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Roth et al.

[11] **3,718,788**

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[54] FLOW SWITCH ASSEMBLY

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[52] **U.S. Cl.**.....**200/81.9 R,** 200/166 BA

[51] **Int. Cl.**.....**H01h 35/40**

[58] **Field of Search**.....200/81.9 R, 166 BA, 166 BH; 340/239; 116/112; 73/228

[56] **References Cited**

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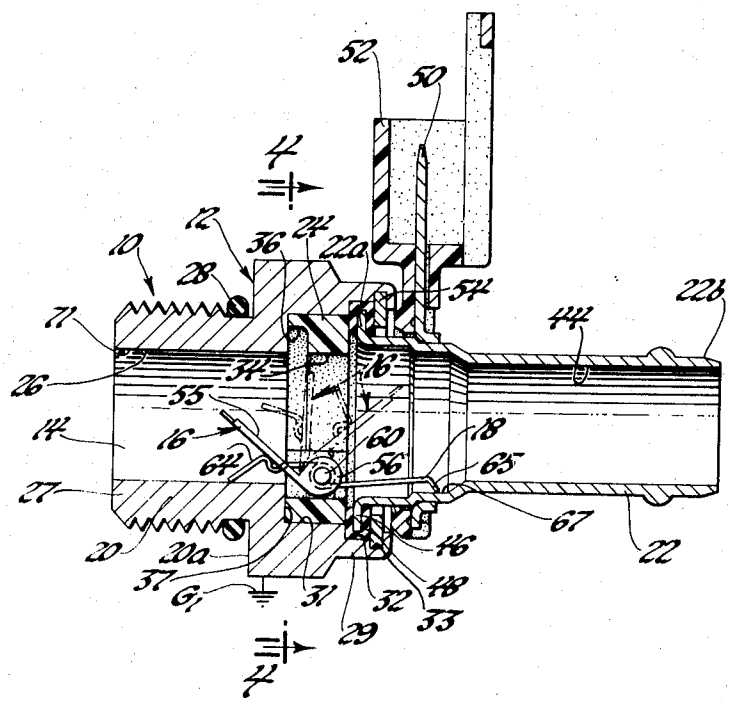
1,513,361	10/1924	Airey	200/81.9 R
1,693,309	11/1928	Mettler	200/81.9 R
3,119,979	1/1964	Martin	200/81.9 R X
2,773,963	12/1956	Mathews	200/153

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Assistant Examiner—Robert A. Vanderhye
Attorney—W. E. Finken et al.

[57] **ABSTRACT**

In a preferred form, this disclosure relates to a flow switch assembly comprising a housing means having a pair of hollow metal housing members which are insulated from each other and which define a flow passage therethrough. The assembly also includes a vane member which is pivotally supported for movement between first and second positions and a spring member which biases the vane member to its first position and normally has its opposite ends engaged with the metal members to provide a conductive path therebetween. The housing means has a recess which extends radially from the flow passage at a location between the first and second positions of the vane member. The vane member is moved from its first toward its second position in response to a fluid flow in excess of a first predetermined magnitude flowing therethrough to break the conductive path and, when the flow decreases to below a second predetermined magnitude less than the first, the vane member moves toward its first position. The recess provides an instantaneous increase in the flow passage area available for fluid flow when the vane member moves toward its first position and is aligned therewith to enable the spring member to rapidly shift the vane member to is first position.

