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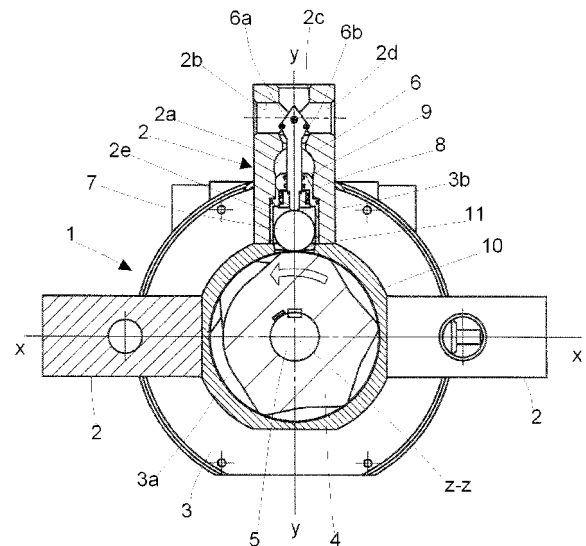
(54) **Fluid control device**

(57) The present invention relates to a fluid control device comprising:

- at least one hollow stator body (3) delimiting an axial bore (3a);
- a rotor group mounted for rotation about an axis of rotation (z-z) in each stator body (3), and comprising a plurality of axially spaced apart cam elements (4);
- at least one bank of valve bodies (2) each formed with a plurality of ways (2b, 2c, 2d) and supported by the stator body angularly spaced apart from one another, a plurality of valve seats (2a) radially extending with respect to the stator body (3) and the rotor group (4) being formed in each valve body;
- a valve element (6) slidingly mounted in each valve seat (2a) and having one intercepting end portion designed to intercept at least one way of its respective valve body (2) and its other end portion operatively coupled with a respective cam element (4) of the rotor group; and
- driving means designed to cause each rotor group to rotate;

the device further comprising:

- friction deadening means (7) arranged between each cam element (4) and the end portion of its respective valve element (6) operatively coupled thereto.



Sole Figure

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Description

[0001] The present invention relates to a fluid control device, particularly suitable for an ink feeding, draining and washing apparatus in a printing machine, preferably a flexographic printing machine.

[0002] Fluid control devices have already been proposed, that are provided with a plurality of valve elements having a spring-loaded stem member designed to control the fluid flow through a respective valve seat, and with a casing in which one or more plate-like elements, e. g. cam elements, is mounted for rotation about an axis that is substantially orthogonal to the longitudinal axis of the stem member. Each cam element is irregular in shape, i. e. the edge of each cam element is at a distance from the axis of rotation that varies from sector to sector of the cam element. The edge of each plate-like element in such devices is directly in contact with a portion of the stem (usually a head portion of the stem protruding from the valve element seat), and each angular displacement of the plate elements results in a longitudinal linear movement of the stem to an extent that depends on the shape of a respective plate element section in sliding contact with the stem, thereby moving the valve element to its opening/closing position.

[0003] Printing machines, such as flexographic printing machines, provided with such a device have already been proposed as disclosed in the Italian patent application VR2005A000143 made available to the public on May 16, 2007 and relating to an ink feeding and washing apparatus for a flexographic machine. With such a device, however, when a cam element is caused to rotate, sliding or creeping friction is generated between cam element and valve element stem, and thus the stem can become at least temporarily stuck to its respective cam element. In other terms, the valve stem does not effectively carry out a reciprocating motion to cause the valve to open/close regularly, which affects the operation of the device. Should sticking occur, the apparatus, e. g. the ink feeding and washing apparatus, must be stopped and then started again, preferably after powerful shaking of the valve in order to unlock the stem of the valve element.

[0004] A main object of the present invention is to provide a fluid control device which is highly reliable in operation, long lasting and free from sticking phenomena.

[0005] Another object of the present invention is to provide a fluid control device that can be produced in a simple way at low production costs, and does not need frequent maintenance.

[0006] These and other objects, that will better appear below, are achieved by a fluid control device comprising:

- at least one hollow stator body delimiting an axial bore;
- a rotor group mounted for rotation about an axis of rotation in each stator body, and comprising a plurality of axially spaced apart cam elements;

- at least one bank of valve bodies each formed with a plurality of ways and supported by the stator body angularly spaced apart from one another, a plurality of valve seats radially extending with respect to the stator body and the rotor group being formed in each valve body;
- a valve element slidably mounted in each valve seat and having one intercepting end portion designed to intercept at least one way of its respective valve body and its other end portion operatively coupled with a respective cam element of the rotor group; and
- driving means designed to cause each rotor group to rotate;

the device further comprising:

- friction deadening means arranged between each cam element and the end portion of its respective valve element operatively coupled thereto.

