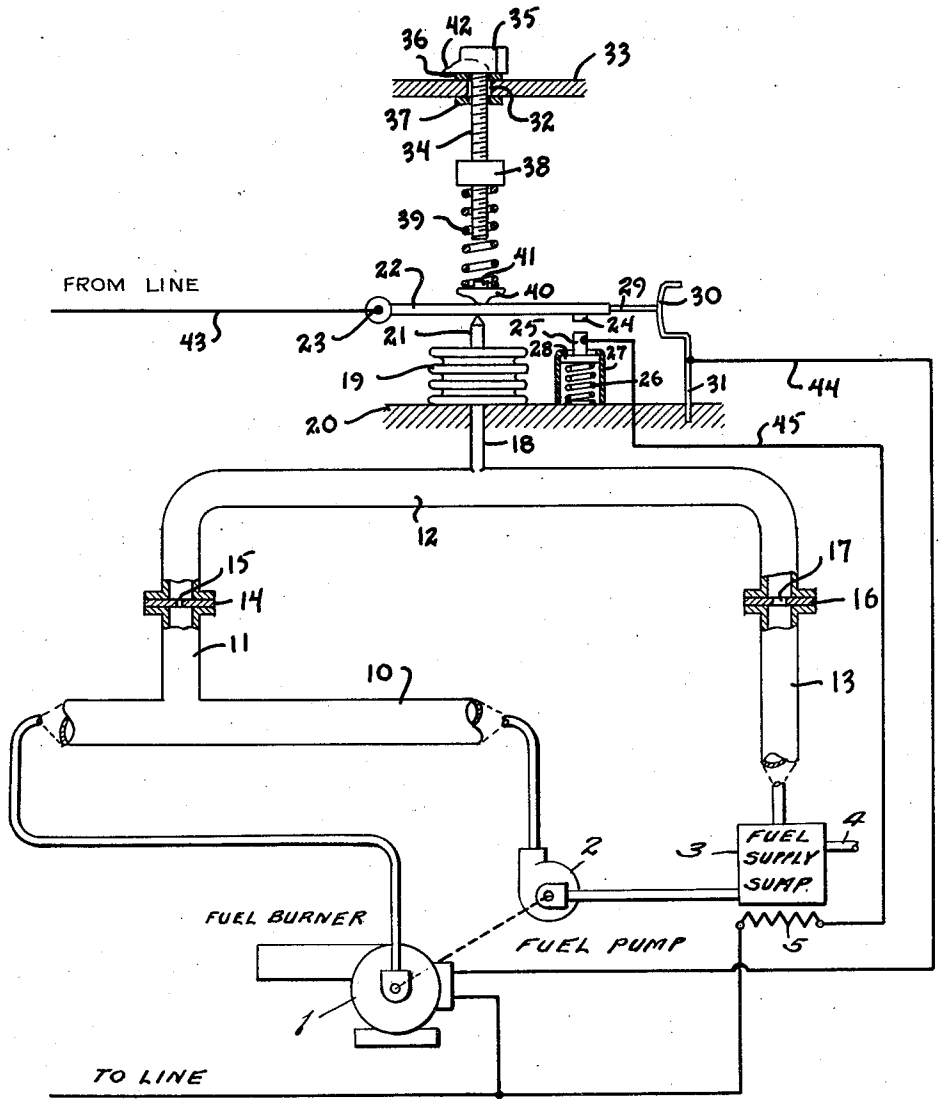
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VISCOSITY CONTROL DEVICE

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VISCOSITY CONTROL DEVICE

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This invention is directed generally to a viscosity control system, and more particularly to a system for controlling the viscosity of the oil flowing to an oil burner.

It is a well known fact that the viscosity of oil increases as its temperature decreases and decreases as its temperature increases, and that the more viscous the oil is the greater is its resistance to flow through a pipe. Therefore, where the oil being delivered to an oil burner becomes too viscous it may resist flow to the extent that an insufficient quantity of oil is being so delivered. It is also possible that it may become so viscous that it will not vaporize properly.

It is an object of this invention to provide a device which is sensitive to the viscosity of a fluid flowing through a pipe line.

A further object of the invention is to provide a device which is connected to an oil line and which produces a pressure which varies inversely as the viscosity of the oil in the oil line. A pressure responsive device responds to this varying pressure and may operate a heater for the oil.

A still further object of this invention is to provide a switch which will break the circuit to the oil burner when the oil becomes too viscous for proper operation of the burner and which will also break the circuit when the oil becomes too thin for proper operation of the burner.

Another object of this invention is to provide a viscosity responsive device which by-passes a sample of the oil whose viscosity is to be measured and which passes the sample of oil through a small orifice and then a larger orifice and measures the variations in the pressure of the oil between the two orifices.

