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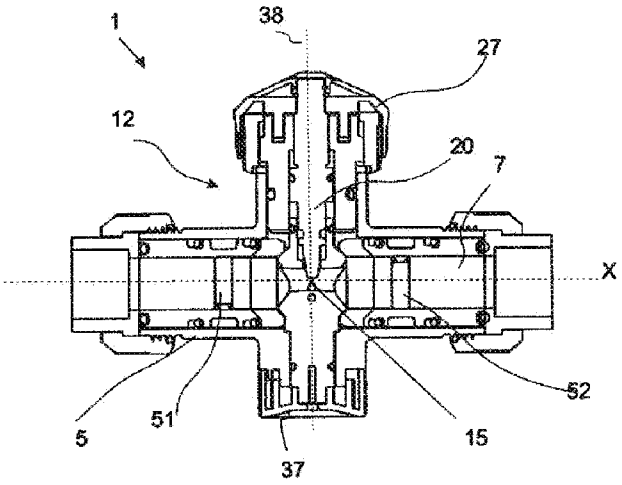
(54) **Balancing valve.**

(57) The present invention proposes a balancing valve, a fluid network with such a balancing valve, and a method of maintaining such a balancing valve. The balancing valve comprises a housing having a main fluid passage extending along a main flow axis, a valve body disposed within the housing in the fluid passage, wherein the valve body has a first through hole forming a first fluid passage with a variable first fluid passage cross section. The valve body has a second through hole distinct from the first through hole and forming a second fluid passage in the valve body. The first fluid passage is a main fluid passage and the second fluid passage is a by-pass passage.



LU100995

Description

Title: Balancing valve

TECHNICAL FIELD

The present invention relates to the field of valves. More precisely, the present invention relates to a balancing valve, a hydraulic network comprising such a balancing valve and a method of maintenance of such a balancing valve.

PRIOR ART

As part of the management of hot water networks, some networks are looped. The hot water is heated and then circulated by means of a pump. The hot water travels around the building to serve the various points of use, before returning to the heating point. The flow rate of the hot water in these loops is generally managed by a valve called a balancing valve.

The balancing valve has an essential function of adjusting the water flow rate to ensure a uniform flow within the installation as well as a uniform temperature throughout the hydraulic installation.

Typically, the balancing valve is a valve with fine adjustment, in which a needle is provided to obstruct the fluid passage therein in a variable manner, thus creating a pressure drop to limit the flow of water. The needle is made of metal in a valve body mainly made of brass.

In those installations, the flow of fluid can lead to particles deposition on the needle or in the fluid passage, which over time can result in a misfunctioning of the balancing valve or can even clog the balancing valve. Therefore, balancing valves must be cleaned regularly. It is important to ensure a continuous flow of hot water even during operations of cleaning, maintenance or repair on the balancing valve. Therefore, a by-pass system comprising a pipe and fittings upstream and downstream of the balancing valve is also provided. Whenever cleaning or maintenance operations are required, the flow of water is directed to the by-pass system, so that the balancing valve may be removed for cleaning/maintenance or repair without interruption of the water flow.

However, such installations with a by-pass system to be added are more complex by increasing the number of valves used and the complexity of the network.

It is an object of the present invention to overcome the prior art drawbacks.

In particular it is an object of the present invention to provide a balancing valve easy to be manufactured. It is also an object of the present invention to provide a valve for managing locally the flow rate of a fluid. It is also an object of the present invention to provide a balancing valve easy to be maintained without adding complexity to the existing network

SUMMARY OF THE INVENTION

These and other objects of the present invention are achieved by a flow control valve according to claim 1, and a hydraulic system according to claim 12, and a method of maintenance according to claim 14.

According the invention, the balancing valve comprises a housing having a main fluid passage extending along a main flow axis, a valve body disposed within the housing in the fluid passage, wherein the valve body has a first through hole forming a first fluid passage with a variable first fluid passage cross section, and wherein the valve body has a second through hole distinct from the first through hole and forming a second fluid passage in the valve body, wherein the first fluid passage is a main fluid passage and the second fluid passage is a by-pass passage.

With other words, the present invention proposes having not only the main fluid passage but also a by-pass passage within the valve body. This allows providing a by-pass system provided within the balancing valve itself. This advantage avoids the use of additional by-pass system.

In one aspect of the invention, the valve body is movably mounted to the housing to select one of the first through hole and of the second through hole for the fluid flow. Therefore, it becomes possible to choose between a position in which the balancing valve is provided for managing the fluid flow, and a by-pass position in which the balancing valve is provided for ensuring a minimum flow for maintenance or cleaning.

In an aspect of the invention, the balancing is ensured by providing a variable first fluid passage cross section which is adjustable by a control element inserted within the valve body and into the first through hole and whose position within the first through hole can be adjusted.