[0007] Further aspects and advantages of the present invention will better appear from the following description of a preferred embodiment of a fluid control device, illustrated by way of non-limiting example in the accompanying drawing, in which the single Figure is a front elevation view partly in cross-section of a control device according to the present invention.

[0008] With reference to the drawing, a fluid control device 1 comprises one or more longitudinal banks (three banks arranged along two axes x-x and y-y extending perpendicular to each other are shown in the drawing) of three-way valve bodies 2 having three ways 2b, 2c and 2d, a valve seat 2a being formed in each valve body. The banks or heads of valve bodies are supported by a tubular stator body 3, and radially arranged about a central axis of rotation z-z, the axes x-x and y-y extending perpendicular to, and crossing at, the axis of rotation z-z. An axial bore 3a is formed in the tubular stator body 3, and a rotor group comprising a plurality of cam elements 4 is mounted for rotation therein. The cam elements 4 are spaced apart from one another, and keyed to a rotor shaft 5 designed to rotate about the axis of rotation z-z.

[0009] At each cam element 4, the device 1 further comprises at least one valve seat 2a which radially extends along, or parallel to, the axis x-x or y-y. A needle valve element 6 is slidably mounted in each valve seat 2a. Advantageously, each valve element 6 has an intercepting conical or frustoconical end portion 6a, which is preferably provided with a sealing O-ring 6b located in a joining zone where the three ways 2b-2d meet, and thus the end portion 6a closes the way 2c when the needle valve 6 is in its extended or working position, whereas it puts the three ways 2b-2d into communication with one another, when it is in its retracted or rest position (as shown in the drawing).

[0010] The other end of the needle valve 6 is in friction engagement with a friction deadening element, prefera-

bly a rolling element, e. g. a sphere or a roller 7 free to rotate in a receiving seat 2e delimited in enlarged end of the valve seat 2a, and located in contact with the peripheral edge of a respective cam 4.

[0011] Each needle valve element 6 is resiliently loaded at an intermediate section thereof, e. g. by means of one or more helical springs 8 designed to keep it urged against the sphere 7, and is provided with a sealing O-ring 9 at its end portion in order to ensure liquid seal between the three ways 2d-2d and the inner rotor.

[0012] Preferably, between the inner cam rotor 4 and the stator body 3 a sleeve insert 10 is arranged, in which a plurality of bores flared towards the respective valve seat and equal in number to the valve seats 2a are formed that are designed to act as bounding element for a respective sphere 7.

[0013] A device according to the invention may comprise one or more pump units (not shown in the drawing) designed to supply one or more fluids according to a predetermined sequence that is established by the shape of the cam rotor 4, which is driven by suitable driving means, e. g. a program-controlled electric motor (not shown in the drawing).

[0014] A device according to the present invention can be advantageously installed in an apparatus as described in the patent application VR2005A000143 referred to above.

[0015] The provision of a rolling member between each needle valve element 6 and cam elements 4 results in creeping sliding friction being drastically reduced and in the risk of jamming, and thus locking, which often occurs in conventional devices, being practically eliminated.

[0016] Preferably, the O-Rings 6b or 9 are made of a perfluorinated compound, such as a perfluorinated fluoro-rubber, e. g. the product FFKM available at FFKM in Hamburg (Germany), or a perfluorinated elastomer, e. g. the product Kaffon obtainable from G.M.I. srl at Civate al Piano (Bergamo - Italy).

[0017] The above-described fluid interception device is susceptible to undergo numerous modifications and variations within the scope defined by the claims.

[0018] Thus, for example, the sphere or roller 7 or a portion thereof can be in a single piece with the needle valve element 6, in which case the valve element would have a rounded end enlargement which would directly slide onto its respective cam element 4 with no rolling friction component between valve and cam elements.

[0019] Also in this latter case, any jamming risk is drastically reduced, whereby improving the efficiency and a regular operation of the device.

Claims

1. A fluid control device comprising:

- at least one hollow stator body (3) delimiting an axial bore (3a);

- a rotor group mounted for rotation about an axis of rotation (z-z) in each stator body (3), and comprising a plurality of axially spaced apart cam elements (4);

- at least one bank of valve bodies (2) each formed with a plurality of ways (2b, 2c, 2d) and supported by said stator body angularly spaced apart from one another, a plurality of valve seats (2a) radially extending with respect to said stator body (3) and said rotor group (4) being formed in each valve body;

- a valve element (6) slidably mounted in each valve seat (2a) and having one intercepting end portion designed to intercept at least one way of its respective valve body (2) and its other end portion operatively coupled with a respective cam element (4) of said rotor group; and

- driving means designed to cause each rotor group to rotate;

characterized in that it comprises:

- friction deadening means (7) arranged between each cam element (4) and the end portion of its respective valve element (6) operatively coupled thereto.

2. A device as claimed in claim 1, **characterized in that** said friction deadening means comprises a rolling element (7).