3 Claims, 4 Drawing Figures



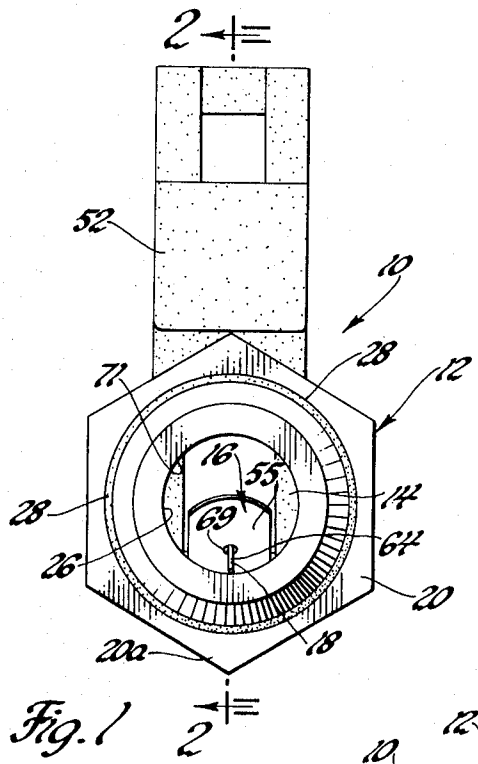


Fig. 1

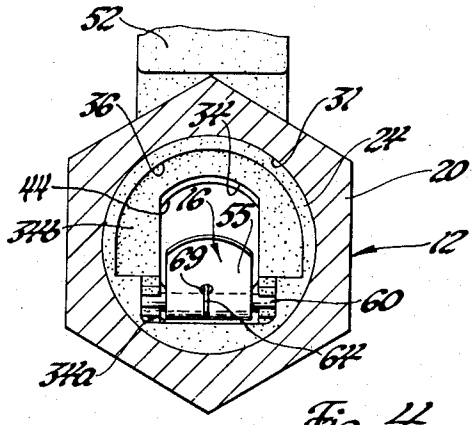


Fig. 4

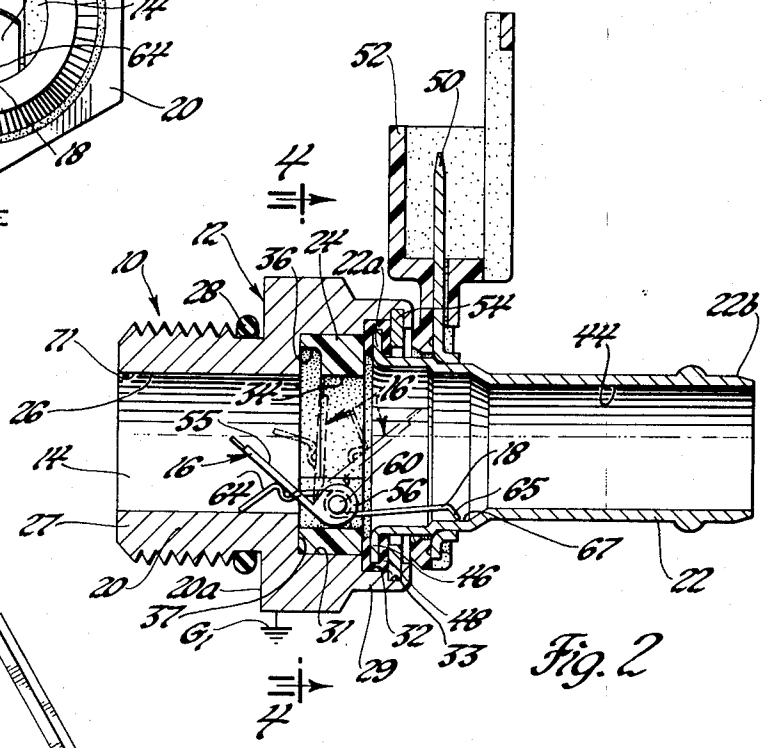


Fig. 2

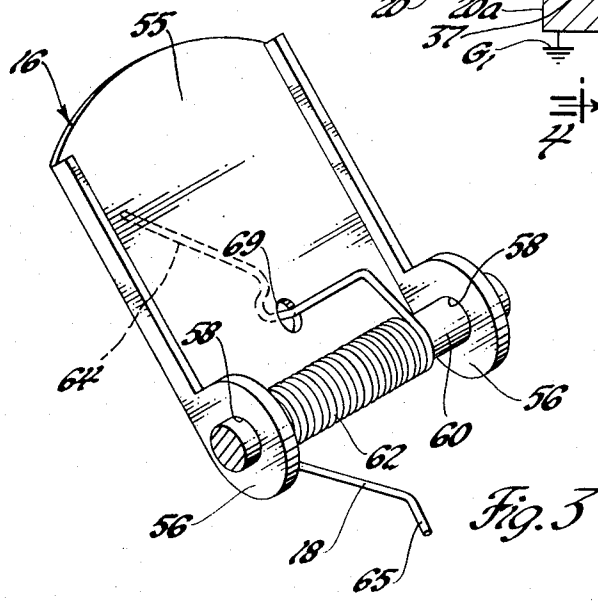


Fig. 3

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FLOW SWITCH ASSEMBLY

The present invention relates to a flow switch assembly, and more particularly to a flow switch assembly which responds to a flow in excess of a first predetermined magnitude to open a circuit and which responds to a flow less than a second predetermined magnitude to close the circuit.

