

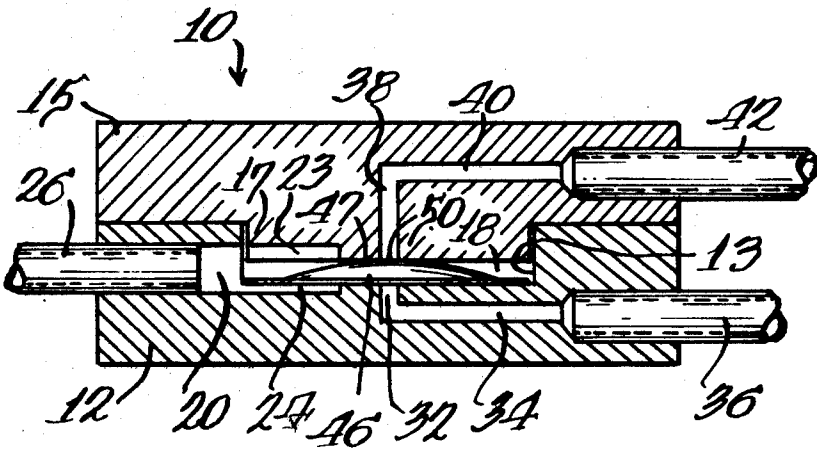
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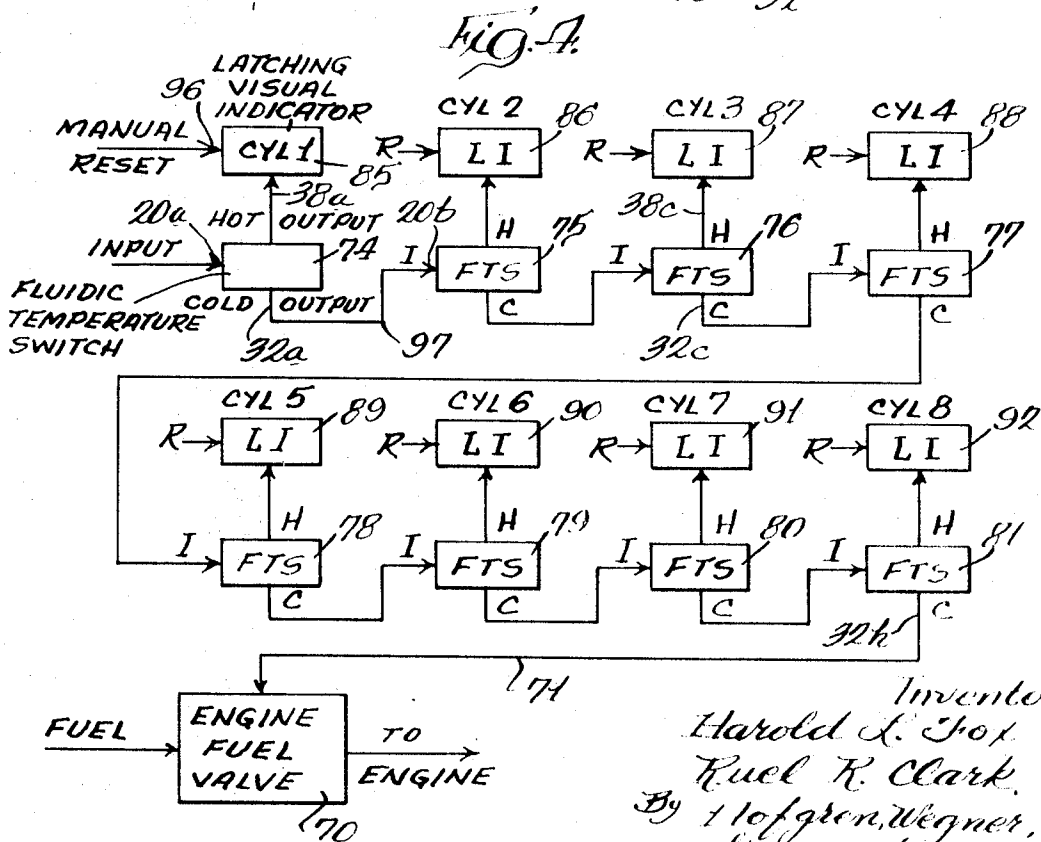
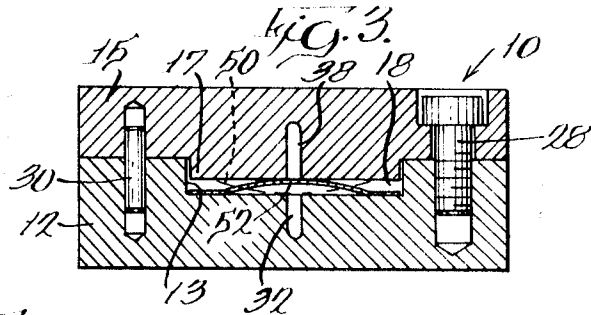
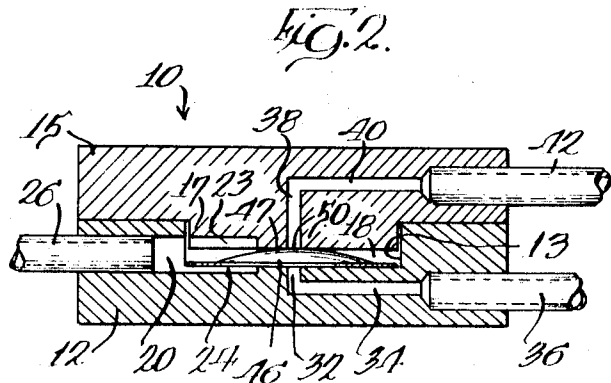
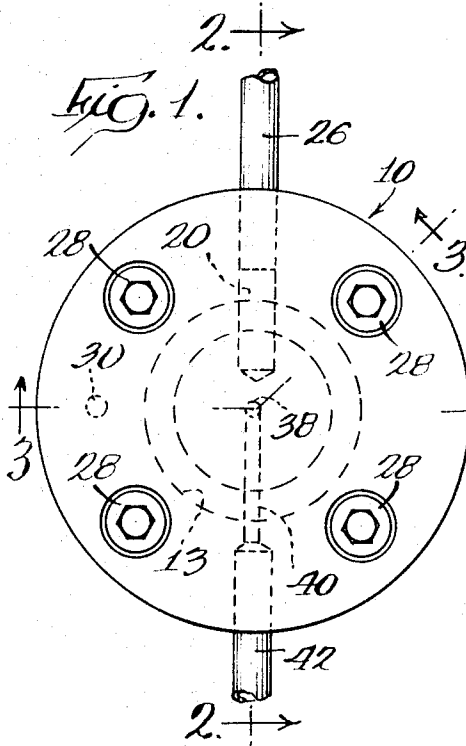
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[54] **TEMPERATURE-RESPONSIVE SWITCH**
8 Claims, 4 Drawing Figs.
[52] U.S. CL..... **137/457,**
73/363.5, 73/378.3, 123/41.12, 123/41.15
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G01k 3/00, F01p 5/14
[50] Field of Search..... **73/363.5,**
378.3; 236/5, 19, 94, 48, 66; 137/457, 468, 469;
123/41.12, 41.02, 180 T, 108
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ABSTRACT: A temperature-responsive fluid switch including a cylindrical valve chamber with a fluid inlet port for directing fluid generally radially into the chamber and opposed central outlet ports extending from the opposite ends of the chamber with a bimetallic disc extending across the chamber and selectively blocking the outlet ports to prevent fluid flow from the inlet port to one of the outlet ports while permitting flow to the other outlet port.





