United States Patent

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[54] **LIQUID-TO-GAS INDICATOR AND ACTUATOR DEVICE**
6 Claims, 1 Drawing Fig.

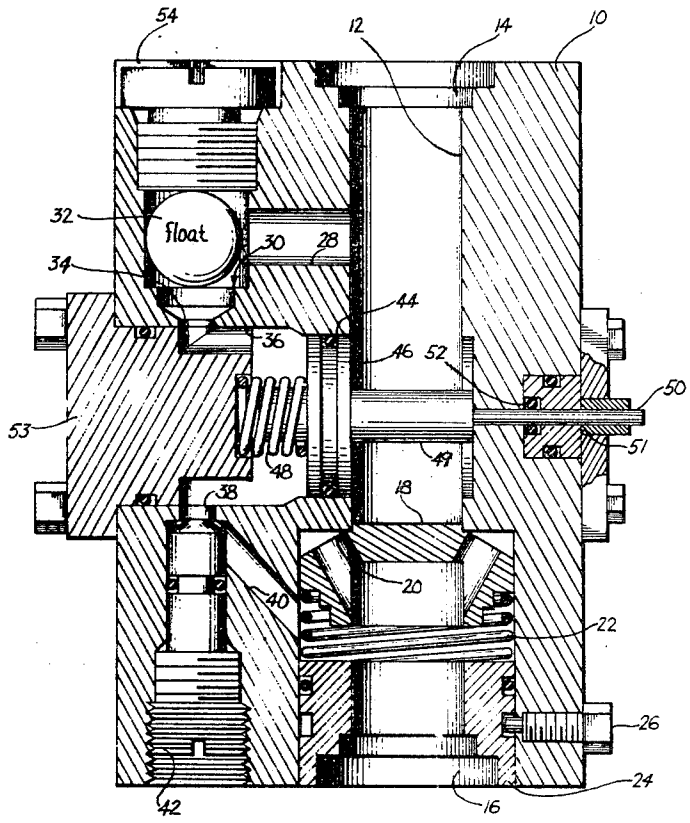
[52] **U.S. Cl.** **91/419,** 73/438, 73/451, 116/70
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[50] **Field of Search** ..... 91/1, 419, 415, 418; 73/451, 290, 438, (Inquired); 340/(Inquired); 116/(Inquired); 33/(Inquired); 137/(Inquired); 89/1.809, 1.81, 1.812, (Inquired); 91/419

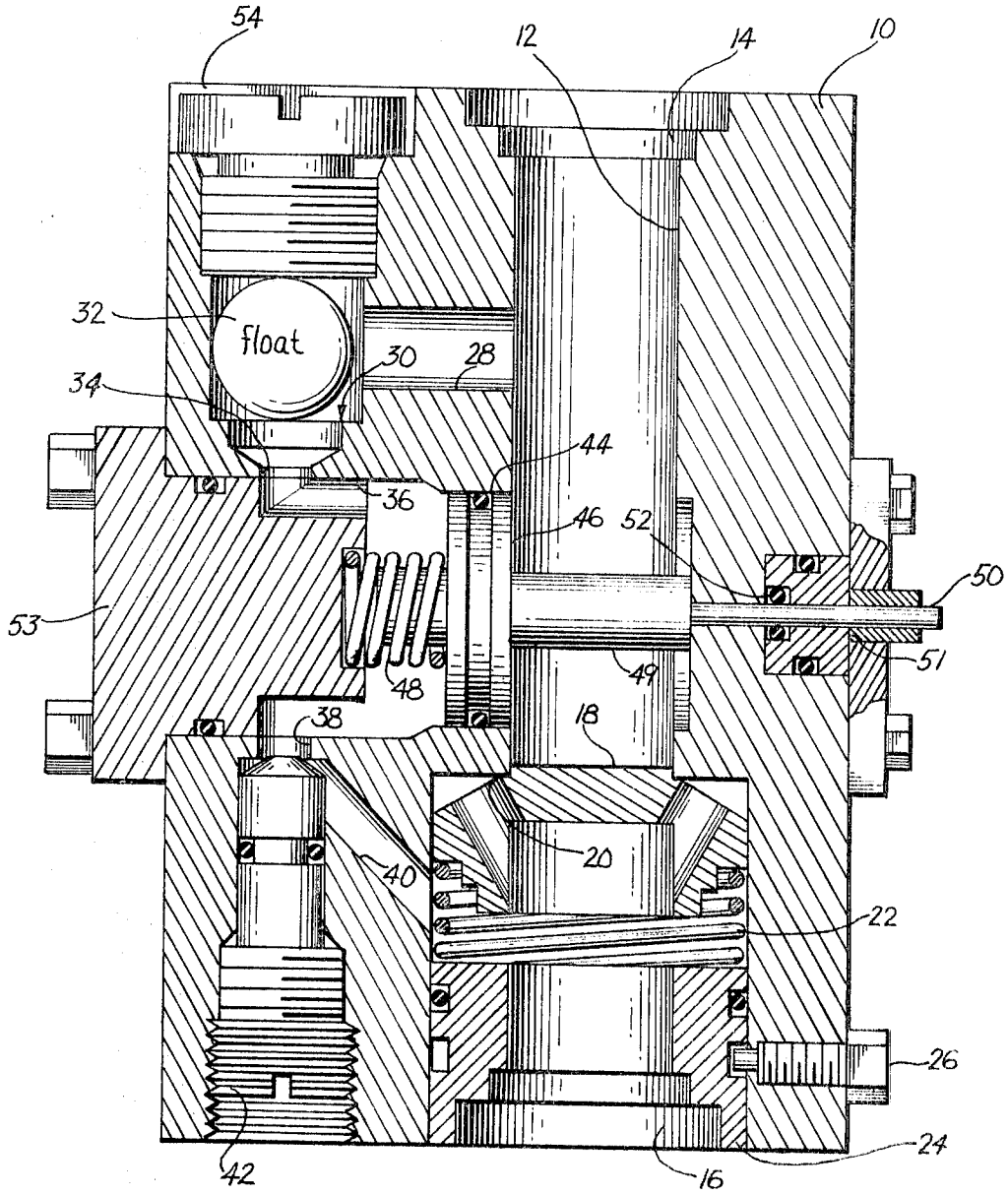
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ABSTRACT: A liquid-to-gas indicator is disclosed which, in one position, will normally flow liquid and will sense and respond to the beginning of gas flow by moving a mechanical actuating member which may operate a microswitch or other output device. When inverted, the device will normally flow gas but will respond to the beginning of liquid flow by moving the actuating member as described. A spring-loaded check valve is installed in a main conduit with a float-type ball valve in a parallel conduit connected across the check valve. A piston is positioned in the wall between the conduits such that it responds to changes in the pressure differential across the check valve and the actuating member is moved in response to movement of the piston. An optional biasing spring is provided urging the piston in one direction, and an adjustment screw is provided for varying the flow rate of the parallel conduit.