Other objects and advantages will become apparent to those skilled in the art as the following specification is read in the light of the accompanying drawing in which the single figure illustrates more or less diagrammatically the viscosity control device of this invention.

An oil burner 1, or the like, is supplied with oil by an oil line 10. A pump 2 is driven by the oil burner motor and delivers oil to the burner under suitable pressure. The pump 2 draws the oil from a fuel supply sump 3 which is connected to the main supply tank (not shown) by a pipe 4. A heater 5 is located in heat transfer relationship with the oil sump 4 for the purpose of heating the oil in a manner to be hereinafter fully described.

The device of the present invention is applied to the oil line indicated by reference numeral 10. A small amount of oil is bled from the oil line 10 by means of pipes 11, 12 and 13, pipe 13 leading to the sump 3. Located between the pipes 11 and 12 is a plate 14 having an orifice 15 therein of relatively small size, and located between the pipes 12 and 13 is a plate 16 having orifice 17 therein of a size somewhat larger than the orifice 15, the purpose of which will be described later.

In open communication with the pipe 12 between the two orifice plates, by means of pipe 18, is a bellows 19 which is held on a stationary support 20 at one end, leaving the other end free to move in accordance with the pressure changes in the pipe 12. Mounted on the movable end of the bellows 19 is an operating pin 21 which engages a switch arm 22 which is pivoted at one end at 23 and at its free end carries a contact 24. Positioned for cooperation with contact 24 is a stationary contact 25 which is resiliently mounted by means of spring 26 and housing 27. A flanged base 28 connected to the contact 25 is located within the housing 27 and engages the spring 26 so that on continued downward movement of the switch arm 22 after it has engaged the contact 25 will merely cause this contact to move downwardly within the housing 27 and compress the coil spring 26. The movable end of the switch arm 22 is provided with an extension 29 which is adapted to cooperate with an arcuate contact 30 carried on a flexible support 31. The arcuate contact 30 is normally held in the path of movement of extension 29 which engages it for a substantial part of its travel.

Extending loosely through a hole 32 in support 33 is a screw 34 having on its upper end a knob 35. Collars 36 and 37 are mounted on the screw on either side of the support 33 to prevent vertical movement of the screw. On the lower part of screw 34 is adjustably positioned a nut 38 which is prevented from rotating by a means not shown. Coil spring 39 surrounds the lower end of the screw 34 and is confined between the nut 38 and a bearing member 40 which engages the center portion of the switch arm 22. A short stem 41 on the bearing member 40 properly centers the lower end of the coil spring 39 and maintains the parts in their proper relation. Rotation of the knob 35 will cause a vertical movement of the nut 38 due to the fact that it is incapable of rotation and this vertical movement will vary the force with which the spring 39 will oppose expansion of the bellows 19. This action will vary the main setting of the device and a scale may be placed on the surface of the support 33 with which a pointer 42 on the knob 35 may cooperate to indicate the viscosity of the oil in line 10 which will cause the bellows 19 to actuate its control switch.

A conductor 43 extends from a source of power (not shown) to the switch arm 22 and conductor 44 is connected to contact 30 and extends to the burner motor 1. Conductor 45 is connected to the stationary contact 25 and extends to the heater 5 for heating the oil for the purpose of reducing its viscosity.

The purpose of this invention is to cause the bellows 19 to move in response to variations in viscosity of the oil in the oil line 10. It is for this reason that the by-pass 11, 12, 13 with its two orifices 15 and 17 has been provided. A small orifice will have a greater effect on the flow of oil under varying conditions of viscosity than a large orifice will. Therefore assuming that the oil pressure in the line 10 remains constant, an increase in the viscosity of the oil will cause a reduced flow through the orifice 15, which reduction will be greater than the reduction of flow through the orifice 17 due to the same increase in viscosity. This means that the pressure in the pipe 12 between the two orifices will drop causing a contraction of the bellows 19. On the other hand, if the viscosity of the oil in the line 10 should decrease, an increased amount of the oil would flow through the orifice 15 due to this decrease in its viscosity. The larger orifice 17 would have a lesser effect on the flow of oil and consequently an increased pressure would be built up in the line 12 causing the bellows 19 to expand.

It is obvious that the bellows 19 could be made to operate an indicating device or any type of signal or alarm but in this case it has been shown as operating two switches which control a pair of circuits.

Variations in the viscosity of the oil flowing to an oil burner over a large range may have an effect on the operation of the burner. For instance, if the oil became too viscous it might possibly be difficult to volatilize it properly to produce combustion. On the other hand, if the viscosity decreased to too great an extent it might happen that an excess of oil would be delivered to the burner due to the reduced resistance to its flow. Therefore, there is a definite range of viscosity of the oil for which it is all right to operate the burner motor, but should this viscosity go beyond this range in either direction it might be desirable to disconnect the burner and shut down the system until this trouble had been corrected. It is for this reason that the arcuate stationary contact 30 is provided for cooperation with the extension 29 on the switch arm 22. The viscosity of the oil in the line 10 as indicated by the position of bellows 19 may vary over a considerable range, and while it is within this range the extension 29 will engage contact 30, but should the oil increase in viscosity to too great an extent the bellows 19 will contract and extension 29 will disengage contact 30 causing the burner to shut down. On the other hand, if the oil should decrease in viscosity beyond the predetermined range the bellows 19 would expand causing the extension 29 to rise and disengage contact 30 and shut down the burner motor.