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TEMPERATURE-RESPONSIVE SWITCH

BACKGROUND OF THE INVENTION

In the past temperature-responsive switching devices have been fairly complex in their construction requiring a plurality of moving parts, springs, etc. A typical prior arrangement is shown in the Sparrow U.S. Pat. No. 3,091,393 and the switch disclosed and described therein includes a pivotally mounted valve member having valving surfaces at each end thereof selectively engageable with adjacent stationary valve seats which communicate with outlet ports. Fluid is supplied to a chamber adjacent the valve seats and depending upon the pivotal position of the valve member flows out the open one of the outlet ports. For biasing the valve member and controlling the position thereof a temperature-responsive bellows is provided as well as a biasing spring. This is a complicated and costly arrangement.

SUMMARY OF THE PRESENT INVENTION

In accordance with the present invention a temperature responsive fluid switch is provided that has no moving parts with the exception of a temperature responsive bimetallic member. The switch has two outlet ports, one of which carries fluid when the surrounding temperature is below a predetermined value and the other of which carries fluid when the surrounding temperature is above a predetermined value. This enables the switch to be employed in an associated fluid circuit, such as a fluidic circuit, with either the presence of a fluid signal at one outlet port or the absence of a fluid signal at the other outlet port indicating a high-temperature condition sensed by the switch.

The device includes an annular valving chamber to which fluid is ported with opposed aligned outlet ports extending from the annular chamber. The only moving part is a disc-shaped bimetallic member in the chamber which when the temperature is below a predetermined value engages and blocks flow from one of the ports and when the predetermined temperature is exceeded snaps across the chamber engaging and blocking the other outlet port and at the same time opening the previously blocked port.

While this device is useful wherever temperature limiting is part of a control system, it is particularly useful in a system requiring fluidic energizing signals. Such a circuit is a failsafe control circuit wherein a plurality of these temperature sensing fluid switches are arranged in series for sensing excessive temperatures at a plurality of locations in a circuit so that if the temperature of any one is exceeded the system will be shut down. Also provided in this circuit are visual indicating devices associated with each of the switches and responsive to a fluid signal from one of the outlet ports of the associated switch for providing a visual indication when an excessive temperature is sensed by the switch.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an elevation view of a temperature responsive switch according to the present invention;

FIG. 2 is a cross section taken generally along line 2-2 of FIG. 1;

FIG. 3 is a cross section taken generally along line 3-3 of FIG. 1; and

FIG. 4 is a schematic diagram of a failsafe control circuit utilizing the switch shown in FIGS. 1 to 3.

While we have shown and shall hereinafter describe one embodiment of the invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as defined in the appended claims.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 to 3 a fluidic temperature responsive switch 10 is seen to include a first body member 12 having a cylindrical central recess 13 therein. A second complementary body member 15 has a central cylindrical projection 17 received within the recess 13 and defining therewith a cylindrical valve chamber 18. The chamber 18 has a diameter at least six times its height. An inlet port 20 is defined by a drilled passage extending radially through the body member 12 and into the body member 15. The inlet port thus has a first portion 23 communicating with the top end of the chamber 18 and a second portion 24 communicating with the bottom end of the chamber.

A suitable inlet fitting 26 is fixed within the body member 12 and communicates freely with inlet port 20. Fitting 26 is adapted to be connected to a source of supply fluid, such as air, under pressure. The body members 12 and 15 are connected together by suitable threaded fasteners 28 with the parts being angularly aligned by an aligning pin 30 as shown in FIG. 3.

Extending axially from the chamber 18 in the body member 12 is a low temperature outlet port 32 which is located centrally with respect to the chamber 18. A radially extending outlet passage 34 communicates at one end with port 32 and at the other end with an outlet fitting 36. Extending centrally from the opposite end of the chamber 18 in the body member 15 is a high temperature outlet port 38. A radially extending passage 40 coplanar with passage 34 is connected at one end to port 38 and at the other end communicates with an outlet fitting 42.

For the purpose of selectively blocking the ports 32 and 38 a bimetallic disc 46 is provided in chamber 18. The disc 46 is circular in configuration with a central spherical portion 47. The disc 46 extends substantially diametrically across the chamber 18 and has a relaxed axial length slightly greater than the height of the chamber 18 so that the center portion 50 of the disc tightly engages one of the ports as shown in FIGS. 2 and 3. As shown in the drawing, the disc is in its low temperature position with valving portion 50 blocking flow through outlet port 38. The disc is constructed so that when a predetermined temperature is exceeded it will snap from the position shown in FIG. 2 to the position shown in FIG. 3 where the opposite center portion 52 of the disc engages the port 32 blocking any flow from that port.