In one aspect, the control element can be removed from the valve body when the balancing valve is in the by-pass position, without interruption of the fluid flow. This allows for cleaning or maintaining operation without interruption of service and without having to provide additional by-pass systems.

In a further aspect of the present invention, the valve body is rotatably mounted to the housing, between a working position in which the first through hole extends along the main flow axis, and a by-pass position in which the second through hole extends along the main flow axis, in particular wherein the first through hole and the second through hole are orthogonal one with respect to the other. With such a rotational movement, it becomes easy for a user to operate the balancing valve and select the desired position.

The valve body comprises a ball and the control element comprises a needle inserted into the ball and movable in a radial direction to obstruct in an adjustable manner the first through hole.

In another aspect, the valve body comprises a first jaw with an first outer surface and a second jaw with a second outer surface, the first through hole being formed between the first outer surface and the second outer surface, with a distance between the first outer surface of the first jaw and the second outer surface of the second jaw being adjustable in a radial direction to modify first fluid passage cross section, in particular the first jaw is fixedly mounted to the valve body and the second jaw is movable in a radial direction as part of the control element.

The first outer surface and second outer surface may have a cross section with complementary saw tooth profiles in along the main flow axis when the valve body is in a working position.

In an aspect, the valve body is provided with a by-pass knob to rotate the valve body, and a balancing control knob for adjusting a cross section of the first through hole, in particular

wherein the by-pass knob is located below the valve body and the balancing control knob is located above the valve body when the balancing valve is installed in a network.

By providing a housing with a first sensor aperture upstream of the valve body and a second sensor aperture downstream of the valve body, for providing access to pressure or flow rate sensor and measure the pressure or flow rate upstream and downstream of the valve body, in use, one can adjust the balancing valve to manage the fluid rate depending on the requirements. The adjustment may further be automated.

In another aspect of the present invention, the valve body and the control element are made of polymer.

The present invention also proposes a hydraulic network comprising a first pipe element, a second pipe element and such a balancing valve, the balancing valve being installed between the first pipe element and the second pipe element extending along a main flow axis, wherein the balancing valve can be rotated between a working position in which the first through hole extends along the main flow axis, and a by-pass position in which the second through hole extends along the main flow axis.

The present invention further proposes a method of maintaining a balancing valve installed in a hydraulic network, the hydraulic network comprising a first pipe element, a second pipe element and a balancing valve, the balancing valve being disposed between the first pipe element and the second pipe element along a main flow axis, the method comprising rotating the balancing valve from a working position in which the first through hole extends along the main flow axis, to a by-pass position in which the second through hole extends along the main flow axis.

In an aspect, the method comprises removing the control element from the valve body for maintenance or cleaning, without interrupting the fluid flow through the hydraulic network.

Still other aspects, features, and advantages of the present invention are readily apparent from the following detailed description, simply by illustrating a preferable embodiments and implementations. The present invention is also capable of other and different embodiments and its

several details can be modified in various obvious aspects, all without departing from the scope of the present invention. Accordingly, the drawings and descriptions are to be regarded as illustrative in nature, and not as restrictive. Additional objects and advantages of the invention will be set forth in part in the description which follows and in part will be obvious from the description, or may be learned by practice of the invention.

DESCRIPTION OF THE DRAWINGS

The invention is described hereinafter with reference to the enclosed drawings, in which:

Fig. 1 is a balancing valve according to a first aspect of the present disclosure,

Fig.2 is the balancing valve of Fig. 1, in a working position of the balancing valve, according to the present disclosure,

Fig. 3 is the balancing valve of Fig. 1, in a by-pass position of the balancing valve, according to the present disclosure,

Fig. 4 shows the balancing valve during maintenance,

Fig. 5 is a balancing valve according to another aspect of the present disclosure,

Fig. 6 is the balancing valve of Fig. 5 in a working position of the balancing valve, according to the present disclosure,

Fig. 7 is the balancing valve of Fig. 5 in a by-pass position of the balancing valve, according to the present disclosure,

Fig. 8 shows the balancing part during maintenance.

DETAILED DESCRIPTION

Figures 1 to 4 illustrate a balancing valve 1 according to a first aspect of the present disclosure.

The balancing valve 1 comprises a housing 5 having a main fluid passage 7 extending along a main flow axis X.

A valve body 12 is disposed within the housing 5 in the fluid passage 7.

The valve body 12 has a first through hole 15 forming a first fluid passage. The first through hole 15 has a variable cross section.

In the first embodiment, the valve body 12 is of a ball type and a control pin or needle 20 is inserted into the valve body 12 and is configured to partially obstruct the through hole 15, in a variable manner, thereby varying the first fluid passage cross section. The skilled person knowns that the first through hole 15 cannot be closed completely and even when obstructed at the maximum, there remains always a minimum aperture required to ensure the minimum fluid flow rate when the balancing valve is installed in a network.

The needle 20 is movable radially, to adjust the first fluid passage cross section and hence the pressure drop inside the balancing valve 1, as known in the art. The needle 20 is therefore a control element which can adjust a cross section of the first fluid passage.

