component, the sealing component includes an elastic pad and a sealing member, the elastic pad and the sealing member are fixed to form an

integral structure, the elastic pad is located between the sealing member and the side wall portion of the valve body component, the sealing member is in contact with the valve core component, a surface of the sealing member in contact with the valve core component is smoother than a surface of the elastic pad in contact with the side wall portion, the control valve has a rotation suppression portion, the rotation suppression portion is integrally formed with or fixedly connected to or in position-limiting connection with an inner surface of the valve body component, and the rotation suppression portion is fitted with the sealing component to limit the sealing component from rotating clockwise or counterclockwise relative to the valve body component.
(5) In this case, the sealing member of the control valve includes the elastic pad and the sealing member which have the integral structure, the surface of the sealing member in contact with the valve core component is smoother than the surface of the elastic pad in contact with the side wall portion, the control valve is provided with the rotation suppression portion, the rotation suppression portion is integrally formed with or fixedly connected to or in position-limiting connection with the inner surface of the valve body component, and the rotation suppression portion is fitted with the sealing member, so as to limit the sealing component from rotating clockwise or counterclockwise relative to the valve body component, limit the elastic pad from rotating relative to the side wall portion, and prevent the sealing component from moving relative to the side wall portion, which has a simple structure and facilitates of assembling.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) FIG. **1** is a schematic exploded view of a control valve according to the present disclosure;
(2) FIG. **2** is a schematic perspective view of a sealing component according to a first embodiment of the present disclosure;
(3) FIG. **3** is a schematic perspective view of a valve body component according to the first embodiment of the present disclosure;
(4) FIG. **4** is a schematic partially cross-sectional view of the valve body component in FIG. **3**;
(5) FIG. **5** is a schematic partially enlarged view of the portion I in FIG. **4**;
(6) FIG. **6** is a schematic partially cross-sectional view of the sealing component in FIG. **2**;
(7) FIG. **7** is a schematic perspective view of the sealing component according to a second embodiment of the present disclosure;
(8) FIG. **8** is a schematic perspective view of the valve body component according to the second embodiment of the present disclosure; and
(9) FIG. **9** is a schematic perspective view of a cover of the control valve according to the present disclosure.
(10) FIG. **10** is a schematic cross-sectional view showing how the position-limiting portions are in contact with two circumferential side surfaces of the stop portion within the elastic range of the sealing component" in FIG. **6**.
DETAILED DESCRIPTION OF THE EMBODIMENTS
(11) The technical solution is described below in conjunction with specific embodiments. As shown in FIG. **1** to FIG. **5**, a control valve **200** includes a valve body component **10**, a valve core component **20**, a driving box **30**, and a sealing component **40**. The control valve has a valve chamber **102**, the valve core component **20** is rotatable driven by a driving member in the driving box, for example, the driving member may be a motor or a motor and a reduction gear set. The valve body component **10** includes a side wall portion **12** and a cover **50**, and the side wall portion **12** is fixedly connected to the cover **50**. The side wall portion **12** is a peripheral wall or at least a part of the peripheral wall of the valve chamber, the valve body component **10** has a communication hole **101**, and multiple communication holes **101** may be provided. For example, in

this embodiment, five communication holes **101** are provided, alternatively, greater than or less than five communication holes **101** can be provided. The sealing component **40** is located between the side wall portion **12** and the valve core component **20**; the sealing component **40** includes an elastic pad **41** and a sealing member **42**, the elastic pad **41** is fixedly connected to the sealing member **42**, the elastic pad **41** is located between the sealing member **42** and the side wall portion **12** of the valve body component **10**, the sealing member **42** is in contact with the valve core component **20**, a surface of the sealing member in contact with the valve core component is smoother than a surface of the elastic pad in contact with the side wall portion, the control valve has a rotation suppression portion, the rotation suppression portion is integrally formed with or fixedly connected to or in position-limiting connection with an inner surface of the valve body component, and the rotation suppression portion is fitted with the sealing component to limit the sealing component from rotating clockwise or counterclockwise relative to the valve body component. The acting force between the sealing member **42** and the valve core component **20** includes sliding friction force, and the acting force between the elastic pad **41** and the side wall portion **12** is static friction force. The rotation suppression portion can limit the sealing component **40** from rotating relative to the side wall portion **12**. The elastic pad **41** and the sealing member **42** may be fixed together by adhesion. The sealing member **42** may be made of Teflon, and the sealing member **42** can be not only used for sealing, but also has a certain lubricating performance, which can reduce the friction between the valve core component and the sealing component, thereby reducing the driving force of the control valve.