Flow switch assemblies have heretofore been provided with vane members which are adapted to move from a first position to a second position in response to a fluid flow in excess of a predetermined magnitude to open or break a circuit. For example, see U.S. Pat. No. 859,147. Flow switch assemblies have also been provided wherein the vane member is spring biased toward a first position to maintain an electric circuit closed. For example, see U.S. Pat. No. 3,119,979. Further, flow switch assemblies have been provided with the above-described features and with the housing of the assembly constituting a conductive element or elements in the electric circuit. For example, see U.S. Pat. No. 1,693,309.

The present invention provides a new and improved flow switch assembly of the above noted type and which is constructed and arranged such that the switch is rapidly opened in response to a fluid flow in excess of a first predetermined magnitude flowing therethrough, rapidly closed when a fluid flow less than a second lesser predetermined magnitude flows therethrough, but which is not sensitive or opened and closed due to fluctuations in the fluid flow rate between the first and second magnitudes.

An object of the present invention is to provide a flow switch assembly having a housing means with a flow passage which is adapted to receive a fluid flow and which includes a pair of metal elements which are electrically insulated from each other, a vane member which is pivotally supported by the housing means for movement between first and second positions, a spring member which biases the vane member toward its first position and which has one end in constant engagement with one of the elements of the housing means and its other end or the vane member in engagement with the other of the elements when the vane member is in its first position to provide a conductive path between the elements, and a recess in the housing means extending radially from the flow passage at a location intermediate the first and second positions of the vane member and in which the vane member is rapidly movable from its first position toward its second position when a fluid flow in excess of a first predetermined magnitude passes through the flow passage and is movable from its second position toward its first position when the fluid flow falls below a second lesser predetermined magnitude, the recess serving to provide an increase in the flow passage area available for fluid flow when the vane member moves therepast toward its first position whereby the fluid pressure on the vane is relieved so that the spring member rapidly shifts the vane member to its first position to again provide a conductive path between the elements.

These and other objects of the invention are accomplished, in the preferred embodiment, by providing a flow switch assembly having a housing means with a flow passage therethrough adapted to receive a fluid flow. The housing means includes an annular fitting member with a counterbored portion having an annular collar member of insulating material which is received within the counterbored portion. The housing means also includes a tubular member which has one end portion which is flanged radially outwardly with an annular insulating seal received thereon and which has one end portion received within the counterbored portion of the fitting member. The tubular member has a terminal means which is fixedly attached thereto for connecting the tubular member to a power source.

The assembly also includes a vane member which is pivotally supported at one end upon a pivot pin carried by the collar member for movement between a first position and a second position. A torsion spring member with a coil portion supported upon the pivot pin has one bent end portion extending through a hole in the vane member and in engagement with the fitting member when the vane member is in its first position and has its other bent end portion in constant engagement with the tubular member to thereby provide a conductive path between the fitting and tubular members. The collar member also has a counterbored portion which with the counterbored portion of the fitting member defines a recess which extends radially of the flow passage at a location which is intermediate the first and second positions of the vane member. The vane member increasingly restricts the flow passage as it moves from its first position toward an intermediate position adjacent the recess and increasingly restricts the flow passage when it is moved from its second position toward its intermediate position. The vane member is movable from its first to its second position upon a fluid flow in excess of a first predetermined magnitude and remains between its intermediate and second positions unless the fluid flow decreases below a second predetermined magnitude less than the first predetermined magnitude whereupon the vane member is moved past its intermediate position toward its first position. The recess serves to provide an increase in the flow passage area which is available for fluid flow to decrease the fluid pressure on the vane member whereby the spring member can rapidly shift the vane member to its first position to complete the conductive path.

These and other objects of the present invention will become more fully apparent from the following description and drawing wherein:

FIG. 1 is an end elevational view of a preferred embodiment of the flow switch assembly of the present invention;

FIG. 2 is a cross-sectional view taken approximately along the line 2—2 of FIG. 1;

FIG. 3 is a perspective view of a part of the subject flow switch assembly of the present invention; and

FIG. 4 is a cross-sectional view taken approximately along line 4—4 of FIG. 2.

As representing the preferred embodiment of the present invention, the drawings show a switch assembly 10. Although the switch assembly 10 could be used for different purposes, it is particularly susceptible for use in a system wherein an electrically operated device is to be deenergized when a fluid flow occurs in excess of a first predetermined magnitude and wherein it is desirable that the electrically operated device be energized again when the fluid flow decreases to below a second predetermined magnitude which is less than the first predetermined magnitude.