A balancing control knob 27 is provided at one end of the needle 20 to adjust the position of the needle 20 within the valve body 12.

The valve body 12 comprises a second through hole 35 forming a second fluid passage, distinct from the first through hole 15. The second through hole 35 is preferably oriented transversely to the first through hole 15.

The second through hole 35 is positioned below the first through hole 15, in operative position of the balancing valve 1.

The second through hole 35 has a specific diameter which is designed to allow to reach the same flow as the one obtained with the first through hole 15 closed at its maximum. The second through hole 35 is intended to form, in use, a by-pass channel.

The valve body 12 is rotatably mounted to the housing 5, around a rotation axis 38, between a working position in which the first through hole 15 extends along the main flow axis, and a by-pass position in which the second through hole 35 extends along the main flow axis, as illustrated in Fig 2 (working position) and Fig.3 (by-pass position).

The rotation axis 38 is preferably perpendicular to the main flow axis X. The needle 20 is also preferably aligned with the rotation axis 38. The angle between the by-pass channel 35 and the

main fluid passage 15 is preferably 90 degrees. An angle of 90 degrees is easy to provide and is easy for a user. Of course, this is not limiting the invention and other angles and orientations and rotation axis can be provided.

Positioning means and stopping means can be provided to control the rotation and positioning of the valve body within the housing.

A by-pass knob 37 is provided for rotating the valve body 12 around said rotation axis 38.

The by-pass knob 37 is positioned opposite the balancing control knob 27 with respect to the valve body 12. In particular wherein the by-pass knob 37 is located one side of the valve body, preferably below the valve body 12, and the balancing control knob 27 is located on the other opposite side of the valve body, preferably above the valve body, when the balancing valve is installed in a network.

The valve body and the needle are made of polymer, instead of metal in the prior art.

In operation, the fluid is directed to flow through the first through hole 15 and the pressure drop is controlled via by rotating the needle 20 of the balancing valve 1 to adjust the cross section of the first through hole. The pressure can be measured by pressure sensors. To do so, the housing 5 comprises a first sensor aperture 51 upstream of the valve body 12 and a second sensor aperture 52 downstream of the valve body 12, for providing access to pressure or flow rate sensor and measure the pressure or flow rate upstream and downstream of the valve body, and hence the pressure drop, when the balancing valve is installed in a fluid network.

This adjustment of the control element position can be automated.

Whenever cleaning or maintenance operations are needed, the fluid can be directed to flow through the second trough hole 35 by rotating the knob 37 about the rotation axis 38, to align the second through hole 35 along the main flow axis X. The second through hole 35 therefore forms a by-pass channel.

As illustrated on Fig. 4, when the second through hole 35 is aligned along the main flow axis X, so that fluid can flow through the second through hole 35, the needle 20 can be removed from the valve body 12 and completely exit the balancing valve 1 to be cleaned, without any interruption of service.

Figure 5 to Figure 8 illustrate a balancing valve 201 according to a second embodiment of the present invention.

The balancing valve 201 comprises a housing 205 having a main fluid passage 207 extending along a main flow axis X.

A valve body 212 is disposed within the housing 205 in the fluid passage 207.

The valve body 212 comprises a first jaw 220 and a second jaw 221, cooperating with the first jaw 220 to form a first through hole or first fluid passage 215 therebetween. In particular, the first jaw 220 has a first outer surface 230 and the second jaw 221 has a second outer surface 231, the first through hole being formed between the first outer surface 230 and the second outer surface 231. A distance between the first outer surface 230 and the second outer surface 231 is adjustable in a radial direction to modify a first fluid passage cross section.

In the example of Figs. 5 to 8, the first jaw 220 is fixedly mounted and the second jaw 221 is movable vertically/radially, to adjust said first fluid passage cross section, and hence the pressure drop inside the balancing valve 201.

The first outer surface 221 and second outer surface 231 have a cross section with complementary saw tooth profiles in along the main flow axis X when the valve body 212 is in a working position.

A control knob 227 is provided at one end of second jaw 221 to adjust the position of the second jaw 221 within the valve body 212.

The valve body 212 comprises a second through hole 235 distinct from the first through hole 215.

The second through hole 235 is preferably oriented transversely to the through hole 215, and below the first through hole 215, in operative position of the balancing valve 201.

The valve body 212 is rotatably mounted to the housing 205, around a rotation axis 238, between a working position in which the first through hole 215 extends along the main flow axis X, and a by-pass position in which the second through hole 235 extends along the main flow axis X, as illustrated in Fig 6 (working position) and Fig.7 (by-pass position).

The rotation axis 238 is preferably perpendicular to the main flow axis X.

An angle between the first through hole 215 and the second through hole 235 is preferably 90 degrees. An angle of 90 degrees is easy to provide and is easy for a user. Of course, this is not limiting the invention and other angles and orientations and rotation axis can be provided.