(12) As shown in FIG. **2**, the elastic pad **41** has a first through holes **411**, a first recessed groove **412** and a second recessed groove **413**, the first through holes **411** are in communication with the communication holes **101**, openings of the first recessed grooves **412** and the second recessed grooves **413** are configured toward the side wall portion **12**. The first recessed groove **412** may extend from one end of the elastic pad **41** to the other end of the elastic pad **41** in a longitudinal direction of the elastic pad **41**, and multiple first recessed grooves **412** are provided. In this embodiment, the first recessed grooves **412** are distributed on two sides of the first through hole **411**, and the first recessed groove **412** located between two adjacent first through holes **411** may be located in the middle of a portion located between the two adjacent first through holes **411**. The first recessed grooves **412** may be arranged axially, the second recessed grooves **413** may be arranged circumferentially or in other form, and an expansion space for the elastic pad **41** may be formed by the second recessed grooves **413** when the elastic pad **41** is compressed under force. In this embodiment, the second recessed grooves **413** are located on at least one side of the elastic pad **41** in the longitudinal direction of the elastic pad **41**, and the first recessed grooves **412** are in communication with the second recessed grooves **413**.

(13) As shown in FIG. **3**, the valve body component **10** includes protruding ribs **123** which protrude from the side wall portion **12**. In this embodiment, the protruding ribs **123** protrude from the side wall portion **12**.

(14) The number of the protruding ribs **123** corresponds to the number of the first recessed grooves **412**, each protruding rib **123** is inserted into the corresponding first recessed groove **412**, and the protruding rib **123** is in interference fit with the corresponding first recessed groove **412**. The arrangement of the protruding ribs **123** and the first recessed grooves **412** can realize the positioning and mounting of the sealing component **40**, so that the positions of the first through holes **411** correspond to those of the communication holes **101** to communicate the fluid. In addition, the fitting manner between the protruding ribs **123** and the first recessed grooves **412** can limit a position of the sealing component **40**, and prevent the sealing component **40** from moving when the valve core component rotates. In this embodiment, the rotation suppression portion includes the protruding ribs **123** and the first recessed grooves **412**. In this embodiment, a height of the protruding ribs **123** protruding from the side wall portion **12** is less than a depth of the first recessed grooves **412**, so that a certain gap is formed between the protruding rib **123** and a bottom

of the first recessed groove **412**. In this way, the elastic pad **41** abuts against the side wall portion **12**, and an expansion space for the elastic deformation generated by the elastic pad can be reserved by the gaps formed between the protruding ribs **123** and the bottom of the first recessed grooves **412**.

(15) As shown in FIG. **3** to FIG. **5**, the valve body component **10** further includes a bottom wall **11** and boss portions **124**, the bottom wall **11** is integrally formed with the side wall portion **12**, and the boss portions **124** protrude from the bottom wall **11**. Each boss portion **124** includes a blocking portion **125** and a first supporting portion **126**, the blocking portion **125** protrudes from the first supporting portion **126** by a set distance, at least part of the first supporting portion **126** is located between the protruding rib **123** and the blocking portion **125**, and a position-limiting space **127** is formed between the blocking portion **125** and the protruding rib **123**. After the sealing component **40** is mounted in the valve body component **10**, one end of the sealing component **40** is accommodated in the position-limiting space **127**. The sealing component **40** has first notch portions **46**, the first notch portions **46** are located in an end surface of the sealing component and extend toward an interior of the sealing component **40**, and the first supporting portion **126** is inserted into the corresponding first notch portion **46** and abuts against the sealing component **40**. The arrangement of the boss portions **124** can limit a position of the end of the sealing component **40**, and prevent the end of the sealing component **40** from being separated from the valve body component **10**. The rotation suppression portion can further include that the first supporting portion **126** is inserted into the corresponding first notch portion **46** and abuts against the sealing component **40**.

