

Description

Fitting for changing liquid paths

5 The invention relates to a fitting for changing liquid paths, in particular for systems with a pressure exchanger which has pipes having alternating flow direction, with a casing that comprises an inlet piece, an outlet piece, and a connection piece for a pipe, the
10 fitting having at least one shut-off member that is connected to an actuator which is connected to a control device that is designed to produce a liquid flow between the inlet piece and the connection piece, or between the connection piece and the outlet piece.

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Such a fitting is used in pressure exchangers, for example as are used in seawater desalination systems in accordance with the reverse osmosis method. Here, a seawater flow is conveyed under high pressure to
20 membrane modules. Pure water is pressed through the membrane, whereas the salt dissolved in the water is retained. The portion flowing through is referred to as the permeate flow, whereas the retained portion is referred to as the retentate flow.

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The retentate flow is enriched with salts and still has a high pressure. This is used by means of a pressure exchanger. Pressure exchangers consist of at least two pipelines. A displaceable partition member may be
30 arranged within the pipes. At the start of a cycle, the first pipe is filled with seawater. The partition member is located at one end of the pipe. The high-pressure retentate is then fed. The seawater and the high-pressure retentate are separated by the partition
35 member. The high-pressure retentate pushes the seawater from the pipe and conveys it to the membrane modules. In doing so, the high-pressure retentate releases its pressure and becomes a low-pressure retentate.

Whilst this process occurs in the first pipe, the following processes take place in the second pipe: the second pipe is initially filled with low-pressure retentate. Seawater is then fed to the second pipe.

5 Seawater and low-pressure retentate are separated by a partition member. The seawater pushes the low-pressure retentate from the second pipe.

10 With periodic change, high-pressure retentate thus flows in one pipe, whereas seawater flows in the other pipe.

The changeover process occurs with generic fittings on which specific requirements are placed. The connection
15 piece is operated in alternating flow directions, wherein the high-pressure liquid during the first cycle flows in via the inlet piece and on to the connection piece, and the low-pressure liquid during the second cycle flows in via the connection piece and on to the
20 outlet piece.

Such a changeover process, in which a connection is operated in alternating flow directions, cannot be ensured with conventional multi-path fittings, as are
25 described for example in WO 2010/091988 A1. Due to their switching logic and their construction, they cannot be used in pressure exchangers in seawater desalination systems. A fitting with a casing made of plastic is described in WO 2010/091988 A1. The fitting
30 is used in coffee machines at flow rates of 400 mL/min and a maximum operating pressure of 2.5 bar. The fitting has an inlet channel and three outlet channels. The inlet channel is connected to one of the outlet channels via the activation of solenoid valves.

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By contrast, a fitting that is suitable for use in pressure exchangers in seawater desalination systems is described in WO 2004/080576 A1. With this fitting, a

rotatable control element is arranged within a casing and is driven by a motor via a drive shaft.

When changing the liquid flows, pressure impulses occur
5 and damage the membranes of the reverse osmosis systems.

A fitting for changeover with few pressure impulses is described in DE 103 10 662 A1. A flow divider is
10 located within a casing of the fitting. A rotating disk-shaped control element is arranged on each end face of the flow divider.

WO 2010/141013 A1 describes a reverse osmosis system
15 with a pressure exchanger in which a disk valve is used as a flow divider.

Such fittings are of very complex construction and are accordingly costly. Furthermore, only an even of number
20 of pipes of a pressure exchanger can be operated with these fittings.

Furthermore, JP 2010253344 A discloses a reverse osmosis system in which the pure open/close valves
25 leading to or away from the pressure exchanger are arranged in the lines and are formed as sliding valves.

On this technical basis, the object of the invention is to provide a fitting having the features described in
30 the introduction, which is cost-effective and enables liquid flows to be changed with few pressure impulses. With the fitting, it should also be possible to operate an odd number of pipes in pressure exchangers. In addition, reliable operation with low maintenance
35 effort is to be ensured. Furthermore, the shut-off members are to be easily operable, even at high counterpressure. By use of these fittings, a clear and

compact design of a pressure exchanger for a reverse osmosis system is to be ensured.

5 This object is achieved in accordance with the invention in that a shut-off member is arranged in each of the inlet piece and the outlet piece and said shut-off members are axially displaceable to vary the size of flow openings.

10 In accordance with the invention, a fitting is attached to one side of the pressure exchanger and, within a casing, has two axially displaceable shut-off members. Each shut-off member is preferably connected to a separate actuator.