Positioning means and stopping means can be provided to control the rotation and positioning of the valve body within the housing.

A by-pass knob 237 is provided for rotating the valve body 212 around said rotation axis 238.

In the example shown on the figures, the by-pass knob 237 is on one side of the valve body 212, opposite to the control knob 227.

The fluid through the balancing valve can be directed to flow either through the first through hole 215 or through the second through hole 235. In particular, when cleaning or maintenance operation need to be performed, a user can rotate the knob 237 about the rotation axis 238, to align the second through hole 235 along the main flow axis X. The second through hole 235 therefore forms a by-pass channel. As illustrated on Fig. 8, when the second through hole 235 is aligned along the main flow axis X, fluid can flow through the second through hole 235, and the second jaw 221 can be removed from the valve body 212 and completely exit the balancing valve 201. This allows operations of maintenance or cleaning without any interruption of service.

A by-pass knob 237 is provided for rotating the valve body 212 around a rotation axis 238.

The by-pass channel 235 diameter cannot be adjusted in this example. This is not limiting the invention.

The geometrical shape of the control element is specific to control the pressure drop.

The foregoing description of the preferred embodiments of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed, and modifications and variations are possible in light of the above teachings or may be acquired from practice of the invention. The embodiment was chosen and described in order to explain the principles of the invention and its practical application to enable one skilled in the art to utilize the invention in various embodiments as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the claims appended hereto, and their equivalents.

Claims

1. Balancing valve comprising
a housing having a main fluid passage extending along a main flow axis,
a valve body disposed within the housing in the fluid passage, wherein the valve body has a first through hole forming a first fluid passage with a variable first fluid passage cross section,
and wherein the valve body has a second through hole distinct from the first through hole and forming a second fluid passage in the valve body,
wherein the first fluid passage is a main fluid passage and the second fluid passage is a by-pass passage.

2. Balancing valve according to claim 1, wherein the valve body is movably mounted to the housing to select one of the first though hole and of the second through hole, between a working position in which the first through hole extends along the main flow axis, and a by-pass position in which the second through hole extends along the main flow axis.

3. Balancing valve according to claim 1 or 2, wherein the variable first fluid passage cross section is adjustable by a control element inserted within the valve body and into the first though hole and whose position within the first through hole can be adjusted.

4. Balancing valve according to the preceding claim, wherein the control element can be removed from the valve body when the balancing valve is in the by-pass position.

5. Balancing valve according to any of claim 1 to 4, wherein the valve body is rotatably mounted to the housing, in particular the first through hole and the second through hole being orthogonal one with respect to the other.

6. Balancing valve according to any one of the preceding claims, wherein the valve body comprises a ball and the control element comprises a needle inserted into the ball and movable in a radial direction to obstruct in an adjustable manner the first through hole.

7. Balancing valve according to any ones of claims 1 to 5, wherein the valve body comprises a first jaw with an first outer surface and a second jaw with a second outer surface, the first through hole being formed between the first outer surface and the second outer surface, with a distance between the first outer surface of the first jaw and the second outer surface of the second jaw being adjustable in a radial direction to modify first fluid passage cross section, in particular the first jaw is fixedly mounted to the valve body and the second jaw is movable in a radial direction as part of the control element.

8. Balancing valve according to the preceding claim, wherein the first outer surface and second outer surface have a cross section with complementary saw tooth profiles in along the main flow axis when the valve body is in a working position.

9. Balancing valve according to any of the preceding claims, wherein the valve body is provided with a by-pass knob to rotate the valve body, and a balancing control knob for adjusting a cross section of the first through hole, in particular wherein the by-pass knob is located below the valve body and the balancing control knob is located above the valve body when the balancing valve is installed in a network.

10. Balancing valve according to any of the preceding claims, wherein the housing comprises a first sensor aperture upstream of the valve body and a second sensor aperture downstream of the valve body, for providing access to pressure or flow rate sensor and measure the pressure or flow rate upstream and downstream of the valve body, in use.

11. Balancing valve according to any of the preceding claims, wherein the valve body and the control element are made of polymer.

12. Hydraulic network comprising a first pipe element, a second pipe element and a balancing valve according to any one of claims 1 to 11, the balancing valve being installed between the first pipe element and the second pipe element extending along a main flow axis, wherein the balancing valve can be rotated between a working position in which the first through hole extends along the main flow axis, and a by-pass position in which the second through hole extends along the main flow axis.

13. Method of maintaining a balancing valve installed in a hydraulic network, the hydraulic network comprising a first pipe element, a second pipe element and a balancing valve according to any of claims 1 to 11, the balancing valve being disposed between the first pipe element and the second pipe element along a main flow axis, the method comprising rotating the balancing valve from a working position in which the first through hole extends along the main flow axis, to a by-pass position in which the second through hole extends along the main flow axis.