The switch assembly **10** broadly comprises a housing means **12** which has a flow passage **14** therethrough, a vane member **16** which is pivotally supported by the housing means **12** within the flow passage **14**, and a spring member **18** which normally biases the vane member **16** to a first or closed-circuit position to provide a conductive path between different portions of the housing means **12**.

Referring to FIGS. **1** and **2**, the housing means **12** includes an annular fitting or housing member **20**, a tubular or housing member **22**, and an annular collar member **24**. The housing member **20** is of any material having suitable electrically conductive properties and has a central cylindrical bore **26** therethrough. The left-hand end portion **27**, as shown in FIG. **2**, of the fitting member **20** is externally threaded and adapted to be threadably connected to a component (not shown) in a fluid flow system. The fitting member **20** carries a conventional rubber seal **28** in a concentric manner about its midpoint and immediately adjacent the threaded end portion **27**. In this respect, the seal **28** will be positioned between one end of the component (not shown) and a flanged portion or shoulder **20***a* on the fitting member **20** when the latter is threadably connected to the component to provide a sealed joint therebetween. Further, the central bore **26** has three counterbored portions **31–33** in the right-hand end portion **29** of the fitting member **20**.

The annular collar member **24** is of any suitable electrically insulating material, such as plastic, and has a centrally located aperture **34** therethrough. Referring to FIG. **4**, the end view of the aperture **34** shows the lower portion **34***a* of the aperture **34** to be generally rectangular in shape with squared lower corners and the upper portion **34***b* to be formed in a rounded manner. Further, the collar member **24** includes a semi-circular radially outwardly extending recess **36** which extends axially from the left-hand end portion of the collar member **24**, as shown in FIG. **2**, and in a circumferential manner about the upper rounded portion **34***b* of the aperture **34**, as shown in FIG. **4**. The collar member **24** has its outer periphery shaped in a circular manner which is complementary to the counterbored portion **31** of the housing member **20** and is received therein such that the aperture **34** is aligned with the bore **26**. In this respect, the recess **36** is located immediately adjacent the bottom wall **37** of the counterbored portion **31** of the housing member **20**.

The tubular member **22** has a cylindrical opening **44** therethrough of substantially the same radius as the bore **26** of the fitting member **20** and the upper portion **34***b* of the aperture **34** of the collar member **24**. The left-hand end portion **22***a*, as shown in FIG. **2**, of the tubular member **22** has a radially outwardly extending flange **46** which has an annular seal **48** of electrically insulating material received thereon. The right-hand end portion **22***b* of the tubular member **22**, as shown in FIG. **2**, is suitably adapted to be connected to a second annular component (not shown), such as a hose, in a fluid system and attached thereto by some suitable means, such as a clamp ring. The tubular member **22** also includes a suitable terminal **50** which is fixedly mounted to the outer periphery of the tubular member **22** and which is carried by insulating socket **52**. In this manner, the tubular member **24** which is of electrically conductive material can be connected to a power source or within an electrical circuit. The left-hand end portion of the tubular member **22**, as shown in FIG. **2**, is positioned within the counterbored portion **32** of the fitting member **20** immediately adjacent the collar member **24** such that the opening **44** is in a substantially coaxial relationship with the bore **26** of the fitting member **20**. An annular retainer ring **54** is positioned within the counterbored portion **33** of the fitting member in juxtaposition with the seal **48** and flange **46** of the tubular member, and the right-hand end portion **29** of the fitting member **20** is bent over or crimped radially inwardly and around the ring **54** to fixedly attach the tubular member **22** thereto.

It should be noted that the bore **26** of the fitting member, the aperture **34** of the collar member **24**, and the opening **44** of the tubular member **22** define the flow passage **14** and that the switch assembly **10** is thereby adapted to receive a fluid flow therethrough. It should also be noted that the recess **36** of the collar member **24** provides an increased area for fluid flow within the flow passage **14**.

Now referring to FIGS. **2** and **3**, the vane member **16** is generally complementary in shape to the aperture **34** of the collar member **24** and slightly undersize with respect thereto. The vane member **16** has a flat body portion **55** with a pair of ear portions **56** at its lower end which have a pair of aligned holes **58** therethrough. The vane member **16** is pivotally supported by the collar member **24** upon a pivot pin **60**. The pivot pin **60** extends through the holes **58** in the ear portions **56** and has its opposite ends received within holes (not shown) in the lower portion of the collar member **24**.