(16) As shown in FIG. **2** and FIG. **6**, the sealing member **42** includes position-limiting portions **422**, a fitting portion **423**, a hemming portion **424** and a connecting portion **425**, the fitting portion **423** is in sliding fit with the valve core component **20**, the two position-limiting portions **422** are located on two sides of the sealing member **42** in a circumferential direction of the sealing member **42**, and each position-limiting portion **422** has an outward protruding structure or a bending structure, which can further limit the position of the two sides of the elastic pad **41**, so as to limit the deformation range of the elastic pad **41** after extrusion. In this embodiment, since the position-limiting fit manner between the protruding ribs **123** and the first recessed grooves **412** is provided, the position-limiting portions **422** are located on two sides of the elastic pad **41**, and a height of the position-limiting portions is less than a thickness of the two sides of the elastic pad, so that the expansion space for the elastic pad **41** can be formed. As shown in FIG. **3**, the valve body component **10** has a stop portion **128**, the stop portion **128** protrudes from the side wall portion **12** and is inserted into the valve chamber **102**, and the position-limiting portions **422** are in contact with a side surface of the stop portion **128**. The position-limiting portions **422** are in contact with two circumferential side surfaces of the stop portion **128** within the elastic range of the sealing component, which can limit the sealing component from rotating relative to the valve body component. The rotation suppression portion can further include that the position-limiting portions **422** are in contact with two circumferential side surfaces of the stop portion **128**.

(17) A second through hole **421** is formed in the hemming portion **424**, and at least a part of the hemming portion **424** is inserted into the first through hole **411** and is fixed to an inner wall of the first through hole **411** by adhesion, so that the first through hole **411** is in communication with the second through hole **421**. A height of the hemming portion **424** is less than a length of the first through hole **411**, so that the sealing member **42** can be prevented from contacting a second side wall portion **122** when the elastic pad **41** is compressed, thus the elastic pad **41** can have greater compression space.

(18) In this embodiment, on one hand, the arrangement of the hemming portion **424** increases a contact area between the elastic pad **41** and the sealing member **42** and improves the adhesive force between the elastic pad **41** and the sealing member **42**, on the other hand, the hemming portion **424** is inserted into the first through hole **411** so as to limit the position of the sealing member **42** and

the elastic pad **41**, and prevent the seal **42** and the elastic gasket **41** from being misplaced when the valve core component rotates.

(19) The connecting portion **425** is located between the hemming portion **424** and the fitting portion **423**, and the hemming portion **424** is rounding connected to the fitting portion **423** by the connecting portion **425**. In this embodiment, a diameter of a connection position of the connecting portion **425** with the fitting portion **423** gradually increases in a direction toward the valve core component, and the connecting portion **425** can be used for buffering and guiding during the rotation of the valve core component.

(20) Referring to FIG. **1**, FIG. **3**, FIG. **4**, FIG. **8** and FIG. **9**, the valve body component **10** is provided with a first valve core supporting portion **1101** and a second valve core supporting portion **1102**, the first valve core supporting portion **1101** protrudes from the bottom wall, the second valve core supporting portion **1102** protrudes from an end surface of the cover **50**, a part of the valve core component **20** is inserted into the first valve core supporting portion **1101**, another part of the valve core component **20** is inserted into the second valve core supporting portion **1102**, and the valve core component **20** is rotatably supported on the first valve core supporting portion **1101** and the second valve core supporting portion **1102**; the first valve core supporting portion **1101** and the second valve core supporting portion **1102** both include a notch portion and a rib plate portion. Taking the second valve core supporting portion **1102** as an example, the second valve core supporting portion **1102** includes notch portions **112** and a rib plate portions **113**, the impurities in the coolant entering the fitting portion **111** can be discharged in time by the arrangement of the notch portions **112** so as to prevent the valve core component from being stuck. The arrangement of the rib plate portions **113** can improve the strength of the second valve core supporting portion **1102** and reduce the influence of the notch portions **112** on the strength of the second valve core supporting portion **1102**. In addition, a height of the second valve core supporting portion **1102** is greater than or equal to a height of the boss portion **124**, which can reduce the friction of the valve core component. In addition, the boss portions **124** can prevent the sealing component **40** from being separated from the valve body component **10** when it is compressed and deformed.

(21) The cover **50** further includes a second supporting portions **51**, an end surface of the sealing component **40** is provided with the first notch portions **46**, another end surface of the sealing component **40** is provided with second notch portions **47**, the first supporting portion **126** is inserted into the corresponding first notch portion **46** and abuts against the sealing component **40**, the second supporting portion **51** is inserted into the corresponding second notch portion **47** and abuts against the sealing component **40**, so as to further limit the position of the sealing component **40**.