14. Method according to the preceding claim, comprising removing the control element from the valve body for maintenance or cleaning, without interrupting the fluid flow through the hydraulic network.

Revendications

1. Vanne d'équilibrage comprenant

un boîtier ayant un passage principal de fluide s'étendant le long d'un axe principal d'écoulement,

un corps de vanne disposé à l'intérieur du boîtier dans le passage de fluide, dans lequel le corps de vanne présente un premier trou traversant formant un premier passage de fluide avec une première section de passage de fluide variable,

et dans lequel le corps de vanne comporte un deuxième trou traversant distinct du premier trou traversant et formant un deuxième passage de fluide dans le corps de vanne,

dans laquelle le premier passage de fluide est un passage de fluide principal et le deuxième passage de fluide est un passage de dérivation.

2. Vanne d'équilibrage selon la revendication 1, dans laquelle le corps de vanne est monté de manière mobile sur le boîtier pour sélectionner l'un du premier trou traversant et du deuxième trou traversant, entre une position de travail dans laquelle le premier trou traversant s'étend le long de l'axe principal d'écoulement, et une position de dérivation dans laquelle le deuxième trou traversant s'étend le long de l'axe principal d'écoulement.

3. Vanne d'équilibrage selon la revendication 1 ou 2, dans laquelle la première section de passage de fluide variable est réglable par un élément de commande inséré dans le corps de vanne et dans le premier trou traversant et dont la position dans le premier trou traversant peut être réglée.

4. Vanne d'équilibrage selon la revendication précédente, dans laquelle l'élément de commande peut être retiré du corps de vanne lorsque la vanne d'équilibrage est en position de dérivation.

5. Vanne d'équilibrage selon l'une quelconque des revendications 1 à 4, dans laquelle le corps de vanne est monté rotatif sur le boîtier, en particulier le premier trou traversant et le deuxième trou traversant étant orthogonaux l'un par rapport à l'autre.

6. Vanne d'équilibrage selon l'une quelconque des revendications précédentes, dans laquelle le corps de vanne comprend une balle et l'élément de commande comprend un poinceau inséré dans la balle et mobile dans une direction radiale pour obstruer d'une manière réglable le premier trou traversant.

7. Vanne d'équilibrage selon l'une quelconque des revendications 1 à 5, dans laquelle le corps de vanne comprend une première mâchoire avec une première surface extérieure et une deuxième mâchoire avec une deuxième surface extérieure, le premier trou traversant étant formé entre la première surface extérieure et la deuxième surface extérieure, une distance entre la première surface extérieure de la première mâchoire et la deuxième surface extérieure de la deuxième mâchoire étant réglable dans une direction radiale pour modifier la première section de passage de fluide, en particulier la première mâchoire est montée fixe au corps de vanne et la deuxième mâchoire est mobile dans une direction radiale en tant que partie de l'élément de commande.

8. Vanne d'équilibrage selon la revendication précédente, dans laquelle la première surface extérieure et la deuxième surface extérieure ont une section transverse avec des profils de dents de scie complémentaires le long de l'axe principal d'écoulement lorsque le corps de vanne est dans une position de travail.

9. Vanne d'équilibrage selon l'une quelconque des revendications précédentes, dans laquelle le corps de vanne est pourvu d'un bouton de dérivation pour faire tourner le corps de vanne, et d'un bouton de commande d'équilibrage pour régler une section transverse du premier trou traversant, en particulier dans laquelle le bouton de dérivation est situé sous le corps de vanne et le bouton de commande d'équilibrage est situé au-dessus du corps de vanne lorsque la vanne d'équilibrage est installée dans un réseau.

10. Vanne d'équilibrage selon l'une quelconque des revendications précédentes, dans laquelle le boîtier comporte une première ouverture de capteur en amont du corps de vanne et une deuxième ouverture de capteur en aval du corps de vanne, pour permettre l'accès à un capteur de pression ou de débit et mesurer la pression ou le débit en amont et en aval du corps de vanne, en utilisation.

11. Vanne d'équilibrage selon l'une quelconque des revendications précédentes, dans laquelle le corps de vanne et l'élément de commande sont en polymère.

12. Réseau hydraulique comprenant un premier élément de conduite, un deuxième élément de conduite et une vanne d'équilibrage selon l'une quelconque des revendications 1 à 11, la vanne d'équilibrage étant installée entre le premier élément de conduite et le deuxième élément de conduite s'étendant suivant un axe principal d'écoulement, dans lequel la vanne d'équilibrage peut être tournée entre une position de travail dans laquelle le premier trou traversant s'étend suivant l'axe principal d'écoulement, et une position de dérivation dans laquelle le deuxième trou traversant s'étend suivant l'axe principal d'écoulement.