15 The changeover process occurs by axial displacement of the shut-off members which are arranged in the inlet piece and in the outlet piece of the casing. In contrast to rotating changeover systems, the fitting according to the invention is constructed much more
20 clearly and can thus be produced cost-effectively. In addition, a changeover process experiencing particularly few pressure impulses is produced. The fitting additionally functions largely without
25 interference, such that only a low maintenance effort is necessary. With the fittings according to the invention, pressure exchangers having an odd number of pipes can also be operated.

30 In accordance with the invention, the fitting is not a pure switching fitting, in which a distinction is made merely between a fully open or fully closed state, but is a regulating fitting, which, besides the pure changeover, enables a regulation of the liquid flow.
35 Pressure impulses are thus considerably reduced.

In a particularly advantageous embodiment of the invention, the casing is a one-piece part, in

particular a cast part, which is formed by the inlet piece, the outlet piece, and the connection piece. These pieces are preferably connectors that are integrally formed on the casing. The inlet connector and the connection connector are formed in one piece with the casing.

The fitting is operated in periodic cycles.

10 In the first cycle, the flow-through opening in the outlet piece is fully closed. During a first phase, the shut-off member in the inlet piece opens. The flow-through opening in the inlet piece becomes larger until it is fully open. During a second phase, the flow opening in the inlet piece remains fully open. During a third phase, the shut-off member in the inlet piece closes. The size of the flow opening in the inlet piece reduces.

20 In the second cycle, the flow opening in the inlet piece is fully closed. During a first phase, the shut-off member of the outlet piece opens. The flow opening in the outlet piece enlarges. During a second phase, the flow opening of the outlet piece is fully open. 25 During a third phase, the shut-off member of the outlet piece closes. The flow opening in the outlet piece reduces.

In a particularly advantageous embodiment of the invention, the actuators are controlled by the control device such that, as a flow opening is opened and/or closed, the actuation speed initially rises with a predefinable gradient and then continues with constant actuation speed. Pressure impulses are thus reduced.

35 In an advantageous embodiment of the invention, a component is attached to the inlet piece. The flow opening is formed between the inlet piece of the casing

and the component. The shut-off member is guided during its axial displacement by the casing and/or the component. As the flow opening is closed and opened, the liquid flows perpendicular to the movement of the shut-off member.

Additionally or alternatively thereto, a component may also be joined to the outlet piece. The flow opening is formed between the component and the outlet piece of the casing. This component preferably carries the actuator of the shut-off member. As a result of axial displacement of the shut-off member, the size of the flow opening is varied, wherein the shut-off member is guided during its axial displacement by the casing and/or the component. The liquid flows radially to the direction of displacement, such that the shut-off member moves perpendicular to the liquid flow.

The shut-off member in the inlet piece is preferably cylindrical. The component attached to the inlet piece comprises a hollow-cylindrical guide element, which projects into the inlet piece. The guide element is closed toward the inflow direction, such that the guide element is formed in a beaker-like manner. The cylindrical shut-off member displaces during opening and closing in the hollow-cylindrical guide element.

If the shut-off member closes the flow opening in the inlet piece, the retentate thus acts perpendicularly on the outer lateral surface of the cylindrical shut-off member. This facilitates the opening process, since, in contrast to conventional fittings, no force acts in the movement direction of the shut-off member, but perpendicular thereto.

In the outlet piece, the hollow-cylindrical guide element is formed by the casing itself. The shut-off member is likewise cylindrical and moves in the hollow-

cylindrical guide element. The guide element is closed toward the inflow direction, such that the guide element is formed in a beaker-like manner. A component is attached to the outlet piece. The shut-off member is
5 operated by means of an actuator.

If the shut-off member closes the outlet piece, the retentate thus acts perpendicular to the outer lateral surface of the cylindrical shut-off member. This
10 facilitates the opening of the shut-off member since, in contrast to conventional fittings, no force acts in the movement direction of the shut-off member, but perpendicular thereto.

15 The inlet piece and the outlet piece are preferably oriented at an angle of 90° to one another.

Further features and advantages of the invention will emerge from the description of an exemplary embodiment
20 on the basis of drawings and from the drawings themselves, in which

figure 1 shows a perspective illustration of a fitting with a view of the connection piece,
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figure 2 shows a perspective illustration of the fitting with a view of the actuator of the outlet piece,

30 figure 3 shows a plan view of the fitting,

figure 4 shows a front view of the fitting,

figure 5 shows a section along the line B-B according
35 to figure 4,

figure 6 shows a schematic illustration of a seawater desalination system,

figure 7a shows a side view of the pressure exchanger
of a seawater desalination system,

figure 7b shows a plan view of the pressure exchanger
5 of a seawater desalination system,

figure 8 shows a perspective sectional illustration of
the fitting,

10 figure 9 shows an enlarged illustration of the outlet
piece of the illustration according to figure
8.