The spring member is a torsion spring made of electrically conductive material and which has its midportion formed into a plurality of coils **62**. A pair of bent end portions **64** and **65** extend perpendicularly in different directions from opposite ends of the coiled portion **62**. The spring member **18** has its coiled portion **62** encircling the pivot pin **60** between the ear portions **56** of the vane member **16**. The spring member **18** is normally self-biased into engagement with both the tubular member **22** and the fitting member **20**. The bent end portion **65** of the spring member **18** projects from one end of the coiled portion **62** and is in constant engagement with the inner periphery **67** of the tubular member **22** which defines the opening **44**. The other bent end portion **64** projects from the opposite end of the coiled portion **62** and extends through a hole **69** in the center of the body portion **55** of the vane member **16** to engage the inner periphery **71** of the housing member **20** which defines the bore **26**.

The spring member **18** biases the vane member **16** to a normal or first position, as shown by the solid lines in FIG. **2**, in which the body portion **55** of the vane member **16** projects at approximately a 45° angle from a vertical plane extending perpendicular to the axis of the aperture **34**. The vane member **16** is adapted to be moved from its first position to a second position, as shown by the phantom lines in FIG. **2**, against the bias of the spring member **18** when a fluid flow in excess of a first predetermined magnitude is flowing through the flow passage **14**. Further, the bias of the spring member **18** is effective to move the vane member **16** from its second position to an intermediate position, as shown by the dotted lines in FIG. **2**, against the pressure of the

fluid flow when the fluid flow decreases to a second predetermined magnitude.

In operation, a circuit can be traced from a power source (not shown), a connector (not shown), the terminal **50**, the tubular member **22**, the bent end portion **65** of the spring member **18**, the coil **62** of the spring member **13**, the other bent end portion **64** of the spring member **18**, the housing member **20**, to ground G_1 when the vane member **16** is in its first position. The vane member **16** remains in its first position and the above described circuit remains completed through the spring member **18** as a result of the bias of the spring member **18** until a fluid flow is received within the flow passage **14** in excess of a first predetermined magnitude. It should be readily apparent that, when a fluid flow is reached which has sufficient magnitude to cause the vane member to move from its first position toward a vertical position, the vane member **16** will increasingly restrict the flow passage **14** as it moves toward the vertical position. The increasing restriction of the flow passage **14** by the vane member **16** results in increasing fluid pressure upon the vane member **16** which serves to rapidly pivot the vane member to its second position against the bias of the spring member **18**. In this regard, the movement of the vane member **16** causes the bent end portion **64** of the spring member **18** to be disengaged from the inner periphery **71** of the fitting member **20** and, consequently, the above-described circuit is broken.

It should also be readily apparent that, when the fluid flow decreases below the first predetermined magnitude, the bias of the spring member **18** causes the vane member **16** to pivot from its second position toward a vertical, intermediate position and the vane member will again increasingly restrict the flow passage **14**. Hence the increasing restriction of the flow passage **14** by the vane member **16** again results in increasing fluid pressures upon the vane member **16** which serve to maintain the vane member between its second position and its intermediate position until the fluid flow decreases to below a second predetermined magnitude. Thus, the bent end portion **64** of the spring member **18** is maintained out of engagement with the fitting member **20** and the circuit is maintained open as long as the fluid flow is equal to or greater than a second predetermined magnitude. When the fluid flow decreases to below the second predetermined magnitude, the bias of the spring member **18** causes the vane member **16** to be pivoted beyond its intermediate position into the portion of the fluid passage having increased area for fluid flow as provided by the recess **36** of the collar member **24**. The recess **36** provides an instantaneous increase in the flow passage area available for fluid flow and the restriction of the flow passage **14** by the vane member **16** is instantaneously decreased. The instantaneous decrease in the restriction of the flow passage **14** results in sudden decrease in the fluid pressure on the vane member **16**, and the bias of the spring member **18** serves to rapidly shift the vane member **16** to its first position. The bent end portion **64** of the spring member **18** thereby again engages the inner periphery **71** of the fitting member **20** and the above-described circuit is again closed to effect energization of the electrical means (not shown).

One advantage of the flow switch assembly of the present invention is the hysteresis effect it presents once the switch is opened. That is, the switch assembly **10** will not open until a fluid flow of a first predetermined magnitude occurs, but thereafter the flow switch assembly tolerates all variations and fluctuations in the fluid flow rate between the first and the lesser second predetermined magnitude without closing. Further, once the flow rate decreases to below the second predetermined magnitude, the closing of the switch assembly **10** is rapid.

The foregoing disclosure relates to only one embodiment of the invention which may be modified within the scope of the appended claims.