13. Procédé de maintenance d'une vanne d'équilibrage installée dans un réseau hydraulique, le réseau hydraulique comprenant un premier élément de conduite, un deuxième élément de conduite et une vanne d'équilibrage selon l'une quelconque des revendications 1 à 11, la vanne d'équilibrage étant disposée entre le premier élément de conduite et le deuxième élément de conduite le long d'un axe principal d'écoulement, le procédé comprenant la rotation de la vanne d'équilibrage d'une position de travail dans laquelle le premier trou traversant s'étend selon l'axe principal d'écoulement, à une position de dérivation dans laquelle le deuxième trou traversant s'étend selon l'axe principal d'écoulement.

14. Procédé selon la revendication précédente, comprenant le retrait de l'élément de commande du corps de vanne pour maintenance ou nettoyage, sans interrompre l'écoulement du fluide dans le réseau hydraulique.

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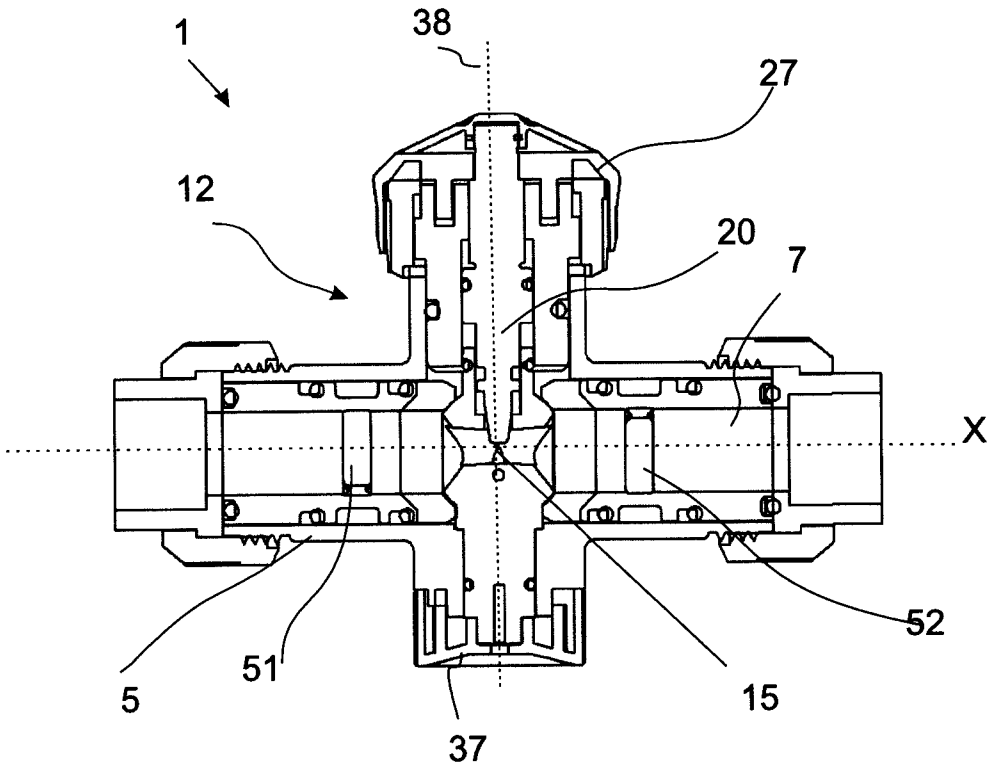