Figure 1 and figure 2 show perspective views of a
15 fitting 28 for changing liquid flows. Such a fitting 28
with a control device is used to change liquid paths,
for example in a pressure exchanger 29 of a seawater
desalination system in accordance with the reverse
osmosis method.

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Figure 6 shows that a pressure exchanger 29 comprises
pipes 30, wherein, with periodic change, high-pressure
retentate flows in one pipe 30 and seawater flows in at
least one other pipe 30.

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Each pipe 30 is connected at one end via the connection
piece 1 to the fitting 28. The high-pressure retentate
that leaves the membrane module 33 is conveyed through
the inlet piece 2. Once the liquid has transferred its
30 pressure, it is carried away as low-pressure retentate
through the outlet piece 3.

Figure 1 and figure 2 show that a component 4 is
attached to the inlet piece 2 via a flange connection.
35 The component 5 comprises a flange 6, to which a 90°
pipe bend 7 is welded. The pipe bend 7 carries a
hydraulic actuator 8, which is secured by means of a

holding arrangement 9. The holding arrangement 9 is welded to the pipe bend 7.

5 A further hydraulic actuator 10 is secured directly to the casing 11 via a holding arrangement 12.

10 A plan view of the fitting 28 is illustrated in figure 3. The liquid flows into the inlet piece 2 through an opening 13 of the component 4. A pipe 30 of the pressure exchanger 29, which is operated in alternating flow directions, is attached to a flange 14 of the connection piece 1.

15 Figure 4 shows a front view of the changeover fitting. One of the pipes 30 of the pressure exchanger 29 is secured to the flange 14 of the connection piece 1.

20 The high-pressure liquid flows through the component 4 and the inlet piece 2 into the fitting 28.

During the first cycle, high-pressure retentate flows out from the fitting 28 from an opening 15 of the connection piece 1. During a second cycle, low-pressure retentate flows into the fitting 28 through the opening 15 of the connection piece 1. An adjusting rod 16 of the actuator 10 runs in the flow chamber of the casing 11.

30 A section along the line B-B according to figure 4 is illustrated in figure 5. The fitting 28 according to the invention comprises a casing 11, which comprises an inlet piece 2, an outlet piece 3, and a connection piece 1. The connection piece 1 is operated in alternating flow directions. A shut-off member 17, 18 is arranged in each of the inlet piece 2 and outlet piece 3. The shut-off members 17, 18 are each connected to an actuator 8, 10 respectively. The actuators 8, 10 are operable via a control device. Here, a liquid flow

occurs either between the inlet piece 3 and the outlet piece 1 or between the connection piece 1 and the outlet piece 3. In accordance with the invention, the size of a flow opening can be varied by axial displacement of one of the shut-off members 17, 18.

The core piece of the apparatus according to the invention is the casing 11, which consists of the inlet piece 2, the outlet piece 3, and the connection piece 1. The casing is a one-piece structure here, which is fabricated in the exemplary embodiment as a cast part.

In the inlet piece 2, a shut-off member 17 is arranged and is connected to the actuator 10 via an adjusting rod 16. A shut-off member 18 is arranged in the outlet piece 3 and is connected via an adjusting rod 19 to the actuator 8. The shut-off members 17, 18 are cylindrical. In the exemplary embodiment, these are hollow cylinders that are closed at one end and are thus formed in a beaker-like manner.

The actuators 8, 10 are operable by means of a control device. Here, both actuators 8, 10 are assigned to a common control device. Here, this is preferably a memory-programmable controller. The size of a flow opening is varied by axial displacement of at least one shut-off member 17, 18.

A component 4 is joined to the inlet piece 2 and comprises a guide element 20. The guide element 20 is a hollow cylinder in which the cylindrical shut-off member 17 moves during opening and closing. The shut-off member 17 moves perpendicular to the liquid flow during its axial displacement. The inner diameter of the hollow-cylindrical guide element 20 is slightly greater than the outer diameter of the hollow-cylindrical shut-off member 17.