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LIQUID-TO-GAS INDICATOR AND ACTUATOR DEVICE

BACKGROUND OF THE INVENTION

in connection with launching of underwater devices such as instruments from ships or submarines, a need has arisen for indicating devices which can tell an operator at any given time whether air or water is in the launching tube and, preferably, which can respond to the changed condition as the air purges all the water from the tube or as the water displaces all the air to actuate some device forming part of a launching mechanism. In the past, this operation has involved either visual observation of the condition or the launch tube or simply waiting a known period of time for purging to be completed, followed by manual operation of the actuating means when it has been determined that the tube is purged either of water or of air. With current requirements for much more data, it has been found desirable to provide means which will make possible much faster automatic launching of devices into the water. Thus, there is a need for devices which will respond very quickly to completion of either of the purging operations described above in order to trip a new step in the launching cycle.

DESCRIPTION OF THE DRAWING

The single FIGURE is a sectional view of a liquid-to-gas indicator made according to my invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The single FIGURE shows a housing at numeral 10 which includes a principal axial conduit 12 with an inlet passage 14 and an outlet passage 16. Positioned in conduit 12 is a check valve 18 which is urged against a seat 20 by means of a spring 22. A retainer 24 is held in the lower end of conduit 12 by means of a set screw 26.

Connected in parallel with conduit 12 across the check valve 18 is a path consisting of a passage 28, a valve seat 30 which cooperates with a ball float valve member 32, and a port 34 leading to a chamber 36 which, in turn, communicates with a port 38 leading to passageway 40 connected into conduit 12 downstream of the check valve 18. A manually adjustable valve member 42 is provided for varying the flow rate of the conduit 40.

A cylindrical opening 44 is formed between chamber 36 and conduit 12, and in this opening is placed a piston 46 which is spring loaded toward the right by means of a spring 48. This spring is carried on a smaller diameter section 49 extending from each face of piston 46. An actuating member 50 is formed as an extension of section 49 and is shown as a simple rod movable axially with piston 46 and which may be used to operate a microswitch or other indicating device in response to movement of piston 46. A plug member is installed in housing 10 for the purpose of retaining a seal 52 around actuating member 50.

A retainer member 53 is provided to close one end of chamber 36 and to act as a retainer for spring 48. An additional plug member 54, which may be threadedly engaged with housing 10, is provided to permit installation, inspection and replacement of ball float valve 32.