When the oil becomes too viscous, the obvious correction is to heat it. This is accomplished by bringing contact 24 into engagement with contact 25 which will cause energization of the heater 5 to heat the oil before it flows into the line 10 leading to the burner motor. This will normally correct the condition which caused the oil to become too viscous but if it should not, as explained above, the bellows will continue to contract and if it goes beyond its predetermined limit the extension 29 will disengage the contact 30 and shut the burner motor down but the heater for the oil will remain energized.

It will therefore be seen that I have provided a device which is sensitive to variations in the viscosity of the oil flowing through an oil line and that this device may be used to operate either an indicator or a control circuit of some sort. It will be seen further that I have provided a control circuit which is adapted to be operated by this device and that this circuit will prevent operation of the burner motor unless the oil flowing to it is within a definite range of viscosity. I have provided further a control switch whereby if the oil becomes too viscous a heater is energized for the purpose of correcting the condition causing the high viscosity.

Certain changes and modifications of this invention may occur to those who are skilled in the art, and it is therefore to be distinctly understood that I am not to be limited by the specific embodiment disclosed but only by the scope of the appended claims.

I claim as my invention:

1. In a viscosity control system for delivering oil to a burner, an oil line, means responsive to variations in the viscosity of the oil in said line, a first switch operated by said means on a rise in the viscosity of the oil for the purpose of energizing a heater for the oil, and a second switch for controlling an oil burner which is maintained closed by said means when said viscosity remains between predetermined limits but which is opened when the viscosity rises above one of said limits or drops below the other limit.

2. In a viscosity control system for delivering oil to a burner, an oil line, means responsive to variations in the viscosity of the oil in said line, a first switch in circuit with a heater for the oil, said means closing said switch on an increase in viscosity of the oil, and a second switch in circuit with the oil burner, said means opening said second switch on a rise in viscosity to a higher value than that which cause closing of said first switch.

3. In a viscosity control system for delivering oil to a burner, an oil line, means responsive to variations in the viscosity of the oil in said line, a first switch in circuit with a heater for the oil, said means closing said switch on an increase in viscosity of the oil, and a second switch in circuit with the oil burner, said means opening said second switch on a rise in viscosity to a higher value than that which caused closing of said first switch and opening said second switch on a decrease in viscosity to a substantially lower value than that which causes opening of said first switch.

4. In a viscosity control system for delivering oil to a burner, an oil line, means responsive to variations in the viscosity of the oil in said line, a first switch for controlling an oil burner, said means opening said switch at two different predetermined values of viscosity, and maintaining said switch closed at all values between said predetermined values, and a second switch for controlling a heater for the oil, said means causing closure of said switch on an increase in viscosity to a value nearly as high as the highest of said two predetermined values.

5. A device of the character described comprising in combination, a main conduit through which oil flows, a by-pass conduit connected to

said main conduit, a pair of flow restricting means in said by-pass conduit, means responsive to the pressure of the oil between said flow restricting means, a contact arm movable by said pressure responsive means, a first stationary contact, said contact arm having sliding engagement with said stationary contact as long as the oil pressure between said restrictions remains between predetermined limits, a second stationary contact engaged by said switch arm as said pressure approaches one of said limits, said first stationary contact being in circuit with an oil burner connected to said main conduit, and said second stationary contact being in circuit with a heater for said oil.

6. A device of the character described comprising in combination, a conduit for delivering a viscous fuel to a burner, means movable in response to viscosity changes in said fuel, a contact arm movable by said means, and a stationary contact cooperating with said contact arm for controlling a circuit to a burner motor, said movable means being operative to separate said contacts and deenergize said burner motor when the viscosity of the fuel reaches a value at which the burner will not operate properly.

7. A device of the character described comprising in combination, a conduit for delivering a viscous fuel to a burner, means movable in response to viscosity changes in said fuel, a contact arm movable by said means, a first stationary contact cooperating with said contact arm for controlling a circuit to a burner motor, said movable means being operative to separate said contacts and deenergize said burner motor when the viscosity of the fuel reaches a value at which the burner will not operate properly, and a second stationary contact cooperating with said contact arm for controlling a circuit to a fuel heater, said movable means being operative to cause engagement of said last contacts to energize the heater before the viscosity attains a value at which the burner will be deenergized.

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