Seals 21 are arranged between the side walls of the cylindrical shut-off member 17 and the inner surfaces of the hollow-cylindrical guide element 20. The guide element 20 is closed toward the inflow direction and is thus formed in a beaker-like manner.

The cylindrical shut-off member 17 is formed in the exemplary embodiment as a hollow cylinder and has a base with openings 22, through which the liquid enclosed between the shut-off member 17 and guide element 20 can escape during the opening process.

If the shut-off member 17 travels upwardly, a flow opening between the hollow-cylindrical guide element 20 of the component 4 and the casing 11 is thus enlarged. Webs 23 protrude from the shut-off member 17 into the flow opening. In the illustration in figure 5, the section passes through these webs 23.

The outlet piece 3 comprises a guide element 24. The guide element 24 is a hollow cylinder. The guide element 24 is formed by the outlet piece 3 of the casing 11. The cylindrical shut-off member 18 moves in the cylindrical guide element 24. The inner diameter of the hollow-cylindrical guide element 24 is slightly greater than the outer diameter of the hollow-cylindrical shut-off member 18. The shut-off member 18 moves perpendicular to the liquid flow during its axial displacement. The guide element 24 is closed toward the inflow direction and is thus formed in a beaker-like manner.

Seals 25 are arranged between the side walls of the beaker-shaped shut-off member 18 and the inner surfaces of the hollow-cylindrical guide element 24. The beaker-shaped shut-off member 18 is provided on its base with openings 26, through which the liquid enclosed between

the shut-off member 18 and guide element 24 can escape during the opening process.

5 A component 5 is joined to the outlet piece 3 and comprises a flange 6. During the opening process, a flow opening between the hollow-cylindrical guide element 24 and the flange 6 is enlarged. The guide element 24 is part of the casing 11. The flange 6 is part of the component 5. The flow opening between the
10 casing 11 and the component 5 is thus formed. Webs 27 protrude from the shut-off member 18 into the flow opening. In the illustration in figure 5, the section passes through these webs 27.

15 The fitting 28 is operated in periodic cycles. In the first cycle, the liquid flow occurs from the inlet piece 2 to the connection piece 1. In the second cycle, the liquid flow occurs from the connection piece 1 to the outlet piece 3.

20 In the first cycle, the flow opening in the outlet piece 3 is fully closed. During a first phase, the shut-off member 17 in the inlet piece 2 opens. The flow opening in the inlet piece 2 becomes larger until it is
25 fully open. During a second phase, the flow opening in the inlet piece 2 remains fully open. During a third phase, the shut-off member 17 in the inlet piece 2 closes, wherein the size of the flow opening in the inlet piece 2 reduces.

30 In the second cycle, the flow opening in the inlet piece 2 is fully closed. During a first phase the shut-off member 18 of the outlet piece 3 opens. The flow opening in the outlet piece 3 enlarges. During a second
35 phase, the flow opening of the outlet piece 3 is fully open. During a third phase, the shut-off member 18 of the outlet piece 3 closes, wherein the flow opening in the outlet piece 3 reduces.

Figure 6 shows a system for seawater desalination in accordance with the reverse osmosis method, having a pressure exchanger 29, which comprises three pipes 30. Three fittings 28 are used in the pressure exchanger 29. By use of the apparatuses according to the invention, it is thus possible to operate a pressure exchanger 29 having an odd number of pipes 30. Each pipe 30 is provided at one end with a fitting 28 according to the invention and at the other end with a check fitting 31, which are formed in the exemplary embodiment as check valves.

The function of the reverse osmosis method for seawater desalination with use of the fittings 28 according to the invention will be described hereinafter on the basis of figure 6.

A feed flow of seawater is conveyed to a membrane unit 33 from a reservoir 32. The seawater, before its storage in the reservoir 32 or before being conveyed to the membrane unit 33, is purified of constituents that could damage or soil the semi-permeable membrane.

A reverse osmosis process takes place in the membrane unit 33, in which the seawater is pressed through the membrane at high pressure. Here, the osmotic pressure has to be overcome. The semi-permeable membrane may consist for example of polyamide, PTFE, or sulfonated copolymers having a pore diameter of $5 \cdot 10^{-7}$ to $5 \cdot 10^{-6}$ mm. The membrane allows water through and retains the salts. The membrane unit 33 separates the feed flow into a permeate flow and a retentate flow. The permeate flow is largely salt-free pure water. The retentate flow has a salt concentration higher than the conveyed feed flow.

The retentate flow, after the membrane unit 33, flows under high pressure into each of the fittings 28

according to the invention via the inlet pieces 2 thereof.