(22) FIG. **7** is a schematic perspective view of the sealing component according to a second embodiment of the present disclosure; compared with the first embodiment, the main difference is that: the sealing component **40** is not provided with the first recessed grooves **412**. FIG. **8** is a schematic perspective view of the valve body component according to the second embodiment of the present disclosure; compared with the first embodiment, the main difference is that: the protruding ribs **123** are not provided. Referring to FIG. **7** and FIG. **8**, the sealing component **40** is arranged in an inner chamber of the valve body component, the position-limiting portions **422** of the sealing component are in contact with the side surface of the stop portion **128**; the position-limiting portions **422** of the sealing component are in contact with the side surface of the stop portion **128** within the elastic range of the sealing component, which can limit the sealing component from rotating relative to the valve body component, thereby simplifying the structure and reducing the difficulty of assembly compared with the first embodiment. Other similar arrangements are not repeated.

(23) In addition, in some embodiments, the first notch portions **46** and the second notch portions **47** may not be provided, and the first supporting portions **126** and the second supporting portions **51** are not provided accordingly, which can further simplify the structure and reduce the difficulty of

assembly.
(24) It should be noted that although the present application has been described herein in detail with reference to the above embodiments, those of ordinary skill in the art should understand that those skilled in the art may still modify or equivalently replace the present application, and all technical solutions and its improvements that do not apart from the spirit and scope of the present application should be covered by the scope of the claims of the present application.

Claims

1. A control valve, comprising a valve body component and a valve core component, wherein the control valve has a valve chamber, at least most of the valve core component is located in the valve chamber, the valve core component is driven to be rotatable; the valve body component comprises a side wall portion, the side wall portion is a peripheral wall or at least a part of the peripheral wall of the valve chamber, the valve body component is provided with a communication hole, wherein the control valve further comprises a sealing component, the sealing component is located between the side wall portion and the valve core component, the sealing component comprises an elastic pad and a sealing member, the elastic pad and the sealing member are fixed to form an integral structure, the elastic pad is located between the sealing member and the side wall portion of the valve body component, the sealing member is in contact with the valve core component, a surface of the sealing member in contact with the valve core component is smoother than a surface of the elastic pad in contact with the side wall portion, the control valve has a rotation suppression portion, the rotation suppression portion is integrally formed with or fixedly connected to or in position-limiting connection with an inner surface of the valve body component, and the rotation suppression portion is fitted with the sealing component to limit the sealing component from rotating clockwise or counterclockwise relative to the valve body component, wherein the sealing member is fixedly connected to the elastic pad, the sealing member comprises a hemming portion and a fitting portion, the fitting portion is arranged toward the valve core component and is in sliding fit with the valve core component, the elastic pad has a first through hole, the first through hole is in communication with the communication hole, the sealing member further has a second through hole, the second through hole is in communication with the communication hole through the first through hole, the second through hole is formed in the hemming portion, at least a part of the hemming portion is inserted into the first through hole and is fixed to an inner wall of the first through hole by adhesion, and a height of the hemming portion is less than a length of the first through hole.
2. The control valve according to claim 1, wherein the sealing member comprises at least two position-limiting portions located on two sides of the sealing member, each position-limiting portion has an outward protruding structure or a bending structure, the position-limiting portions are located on two sides of the elastic pad, and a height of the position-limiting portions is less than a thickness of the two sides of the elastic pad; the valve body component has a stop portion, the stop portion is arranged to protrude from the side wall portion and is inserted into the valve chamber, and the position-limiting portions are in contact with two circumferential side surfaces of the stop portion, respectively.
3. The control valve according to claim 2, wherein the sealing member further comprises a connecting portion, the connecting portion is located between the hemming portion and the fitting portion, the hemming portion has a rounded connection to the fitting portion by the connecting portion, and a diameter of a connection position of the connecting portion with the fitting portion gradually increases in a direction toward the valve core component.
4. The control valve according to claim 1, wherein the elastic pad has a first recessed groove which extends axially, the valve body component has a protruding rib that protrudes from the side wall portion, the protruding rib is inserted into the first recessed groove, and a height of the protruding