What is claimed is:

1. A flow switch assembly, comprising: a housing means having a flow passage therethrough adapted to receive a fluid flow, said housing means including a pair of metal elements electrically insulated from each other; a vane member pivotally supported by said housing means for movement between a first position and a second position; a spring member for biasing said vane member toward its first position, said spring member having one end in constant engagement with one of said elements of said housing means and one of said vane and spring members being in engagement with the other of said elements when said vane member is in its first position to provide a conductive path between said elements; said housing means having a recess extending radially outward from said flow passage at a location intermediate said first and second positions of said vane member, said vane member increasingly restricting the flow passage as it moves from its first position towards an intermediate position adjacent said recess and increasingly restricting the flow passage when moved from its second position toward its intermediate position, said vane member being movable from its first position toward its second position when a fluid flow in excess of a first predetermined magnitude passes through said flow passage, said vane member remaining between its intermediate and second positions unless said fluid flow decreases below a second predetermined magnitude less than said first predetermined magnitude whereupon said vane member moves past its intermediate position toward its first position, said recess serving to increase the flow passage available for fluid flow when said vane member moves past its intermediate position toward its first position to decrease the fluid pressure upon said vane member whereby said spring member rapidly shifts said vane member to its first position to again provide a conductive path between said elements.

2. A flow switch assembly for controlling energization of electrical means, comprising: a housing means having a flow passage therethrough adapted to receive a fluid flow, said housing means including first and second annular metal elements electrically insulated from each other, said first annular element having a counterbored portion; a vane member pivotally supported by said housing means for movement between a first position and a second position; a spring member for biasing said vane member toward its first position, said spring member having one end in constant engagement with said second annular element of said housing means and having its other end in engagement with said

first annular element when said vane member is in its first position to provide a conductive path between said first and second annular elements and effect energization of the electrical means; an annular collar member received within said counterbored portion of said first element of said housing means and also having a counterbored portion, said counterbored portions defining a recess extending radially of said flow passage at a location intermediate the first and second positions of said vane member; said vane member increasingly restricting said flow passage as it moves from its first position toward an intermediate position immediately past said recess and increasingly restricting the flow passage when moved from its second position toward its intermediate position, said vane member being movable from its first position toward its second position upon a fluid flow in excess of a first predetermined magnitude flowing through said housing means, said vane member remaining between its intermediate and second positions unless said fluid flow decreases below a second predetermined magnitude less than said first predetermined magnitude whereupon said vane member moves past its intermediate position toward its first position, said recess serving to increase the flow passage area available for fluid flow when said vane member moves past its intermediate position toward its first position to decrease the fluid pressure against the vane member whereby said spring member rapidly shifts said vane member to its first position to effect energization of the electrical means.

3. A flow switch assembly for controlling energization of an electrical means, comprising: a housing means having a flow passage adapted to receive a fluid flow, said housing means including an annular fitting member with a counterbored portion having an annular collar member of insulating material received within said counterbored portion, said housing means also including a tubular member having one end portion flanged radially outwardly with an annular insulating seal received thereon and having said one end portion received within said counterbored portion, said tubular member having terminal means fixedly attached thereto for connecting said tubular member to a power source; a vane member pivotally supported at one end upon a pin projection of said collar member for movement between a first position and a second position; a torsion spring member having a coil portion supported within said flow passage upon said pin projection of said collar member, said spring member having one bent end portion extending through a hole in said vane member and biasing said vane member toward its first position, said spring member having said one bent end portion in engagement with said fitting member when said vane member is in its first position and having its other bent end portion in constant engagement with said tubular member to provide a conductive path between said fitting and tubular members to effect energization of the electrical means; said collar member having a counterbored portion, and said counterbored portions of said fitting member and said collar member defining a recess extending radially of said flow passage at a location intermediate the first and second positions of said vane member; said vane member increasingly restricting the flow passage as it moves from its first position toward an intermediate position immediately past said recess and increasingly restricting said flow passage when moved from its second position toward its intermediate position, said vane member being movable from its first position toward its second position upon a fluid flow in excess of a first predetermined magnitude within said flow passage, said vane member remaining between its intermediate and second positions unless said fluid flow decreases below a second predetermined magnitude less than said first predetermined magnitude whereupon said vane member moves past its intermediate position toward its first position, said recess serving to increase the flow passage area available for fluid flow when said vane member moves past its intermediate position toward its first position to decrease the fluid pressure upon said vane member whereby said spring member can rapidly shift said vane member to its first position to effect energization of the electrical means.

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