Figure 6 illustrates a snapshot in which the shut-off members 17, 18 of the fittings 28 adopt a position in which the low-pressure retentate is pushed out from the middle and lower pipe 30. Here, a shut-off member 17 closes the inlet piece 2 of the lower and middle fitting 28, whereas the shut-off members 18 in the outlet pieces 3 of these two fittings 28 adopt an open position.

At the same time, in the state illustrated in figure 6, the lower and middle pipe 30 fill with fresh seawater from the reservoir 32. The seawater is aspirated by a pump 34. Some of the seawater flows into the lower and middle pipe 30 at a branching via check fittings 31.

At the same time as this process, seawater is pushed out from the upper pipe 30. In the case of the fitting 28 that is attached to the upper pipe 30, the inlet piece 2 is open, whereas the outlet piece 3 is closed. The seawater flows through a check fitting 31 and a pump 35 to the membrane unit 33. The feed flow is additionally fed by a flow that is conveyed via a pump 36. Whilst the seawater is displaced from the upper pipe 30, the upper pipe 30 simultaneously fills with high-pressure retentate from the membrane unit 33.

As soon as the seawater has been pushed out completely from a pipe 30, the fitting 28 of said pipe is changed such that the inlet piece 2 is closed and the outlet piece 3 is open. The low-pressure retentate is pushed out from the outlet piece 3. Here, a continuous pulsation-free operation without mixing of fresh seawater and retentate is ensured.

In the exemplary embodiment, seawater and retentate are not separated in the pipes 30 of the pressure exchanger 29 by a partition member.

5 Figures 7a and 7b show the pressure exchanger 29 from different perspectives. The pressure exchanger comprises three pipes 30. Each pipe 30 is provided at one end with a fitting 28 according to the invention and at the other end with a check fitting 31. The
10 fittings 28 are connected to the pipes 30 via the connection pieces 1. High-pressure retentate enters the pipes 30 through the inlet pieces 2 of the fittings 28. Low-pressure retentate exits through the outlet piece 3 of the fittings 28.

15 Each check fitting 31 has an entry 37, through which seawater flows into the respective pipe 30, and an exit 38, through which the seawater located in the pipe 30 is conveyed out.

20 Figure 8 shows a perspective sectional illustration of the fitting 28. The shut-off member 17 in the inlet piece 2 is axially displaceably guided and is operated by means of an adjusting rod 16.

25 The actuators 8, 10 are operable by means of a control device. Here, both actuators 8, 10 are assigned to a common control device. Here, the control device is preferably a memory-programmable controller. By axial
30 displacement of at least one shut-off member 17, 18, the size of a flow opening is varied.

A component 4 is joined to the inlet piece 2 and comprises a guide element 20. The guide element 20 is a
35 hollow cylinder in which the shut-off member 17 moves. The shut-off member 17 moves perpendicular to the liquid flow during its axial displacement.

Seals 21 are arranged between the side walls of the cylindrical shut-off member 17 and the inner surfaces of the hollow-cylindrical guide element 20. The beaker-shaped shut-off member 17 is provided on its base with openings 22, through which the liquid enclosed between the shut-off member 17 and guide element 20 can escape during the opening process.

If the shut-off member 17 travels upwardly, a flow opening between the hollow-cylindrical guide element 20 of the component 4 and the casing 11 is thus enlarged. Webs 23 protrude from the shut-off member 17 into the flow opening.

If the shut-off member 17 closes the flow opening of the inlet piece 2, the retentate thus acts perpendicularly on the outer lateral surface of the hollow-cylindrical shut-off member 17. This facilitates the opening of the shut-off member 17, since, in contrast to conventional fittings, no force acts in the movement direction of the shut-off member 17, but perpendicular thereto.

If the shut-off member 17 in the inlet piece 2 is in an open position, the liquid thus flows in radially and flows out axially.

Figure 9 shows an enlarged illustration of the outlet piece 3 of the fitting 28. The cylindrical shut-off member 18 in the outlet piece 3 is axially displaceably guided and is operated via an adjusting rod 19. The guide element 24 of the outlet piece 3 is a hollow cylinder. The shut-off member 18 moves in the hollow-cylindrical guide element 24. The shut-off member 18, during its axial displacement, moves perpendicular to the liquid flow.

A component 5 is joined to the outlet piece 3 and comprises a flange 6. During the opening process, a flow opening between the hollow-cylindrical guide element 24 and the flange 6 is enlarged. The guide
5 element 24 is part of the casing 11. The flange 6 is part of the component 5. The flow opening between the casing 11 and the component 5 is thus formed. Webs 27 protrude from the shut-off member 18 into the flow opening.

