

Description

The present invention relates to a fluid flow controller for use in a fluid duct of, for example chemical apparatus or mechanical apparatus, which uses the resilient flexing of a metal diaphragm to open and close the flow passage.

A fluid flow controller of this type is disclosed in, for example, the Japanese Laid-open Patent Sho. 63-72984. This controller is basically composed of a support member for the diaphragm, a clamping member disposed so as to be capable of bearing against the fixing member, and a laminate consisting of a plurality of metal diaphragms with the peripheral edges clamped between the support member and clamping member. The metal laminate is repeatedly deformed for the purpose of fluid flow control. DE-A-2,759,257 discloses another fluid flow controller of the above type comprising a flow passage which is opened and closed by the flexing of a plurality of metal diaphragms secured at their periphery, friction reducing material being provided between the diaphragms. The friction reducing material is the dry lubricant molybdenum disulphide.

The present invention is characterised in that the friction-reducing material is lubricating oil or an applied plating layer. These materials not only reduce friction but also act to prevent rusting.

FR-A-2,180,213 discloses a composite membrane which flexes as a pump impeller and incorporates an anti-friction layer between the membranes.

The invention will now be described by way of example and with reference to the drawings wherein:-

Figure 1 is a longitudinal sectional view showing a fluid flow controller in a first embodiment of the invention;

Figure 2 is a magnified longitudinal sectional view of essential parts of Figure 1.

A fluid flow controller 1 comprises a base body 2 with an inlet 6 at the left side, an outlet 7 at the right side, and a stepped concave chamber 8 opening upward. The inlet 6 and the middle part of the bottom of the concave chamber 8 communicate with each other through a flow-in passage 9, and the right side of the bottom of the concave chamber 8 and the outlet 7 through a flow-out passage 10. An upwardly facing annular seat 11 is disposed at a part of the flow-in passage 9 opposite to the concave chamber 8, that is, in the middle part of the bottom of the concave chamber 8.

A valve cover or bonnet 3 is arranged to be in clamping relationship with body 2.

Thus the cover 3 is fitted into the enlarged part of the concave chamber 8, and is fixed to the upper part of the body 2 by a nut 12 screwed into the upper part of the body 2.

A plurality of metal diaphragms 4 are arranged as a

laminate with the peripheral edges held and fixed, i.e. clamped between the member 2 and cover 3. In this embodiment, being of direct type contacting directly with the seat 11, three or four nickel alloy discs of about 0.1 to 0.2 mm in thickness and about 25 to 30 mmφ in outside diameter are used.

The metal diaphragms 4 are put into the enlarged part of the concave chamber 8, and their outer circumferenci are clamped in airtight manner by the cover 3. The laminates are operated, i.e. flexed by an actuating mechanism 13.

The actuating mechanism 13 in this embodiment is of reverse action pneumatic type and comprises a stem 14 elevatably disposed on the cover 3, a diaphragm holder 15 being located in the lower part thereof to abut against the metal diaphragms 4, a spring 16 urging the stem 14 downwardly being placed between the cover 3 and stem 14, and a pneumatic actuator 17 for lifting the stem 14 by pneumatic pressure such as air pressure against the bias of spring 16 being mounted on the upper part of the cover 3. The pneumatic actuator 17 is composed of an actuating body 18, an actuator cap 19, a piston 20, a counterplate 21 and a gas intake/exhaust port 22.

The sliding smoothing non-friction material 5 is disposed between metal diaphragms 4 and is designed to smooth their sliding, and in this embodiment it is a lubricating oil 23 such as grease placed between metal diaphragms 4, and it is applied to the contacting surfaces of metal diaphragms 4.

The operation is described below.

Figures 1 and 2 show the closed state, in which fluid flow from the inlet 6 is arrested at the position of the seat 11. In this state the elastic force of the spring 16 presses stem 14 and the diaphragm holder 15 downward, and the middle part of the metal diaphragm 4 is deformed downwardly to be seated on the seat 11.

When a pressure gas is supplied into the pneumatic actuator 17, the stem 14 and diaphragm holder 15 are moved upward against the elastic force of the spring 16, and the metal diaphragms 4 are deformed upward by their own elastic recovery and the fluid from the inlet 6 and are separated from the seat 11.