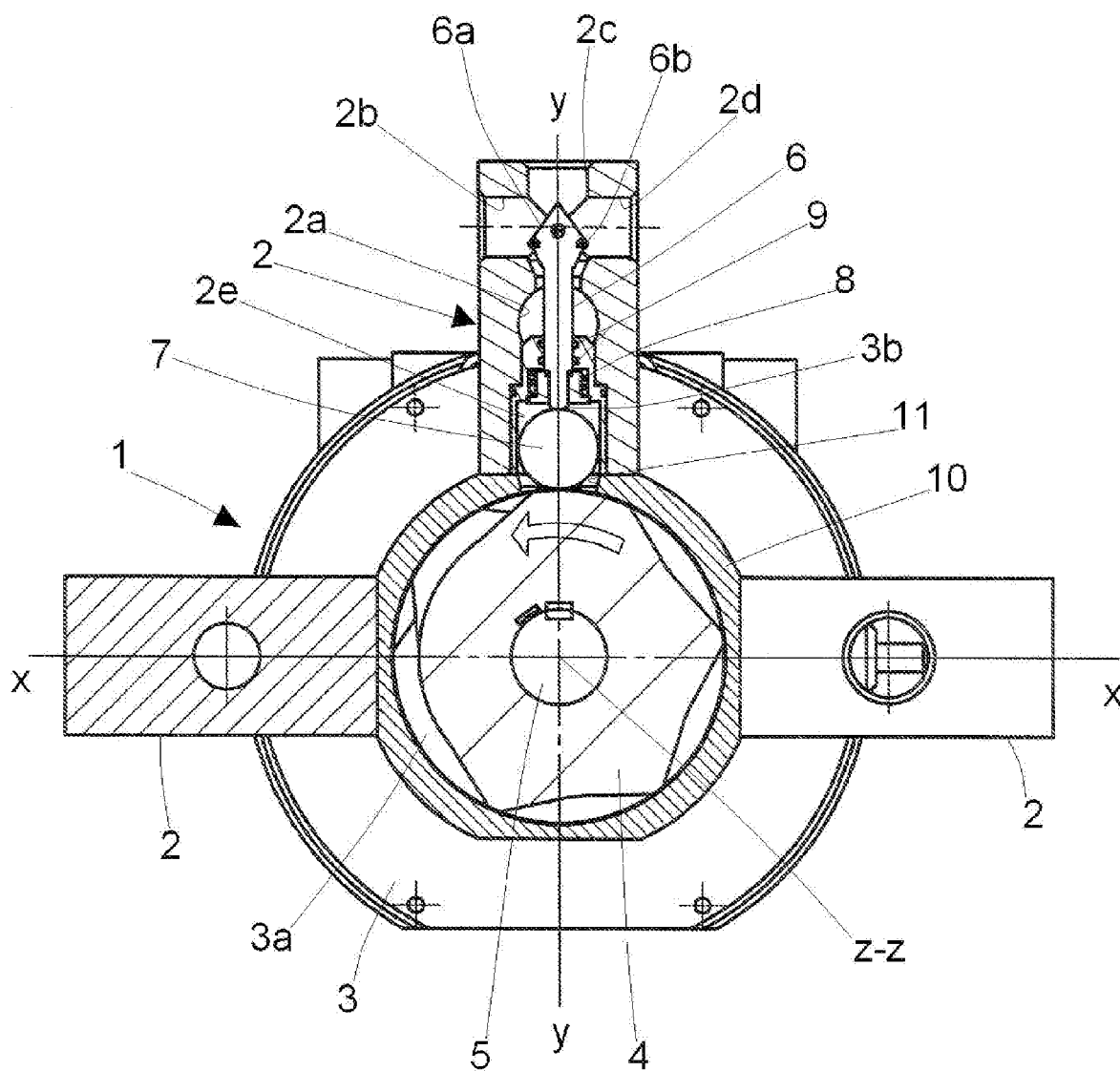
3. A device as claimed in claim 1 or 2, **characterized in that** said friction deadening means comprises a rounded end enlargement, at said end portion coupled with said cam element (4).

4. A device as claimed in any previous claim, **characterized in that** each valve element (6) is resiliently loaded.

5. A device as claimed in any previous claim, **characterized in that** it comprises a sleeve insert (10) arranged between said inner cam rotor (4) and said stator body (3), a plurality of bores (11) flared towards the respective valve seat (2a) and equal in number to the valve seats (2a), said bores being designed to act as receiving seat for friction deadening means (7).

6. A device as claimed in any previous claim, **characterized in that** said valve element (6) is provided with a sealing O-ring (6b, 9) made of a perfluorinated compound.

7. A device as claimed in claim 6, **characterized in that** said perfluorinated compound is selected from the group comprising perfluorinated fluoro-rubber and perfluorinated elastomer.



Sole Figure

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- IT VR20050143 A [0003]