Fig. 1

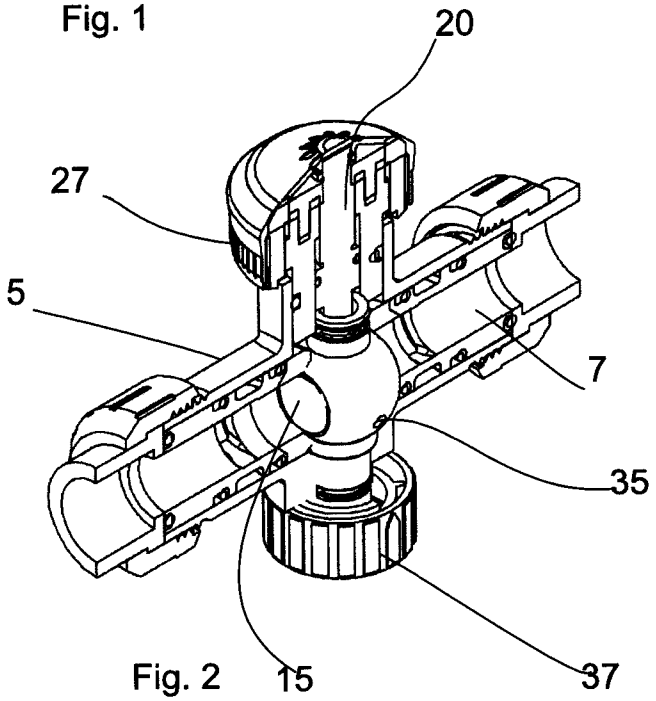

Fig. 2

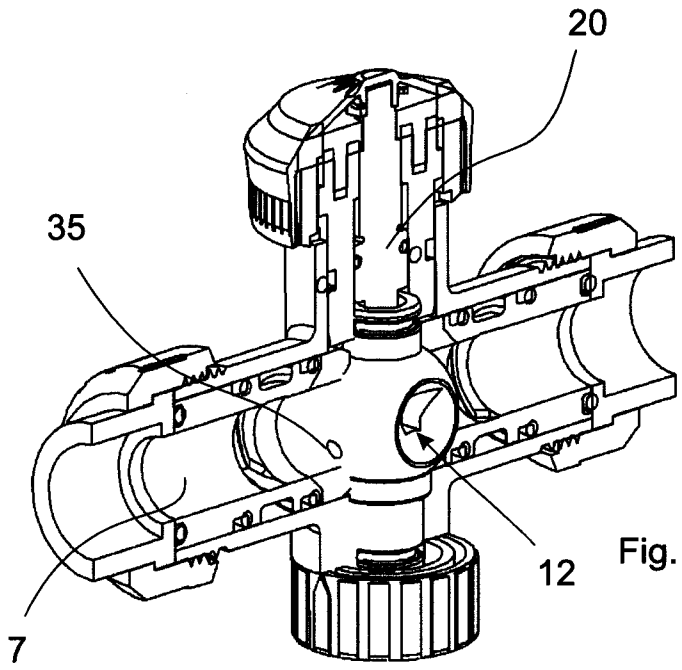

Fig. 3

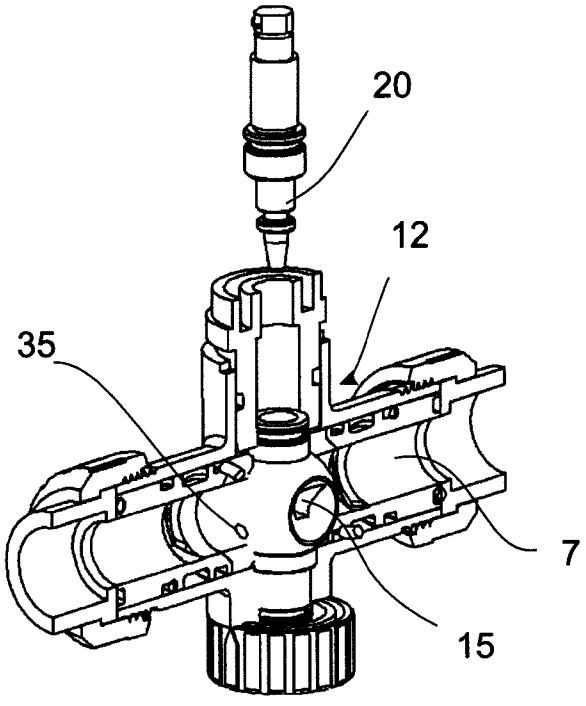

Fig. 4

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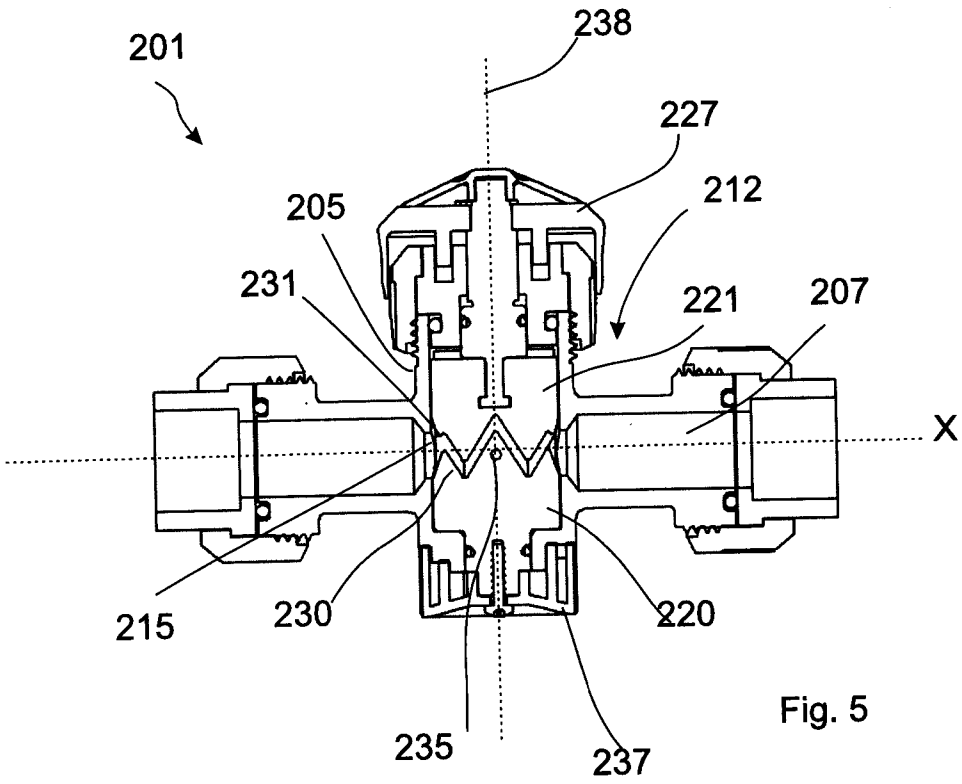
