

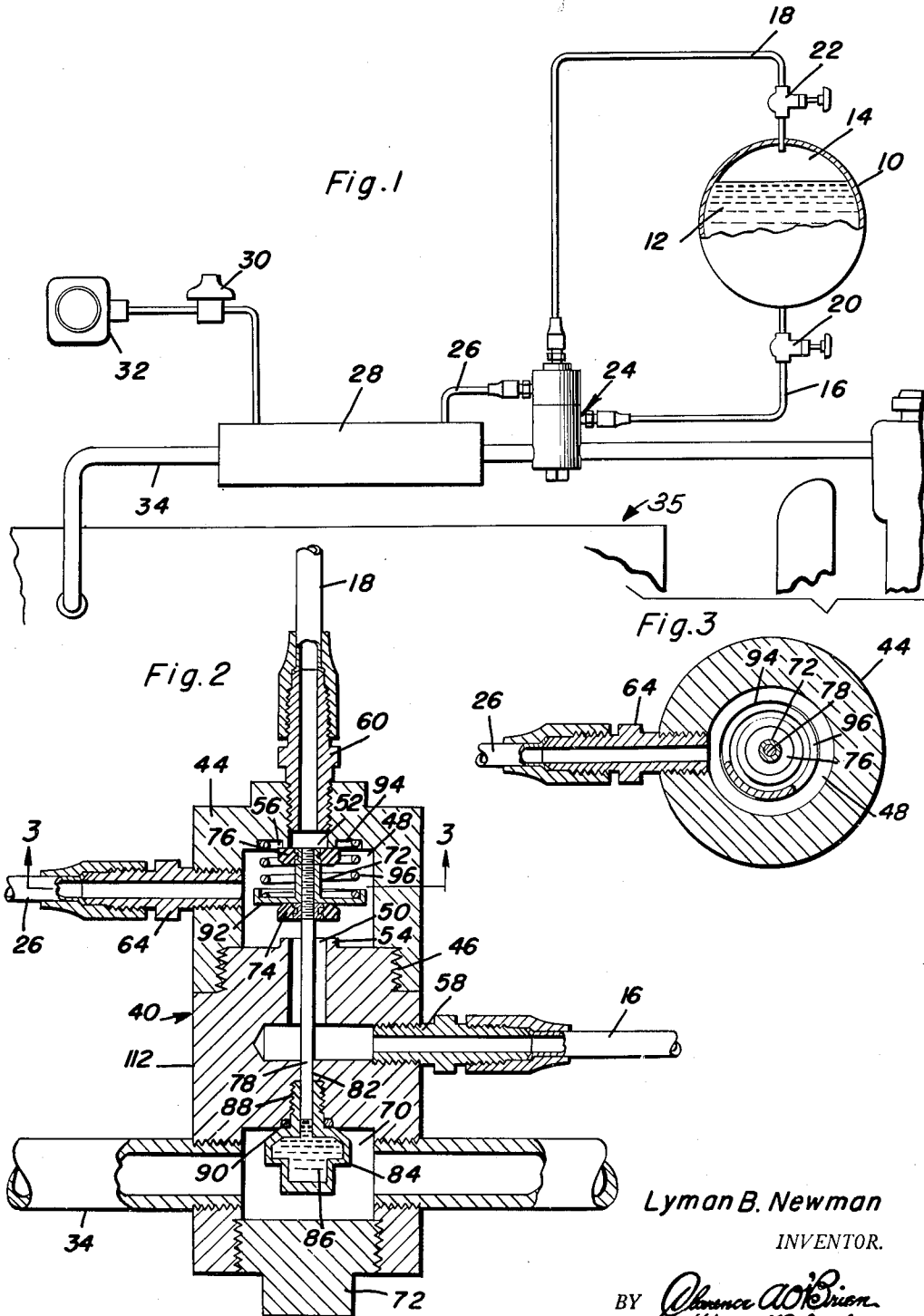
Oct. 4, 1955

L. B. NEWMAN
AUTOMATIC VALVE

2,719,518

Filed May 4, 1954

2 Sheets-Sheet 1



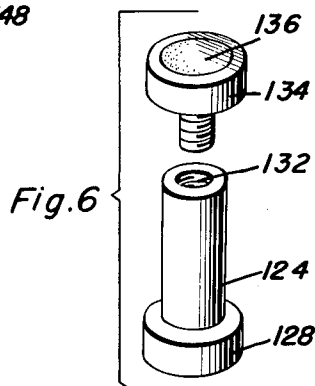
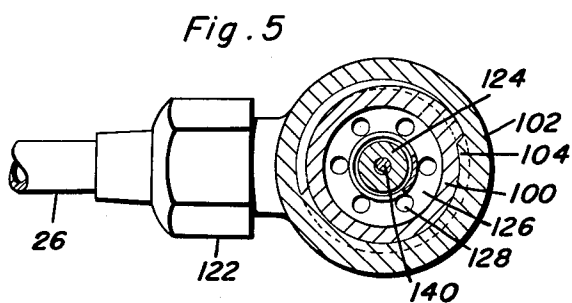
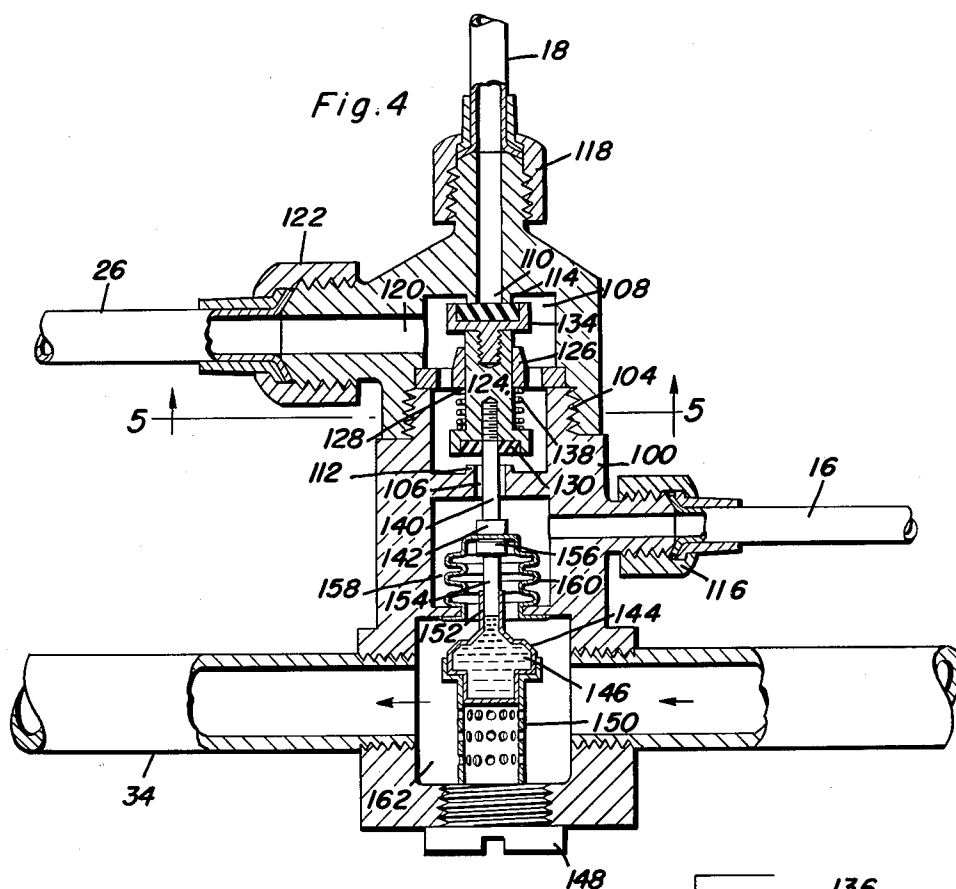
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AUTOMATIC VALVE

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6 Claims. (Cl. 123—120)

This invention relates to an automatic valve, and particularly to an automatic valve responsive to the temperature of a prime mover for determining the nature of the fuel fed thereto.