Therefore, the fluid from the inlet 6 flows in the route of flow-in passage 9, concave chamber 8, flow-out passage 10, and outlet 7, which is the open state. When supply of pressure gas to the pneumatic actuator 17 is stopped spring 16 closes the valve as set out above.

Since the metal diaphragms 4 have their peripheral edges held and fixed in airtight state between the body 2 and cover 3, the fluid reaching the concave chamber 8 will not leak outside.

For the purpose of fluid control, as the metal diaphragms 4 are repeatedly deformed, the adjacent ones will slide on each other, but since the lubricating oil 23 is placed between them, they slide smoothly.

Accordingly, wear, seizure or early breakage due to contact friction of the adjacent diaphragms 4 may be

avoided. As a result of experiment, the life could be extended 1.5 to 2 times longer.

A second embodiment of the invention is described by reference to Figure 3.

The second embodiment is different from the first embodiment in that the friction reducing sliding smoothing material 5 is a plating layer 24 such as silver plating disposed on each metal diaphragm 4.

In the second embodiment, the plating layer 24 is applied on both face and reverse sides of each metal diaphragm 4.

The fixing member 2 and tightening member 3 were body and cover in the preceding embodiment, but these are not limitative.

The metal diaphragms 4 were of direct type directing contacting with the seat in the foregoing embodiment, but this is not limitative and for example they may be of indirect type having a disc to be seated on the seat as disclosed in the Japanese Laid-open Patent Sho. 63-72984.

The actuating mechanism 13 was of pneumatic operating type in the embodiments, but may be also of other operating type or manual type.

The actuating mechanism 13 was of reverse action type in the preceding embodiments, but it is not limitative and it may be of, for example, normal action type.

The use of lubricating oil or a plating layer as the friction-reducing material reduces the rusting of the metal diaphragms.

Claims

1. A fluid flow controller comprising a flow passage (9,10) which is opened and closed by the flexing of a plurality of metal diaphragms (4) secured at their periphery, friction reducing material being provided between the diaphragms (4) characterised in that the friction reducing material is lubricating oil (23) or an applied plating layer (24).
2. A fluid flow controller according to Claim 1, wherein the said plurality of metal diaphragms 4 is clamped between a valve body (2) surrounding the fluid flow passage (9, 10) and a valve cover (3).
3. A fluid flow controller as claimed in Claim 1, or Claim 2 wherein a pressure fluid actuator (13) operates to relieve a spring biased closure of the diaphragm (4).

Patentansprüche

1. Durchflußregler mit einem Strömungskanal (9,10), der durch flexible Eigenbewegungen einer Mehrzahl von Metallmembranen (4) verschlossen und freigegeben wird, die an ihrem jeweiligen Umfangsrand

festgehalten sind und zwischen denen ein reibungsminderndes Material vorgesehen ist, dadurch gekennzeichnet, daß das reibungsmindernde Material schmierendes Öl (23) oder eine durch Plattierung zugeordnete Schicht (24) ist.

2. Durchflußregler gemäß Anspruch 1, bei dem die mehreren Metallmembrane (4) zwischen einem Ventilgehäusegrundkörper (2), der den Strömungskanal (9,10) umgibt, und einer Ventilgehäuseabdeckung eingespannt sind.
3. Durchflußregler wie in Anspruch 1 oder Anspruch 2, bei dem ein Fluiddruckerzeuger (13) die Verschließbewegung der Membrane unter dem Einfluß einer Feder unterstützt.

Revendications

1. Régulateur d'écoulement d'un fluide comprenant un passage d'écoulement (9, 10) qui est ouvert et fermé par la flexion de plusieurs diaphragmes métalliques (4) fixés sur leur périphérie, un matériau de réduction de friction étant disposé entre les diaphragmes (4), caractérisé en ce que le matériau de réduction de friction est de l'huile de lubrification (23) ou une couche de placage appliquée (24).
2. Régulateur d'écoulement d'un fluide selon la revendication 1, caractérisé en ce que l'ensemble des diaphragmes métalliques (4) sont serrées entre un corps de soupape (2) entourant le passage d'écoulement de fluide (9, 10) et un couvercle de soupape (3).
3. Régulateur d'écoulement selon la revendication 1 ou la revendication 2, caractérisé en ce qu'un dispositif d'actionnement à fluide sous pression (13) fonctionne pour éliminer la fermeture provoquée par un ressort du diaphragme (4).

avoided. As a result of experiment, the life could be extended 1.5 to 2 times longer.

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