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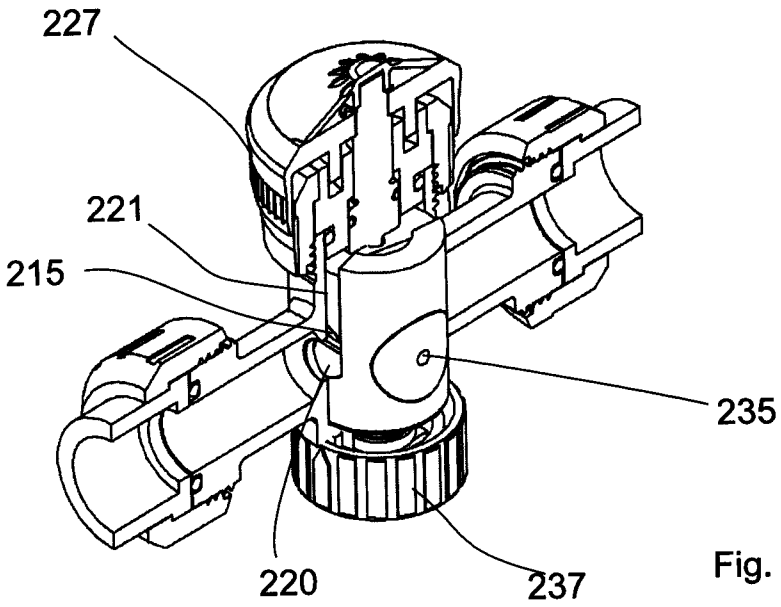
Fig. 5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237

Fig. 6

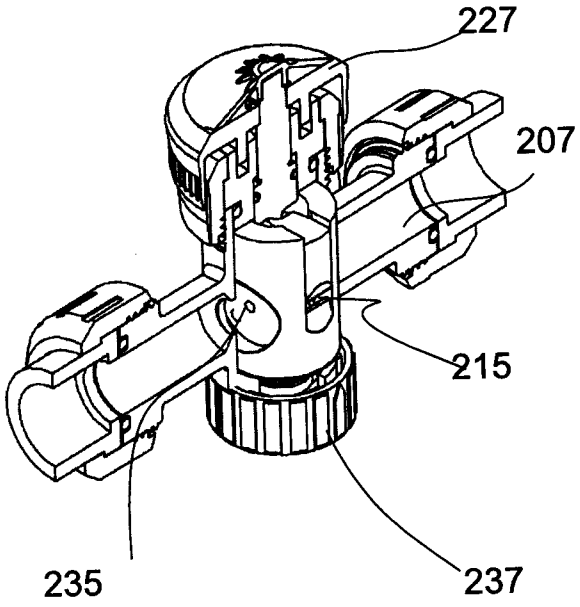

Fig. 7

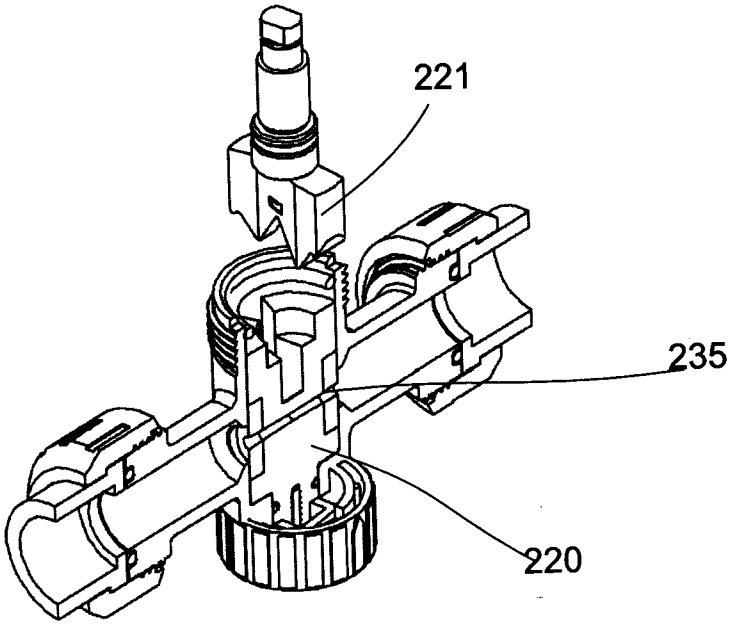

Fig. 8