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A guide element is formed in the outlet piece 3 by the casing itself. The shut-off member 18 is likewise hollow-cylindrical and moves in the hollow-cylindrical guide element 24. If the shut-off member 18 closes the
15 flow opening in the outlet piece 3, the retentate thus acts perpendicular to the outer lateral surface of the beaker-shaped shut-off member 18. This facilitates the opening of the flow opening, since, in contrast to conventional fittings, no force acts in the movement
20 direction of the shut-off member 18, but perpendicular thereto.

If the shut-off member 18 in the outlet piece 3 is in an open position, the liquid thus flows in radially in
25 relation to the direction of displacement of the shut-off member 18 and then flows on axially.

List of reference signs

	1	connection piece
	2	inlet piece
5	3	outlet piece
	4	component
	5	component
	6	flange
	7	pipe bend
10	8	actuator
	9	holding arrangement
	10	actuator
	11	casing
	12	holding arrangement
15	13	opening
	14	flange
	15	opening
	16	adjusting rod
	17	shut-off member
20	18	shut-off member
	19	adjusting rod
	20	guide element
	21	seal
	22	opening
25	23	web
	24	guide element
	25	seal
	26	opening
	27	web
30	28	fitting
	29	pressure exchanger
	30	pipe
	31	check fitting
	32	reservoir
35	33	membrane unit
	34	pump
	35	pump
	36	pump

37 entry

38 exit

Patent Claims

1. A fitting (28) for changing liquid paths, in particular for systems with a pressure exchanger (29) which has pipes (30) having alternating flow direction, with a casing (11), which comprises an inlet piece (2), an outlet piece (3), and a connection piece (1) for a pipe (30), the fitting (28) having at least one shut-off member (17, 18) that is connected to an actuator (8, 10) which is connected to a control device that is designed to produce a liquid flow between the inlet piece (2) and the connection piece (1), or between the connection piece (1) and the outlet piece (3),
- characterized in that**
- a shut-off member (17, 18) is arranged in each of the inlet piece (2) and the outlet piece (3), the shut-off members being axially displaceable so as to vary the size of flow openings.
2. The fitting as claimed in claim 1, characterized in that each shut-off member (17, 18) is connected to a separate actuator (8, 10).
3. The fitting as claimed in claim 1 or 2, characterized in that at least one component (4, 5) is joined to the inlet piece (2) and/or outlet piece (3), at least one flow opening being formed between the casing (11) and the component (4, 5).
4. The fitting as claimed in claim 3, characterized in that at least one shut-off member (17, 18) is guided during its axial displacement by the casing (11) and/or the component (4, 5).

5. The fitting as claimed in one of claims 1 to 4, characterized in that at least one shut-off member (17, 18), during its axial displacement, moves perpendicular to the liquid flow.
- 5 6. The fitting as claimed in one of claims 1 to 5, characterized in that at least one of the shut-off members (17, 18) is hollow-cylindrical or cylindrical.
- 10 7. The fitting as claimed in one of claims 1 to 6, characterized in that at least one of the shut-off members (17, 18) moves in a hollow-cylindrical guide element (20, 24).
- 15 8. The fitting as claimed in claim 7, characterized in that the guide element (20, 24) is closed toward the inflow direction.
- 20 9. The fitting as claimed in one of claims 1 to 8, characterized in that the inlet piece (2) and the outlet piece (3) are oriented at an angle of 90° to one another.
- 25 10. A method for operating a fitting (28) as claimed in one of claims 1 to 9, said method comprising the following periodically repeating cycles:
- first cycle: flow opening in outlet piece (3) fully closed,
 - 30 - first phase: shut-off member (17) opens flow opening in the inlet piece (2),
 - second phase: flow opening in the inlet piece (2) fully open,
 - 35 - third phase: shut-off member (17) closes flow opening in the inlet piece (2),

- second cycle: flow opening in the inlet piece (2) fully closed,
 - first phase: shut-off member (18) opens flow opening in the outlet piece (3),
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 - second phase: flow opening in the outlet piece (3) fully open,
 - third phase: shut-off member (18) closes flow opening in the outlet
10 piece (3).
11. The method as claimed in claim 10, characterized in that, as at least one of the flow openings opens and/or closes, the actuation speed initially
15 rises with a predefinable gradient and then continues with constant actuation speed.