Assuming that the fitting 26 is connected to a suitable source of fluid under pressure and the temperature surrounding the device 10 is below the predetermined value at which disc 46 snaps, fluid will flow from inlet port 20, inlet portion 24 inside spherical portion 47 and out the low temperature or "cold" port 32. The fluid signal issuing from port 32 may be utilized in associated circuitry to indicate that the temperature of the component sensed by switch 10 is within predetermined permissible limits. When the temperature surrounding switch 10 rises above the predetermined value disc 46 will snap opening port 38 and blocking port 32 so that inlet fluid flows then from port 20, through port portion 23, within the inverted bimetallic disc 46, through port 38 and out fitting 42. This signal may be used to indicate an excessive temperature condition associated with switch 10, or alternatively, the absence of a signal from port 32 may be used to indicate an excessive temperature condition. It is important to note that the switch 10 may be used to sense either the surrounding temperature or the temperature of the fluid flowing in inlet 26.

In FIG. 4 a plurality of the switches are employed in a failsafe control circuit for a diesel engine. The circuit functions to close a fuel valve 70 and shut off fuel flow to the diesel engine when the temperature of any one of the cylinders in the engine exceeds a predetermined critical value. The engine fuel valve 70 remains open in response to the presence of a fluid signal in line 71 and closes in response to the absence of a signal in line 71 thereby shutting off the flow of fuel to the engine.

There is one temperature switch 74, 75, 76, 77, 78, 79, 80 and 81 associated with each of the eight cylinders in the diesel engine. A mechanical heat conducting connection is provided between each cylinder and the associated temperature switch so that the switch can sense cylinder temperature. Associated with each of the switches is a latching visual indicator 85, 86, 87, 88, 89, 90, 91 and 92 which provides a visual representation when the associated switch senses an excessive pressure. Each of the switches includes a manual reset 96. These visual indicators may be any one of a number of conventional visual indicators that respond to fluid signals. The indicators are connected to the high-temperature outlets 38 of the temperature switches and respond to a fluid signal in the high temperature outlet for providing a visual representation indicating an excessive temperature. After being placed in a state representing an excessive temperature the switches must be manually reset.

The low-temperature outlets 32 of each of the switches (except switch 81) is connected through suitable conduits 97 with the inlet ports 20 of the following switches. In this manner the switches are arranged in series. The cold outlet port 32h of the last switch 81 is connected to passage 71 providing a signal to maintain the engine fuel valve in its open position.

When the temperature of the cylinders associated with all of the switches 74 to 81 is below the predetermined critical value, fluid flowing in inlet port 20a of the first switch 74 will flow out the cold output 32a to the inlet 20b of switch 75 and from switch 75 to the inlet of switch 76, etc., through all of the following switches and out port 32h to switch 81 maintaining fuel valve 70 open. If the temperature of any one of the cylinders exceeds the predetermined value the switch associated with that cylinder will snap to its high temperature position blocking flow from the cold outlet port and directing flow to its hot outlet port. This interrupts the flow through the following temperature switches terminating flow through line 71 permitting the engine fuel valve to move to its closed position cutting off the supply of fuel to the engine and thereby shutting down the engine. For example, when the switch 76 senses an excessive temperature in cylinder 3, cold port 32c will be blocked interrupting flow to switch 77 and the following switches as well as to the engine fuel valve 70. At the same time switch 76 will direct inlet flow through to outlet port 38c and the visual indicator 87 providing a visual indication that cylinder 3 is the overheated cylinder. After the overheating problem has been corrected it is necessary to activate the manual reset associated with indicator 87 to remove the excessive temperature representation.

It should be understood that while the present temperature switch is particularly useful in the failsafe circuit shown in FIG. 4 that there are numerous other applications for the switch.