rib protruding from the side wall portion is less than a depth of the first recessed groove.
5. The control valve according to claim 4, wherein the elastic pad has a first through hole, the first recessed groove extends from one end of the elastic pad to the other end of the elastic pad in a longitudinal direction of the elastic pad, wherein a plurality of first recessed grooves are provided, the first recessed grooves are distributed on two sides of the first through hole, and the protruding rib is in interference fit with the corresponding first recessed groove.
6. The control valve according to claim 5, wherein the valve body component further comprises a bottom wall and a boss portion, the bottom wall is integrally formed with the side wall portion, the boss portion protrudes from the bottom wall and extends toward the valve chamber, the boss portion comprises a blocking portion and a first supporting portion, the blocking portion protrudes from the first supporting portion by a set distance, wherein the first supporting portion is located between the protruding rib and the blocking portion, the protruding rib is connected to the first supporting portion, a position-limiting space is formed between the blocking portion and the protruding rib, one end of the sealing component is located in the position-limiting space, and the sealing component abuts against the first supporting portion.
7. The control valve according to claim 5, wherein the valve body component further comprises a bottom wall and a cover, the cover is fixedly connected to the side wall portion, the valve body component further comprises a first valve core supporting portion which protrudes from the bottom wall, the cover comprise a second valve core supporting portion which protrudes from an end surface of the cover, a part of the valve core component is inserted into the first valve core supporting portion, another part of the valve core component is inserted into the second valve core supporting portion, and the valve core component is rotatably supported on the first valve core supporting portion and the second valve core supporting portion.
8. The control valve according to claim 1, wherein the elastic pad is made of rubber material, the valve body component is made of aluminum material or made of plastic material by injection molding, the valve core component is made of plastic material by injection molding, the sealing member is made of Teflon, and the elastic pad is fixed to the sealing member by adhesion.
9. The control valve according to claim 8, wherein the elastic pad has a first recessed groove and a second recessed groove, the first recessed groove extends axially, the second recessed groove is arranged circumferentially, the second recessed groove is located on at least one side of the elastic pad, and the first recessed groove is in communication with the second recessed groove.
10. The control valve according to claim 1, wherein the elastic pad has a first recessed groove which extends axially, the valve body component has a protruding rib that protrudes from the side wall portion, the protruding rib is inserted into the first recessed groove, and a height of the protruding rib protruding from the side wall portion is less than a depth of the first recessed groove.
11. The control valve according to claim 2, wherein the elastic pad has a first recessed groove which extends axially, the valve body component has a protruding rib that protrudes from the side wall portion, the protruding rib is inserted into the first recessed groove, and a height of the protruding rib protruding from the side wall portion is less than a depth of the first recessed groove.
12. The control valve according to claim 3, wherein the elastic pad has a first recessed groove which extends axially, the valve body component has a protruding rib that protrudes from the side wall portion, the protruding rib is inserted into the first recessed groove, and a height of the protruding rib protruding from the side wall portion is less than a depth of the first recessed groove.
13. The control valve according to claim 1, wherein the elastic pad is made of rubber material, the valve body component is made of aluminum material or made of plastic material by injection molding, the valve core component is made of plastic material by injection molding, the sealing member is made of Teflon, and the elastic pad is fixed to the sealing member by adhesion.
14. The control valve according to claim 2, wherein the elastic pad is made of rubber material, the valve body component is made of aluminum material or made of plastic material by injection molding, the valve core component is made of plastic material by injection molding, the sealing

member is made of Teflon, and the elastic pad is fixed to the sealing member by adhesion.
15. The control valve according to claim 3, wherein the elastic pad is made of rubber material, the valve body component is made of aluminum material or made of plastic material by injection molding, the valve core component is made of plastic material by injection molding, the sealing member is made of Teflon, and the elastic pad is fixed to the sealing member by adhesion.
16. The control valve according to claim 4, wherein the elastic pad is made of rubber material, the valve body component is made of aluminum material or made of plastic material by injection molding, the valve core component is made of plastic material by injection molding, the sealing member is made of Teflon, and the elastic pad is fixed to the sealing member by adhesion.
17. The control valve according to claim 5, wherein the elastic pad is made of rubber material, the valve body component is made of aluminum material or made of plastic material by injection molding, the valve core component is made of plastic material by injection molding, the sealing member is made of Teflon, and the elastic pad is fixed to the sealing member by adhesion.
18. The control valve according to claim 6, wherein the elastic pad is made of rubber material, the valve body component is made of aluminum material or made of plastic material by injection molding, the valve core component is made of plastic material by injection molding, the sealing member is made of Teflon, and the elastic pad is fixed to the sealing member by adhesion.
19. The control valve according to claim 7, wherein the elastic pad is made of rubber material, the valve body component is made of aluminum material or made of plastic material by injection molding, the valve core component is made of plastic material by injection molding, the sealing member is made of Teflon, and the elastic pad is fixed to the sealing member by adhesion.