In considering the operation of the device above described, it will first be assumed that water or other liquid is being supplied to inlet port 14 under sufficient pressure to open the check valve 18 such that it will flow through the housing 10 and out of outlet port 16. During such time the liquid will also enter passage 28, will float the ball valve member 32 off its seat 30, will flow past port 34 into chamber 36, past port 38, through passage 40, and into the lower end of conduit 12. Under these conditions, the fluid pressure acting on both faces of piston 46 is substantial and nearly equal, with the force acting on a slightly larger effective area tending to force piston 46 to the right. To ensure that piston 46 is maintained in this position, the spring 48 is supplied to provide a further biasing force in this direction. Since the operating areas may be carefully controlled, the use of the spring 48 is not absolutely required, but it will simplify calibration of the device. When the flow through the housing 10 ceases to be liquid and begins to be a gas, the pressure will continue to be sufficient to keep check valve 18 off its seat, but the ball float valve 32 will be positioned on its seat 30. As a result, there is a substantial drop in the pressure in chamber 36, and the pressure differential acting across piston 46 will be sufficient to move this piston and the associated members, including actuator 50, to the left against the force of spring 48. As indicated above, the actuating member 50 will typically operate a microswitch which may then initiate a launching process.

When the device is used to operate the actuating member 50 in response to a change from gas to liquid flow, it will be installed in inverted position but with passage 14 still operating as the inlet passage. Under these conditions the gas supplied to conduit 12 will force check valve 18 off of seat 20 against the action of spring 22, and this gas will flow directly through conduit 12 and out of outlet passage 16. Also, the float member 32 will remain in the position shown through gravitational force, thus allowing gas to flow across seat 30, into chamber 36, across port 38, passage 40, and into the lower end of conduit 12. Here again, the fluid forces acting on the opposite sides of piston 46 tend to bias piston 46 toward the position shown with the spring 48 serving to additionally bias piston 46 toward the position illustrated. When liquid appears at conduit 12, it will act to float ball valve 32 against the seat 30, resulting in reducing the fluid pressure in chamber 36 substantially below that in conduit 12, thereby causing piston 46 and its associated parts to move to its opposite position.

As indicated above, the valve member 42 which acts to control the flow rate of passageway 40 may or may not be required in a given application. It has been shown as a useful means for providing a threshold adjustment for the device. Similarly, spring 48 may not be an absolute requirement in all installations, but it will be appreciated that somewhat more care will be required in connection with the balancing of effective areas of piston 46 if spring 48 is not used. Other modifications will be obvious to those skilled in the art in that while member 46 has been shown as a piston with spring-biasing means, an essentially identical function could be provided by means of a bellows or even a diaphragm device if it has sufficient travel. Such members as retainer 24 and the plug members 51 and 53 may obviously be retained by means other than those shown.

I claim:

1. A liquid-to-gas indicator and actuator comprising:
   - a housing having an inlet port, an outlet port, a first fluid flow conduit connecting said ports, a check valve in said conduit, and resilient means urging said check valve in a direction to block flow through said conduit;
   - a second fluid flow conduit in said housing connected in parallel with said check valve including a valve seat in communication with said first conduit upstream of said check valve, a ball float valve in said second conduit operative with said seat to close said second conduit; said ball float valve being of such density that it will float in a liquid but will not float in a gas;
   - movable wall means midstream of said check valve and said float valve and in communication with said first and second conduits including means urging said movable wall means toward said first conduit when said ball float valve is not seated;
   - and an actuating member operatively connected to said movable wall means.

2. A liquid-to-gas indicator and actuator as set forth in claim 1 wherein an adjustment means is provided for varying the flow rate of said second conduit downstream of said ball float valve.

3. A liquid-to-gas indicator as set forth in claim 1 wherein said means urging said movable wall means includes resilient means.

4. A liquid-to-gas indicator as set forth in claim 1 wherein said actuating member is a rod connected to said movable wall means.

5. A liquid-to-gas indicator as set forth in claim 3 wherein said movable wall means includes a piston and said resilient means includes a spring.

6. A liquid-to-gas indicator and actuator comprising:

a housing having an inlet port, an outlet port, a first fluid conduit connecting said ports, a check valve in said conduit and a spring yieldably urging said check valve in a direction to close said conduit;

a second fluid flow conduit in said housing providing communication between said ports and connected to said first fluid flow conduit in parallel with said check valve,

a valve seat in said second conduit and a ball float valve member operative with said seat to close said second conduit said ball float valve being of such density that it will float in a liquid but will not float in a gas;

a movable wall device in said housing having one side thereof exposed to the fluid pressure in said first fluid conduit upstream of said check valve and an opposing side thereof exposed to the fluid pressure in said second conduit downstream of said check valve, and spring means urging said movable wall device toward said first fluid conduit;

and an actuating member operatively connected to said movable wall means;

whereby when said housing is maintained in a first position and liquid is supplied to said inlet port said ball float valve member floats off its seat permitting liquid to impinge against both sides of said movable wall device and retaining said actuating member in a first position, and when gas is supplied to said inlet port said ball valve is seated on its seat resulting in a reduced pressure in said second conduit and said movable wall device moves said actuating member to a second position; and

when said housing is inverted and gas is supplied to said inlet port, said ball valve member drops away from its seat, permitting the pressure of said gas to be applied against both sides of said movable wall device retaining said actuating member in said first position, and when liquid is supplied to said inlet port, said ball valve floats against its seat resulting in a reduced pressure in said second conduit and said movable wall device moves said actuating device to said second position.