We claim:

1. A fluid temperature switch, comprising: body means having a fluid inlet port, means for supplying fluid to said fluid inlet port, first outlet port means in said body means, second outlet port means in said body means generally opposed and aligned with said first outlet port means, both of said outlet port means positioned to receive fluid from said inlet port, and a temperature responsive bimetallic member for selectively blocking communication between the inlet port and either of the outlet port means, said bimetallic member being positioned so that a central portion thereof engages said first outlet port and blocks communication between the inlet port and the first outlet port means in a first temperature range and positioned so that a central portion thereof engages said second outlet port and blocks communication between the inlet port and the second outlet port means in a second temperature range.

2. A fluid temperature switch as defined in claim 1, wherein said bimetallic member is a disc having a generally spherical portion, said spherical portion engaging both of said outlet port means to block flow therein.

3. A fluid temperature switch as defined in claim 1, wherein said first and second outlet port means are spaced and aligned,

said bimetallic member being positioned between said first and second outlet port means for selective engagement therewith.

4. A fluid temperature switch as defined in claim 1, wherein said body means has a generally annular chamber therein, said inlet port communicating with said chamber and directing fluid generally radially therein, both said outlet port means extending axially from said chamber and communicating therewith, said outlet port means being located substantially centrally with respect to said chamber, said bimetallic member being a generally circular disc in said chamber, and having a spherical portion adapted to project against said first port means in said first temperature range and project against said second port means in said second temperature range, said inlet port being positioned to direct fluid continuously to opposite sides of said bimetallic member.

5. A fluid temperature switch, comprising: a first body member having a cylindrical recess therein, a second body member having a cylindrical projection received in said recess and defining therewith a fluid chamber, a radially disposed inlet port in said first body member communicating with said chamber, said inlet port communicating with the chamber at the periphery of said recess and extending radially inwardly from the periphery along the bottom of said recess, an inlet fitting projecting from said first body member and communicating with said inlet port, a first outlet port in said first member extending axially and centrally from said recess, first outlet passage means in said first member extending radially from said first outlet port to the periphery of said first body member, a second outlet port in said second body member extending axially and centrally from the end of said projection adjacent the chamber, second outlet passage means in said second body member extending radially from said second port to the periphery of said second body member, and a bimetallic disc mounted in said chamber and extending substantially diametrically across said chamber, said disc having a central generally spherical portion, one side of said spherical portion being engageable with said first port blocking flow thereto in said first temperature range, the other side of said spherical portion being engageable with said second port blocking flow therethrough in said second temperature range.

6. A subsystem for deactivating a system upon the occurrence of excessive temperature at any one of a plurality of locations in the system, comprising: means for terminating operation of the system, a plurality of temperature sensing switches positioned to sense temperature at a plurality of locations in the system, each of the temperature-sensing switches including body means having a fluid inlet port, means for supplying fluid to said fluid inlet port, first outlet port means in said body means, second outlet port means in said body means generally opposed to said first outlet port means, both of said outlet port means positioned to receive fluid from said inlet port, and a temperature responsive bimetallic member for selectively blocking communication between the inlet port and either of the outlet port means, said bimetallic member being positioned to block communication between the inlet port and the first outlet port means in a first temperature range and positioned to block communication between the inlet port and the second outlet port means in a second temperature range, said second temperature range being the higher temperature range, means connecting the second port means of at least one temperature switch with the inlet port means of another temperature switch, one of the outlet port means of the latter temperature switch providing a signal to said system terminating means.

7. A subsystem for deactivating a system upon the occurrence of excessive temperature at any one of a plurality of locations in the system as defined in claim 6, including a fluid responsive visual indicating device associated with each temperature switch, the first outlet port means of each switch being connected to direct a fluid signal to the associated indicator, the second outlet port means of at least one switch being connected to direct a fluid signal to the next port of the following switch.

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8. A subsystem for deactivating a system upon the occurrence of excessive temperature at any one of a plurality of locations in the system as defined in claim 7, wherein the one of the outlet port means of said latter switch connected to said system terminating means is the second outlet port means whereby when the temperature of the locations associated with each of said switches is in the first lower range, fluid will flow from the second port means of both the switches and

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prevent actuation of said system terminating means and when the temperature of the locations associated with either of said switches is in the second temperature range fluid from one of the switches will flow from the associated first port means interrupting flow from the associated second port means thereby actuating the system-terminating means.

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