In the operation of prime movers such as internal combustion engines utilizing a vapor as a fuel, it is necessary that at all stages of the operation the fuel be fed in a vapor condition. It has heretofore been proposed to start the engine cold by drawing vapor from the top of a tank of vaporizable fuel and supplying this vapor through a suitable carburetor until such time as the engine has warmed up and suitable means are then used to vaporize the liquid fuel to continue the operation of the device. Usually it is found that the cooling fluid for the prime mover may be utilized to operate a heat exchanger to vaporize the liquid fuel and thus maintain the operation of the device after the initial starting by means of vapor given off in the usual fuel container.

In the construction according to the present invention, an automatic valve is provided with a valve chamber having first and second inlet ports with the first inlet port being connected to the source of fuel at a position to receive liquid fuel therefrom and the second inlet port being connected to the source of fuel at a position to receive gaseous or vapor fuel therefrom. An outlet port from the valve chamber that flows through a vaporizing device to a suitable carburetor for delivering the fuel to the prime mover. The valve is provided with a fluid chamber through which the cooling fluid of the prime mover flows and also the vaporizer is provided with a connection for the flow of cooling fluid from the prime mover with preferably the fluid chamber of the valve and the vaporizer being connected in series for the flow of cooling fluid therethrough. The valve is provided with a movable valve element which may move into closing position with either the first or second inlet ports and a thermostatic element is provided in the fluid chamber for controlling the position of the valve element so that while the prime mover is in cold condition, the second valve port will be open to receive vapor from the source of fuel, and after the engine has warmed up the first port will be opened to deliver fuel in a liquid condition. It will be apparent that the vaporizer, while cold, will not vaporize the material so that the vapor flowing from the tank will flow through the vaporizer substantially unchanged to the carburetor. However, as soon as the engine has warmed up, the heat of the cooling fluid will be delivered by the vaporizer to the liquid fuel to vaporize the same so that the flow of vapor to the engine will be substantially constant in all phases.

It is, accordingly, an object of the invention to provide an improved automatic valve.

It is a further object of the invention to provide an automatic valve responsive to the temperature of a prime mover.

It is a further object of the invention to provide a thermostatically controlled automatic valve.

It is a further object of the invention to provide a system

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for delivering vapor to a prime mover regardless of the temperature condition thereof.

Other objects and many of the attendant advantages of the present invention will be apparent from the following detailed description, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a schematic illustration of the vapor system according to the invention;

Figure 2 is a sectional elevation through the automatic valve;

Figure 3 is a cross-section through the automatic valve taken substantially on the plane indicated by section line 3—3 of Figure 2;

Figure 4 is a sectional elevation of a modification according to the invention;

Figure 5 is a cross-section through the modification of Figure 4, taken substantially on the plane indicated by the section line 5—5 thereof; and

Figure 6 is an exploded perspective of the reciprocating valve element.

In the exemplary embodiment according to the invention, a tank 10 contains a quantity of fuel 12 in a liquid phase and a quantity of fuel 14 in a vapor phase with the pressure of the vapor phase being responsive to the vapor pressure of the liquid at that temperature. A first connection 16 is applied to the tank 10 in a position to receive liquid fuel from the quantity 12 therein, and a second connection 18 is connected to the tank 10 to receive fuel from the vapor phase 14. A manual valve 20 is provided in the connection 16 and a manual valve 22 is provided in the connection 18.

An automatic valve 24 for connecting a discharge line 26 to either of the connections 16 or 18 includes a vaporizer 28 and an automatic control valve 40 for supplying vapor to a suitable carburetor 32. A conduit 34 is connected in the cooling fluid circulating system of the motor 35, shown diagrammatically, and is connected to the heat exchanger or vaporizer 28 and to the valve 24.

The valve 24 is constituted by a body preferably constructed of a plurality of parts for ease of construction and assembly. For example, the valve 24 may provide a body 40 having a lower portion 42 and an upper portion 44 joined together by means of suitable threaded connections 46. The body 40 is provided with a valve chamber 48 having a first inlet port 50 and a second inlet port 52 with a valve seat 54 about the inlet port 50, and a valve seat 56 about the inlet port 52. A connection 58 connects the first fuel connection 16 into the first inlet port 50, and a similar screw connection 60 connects the second fuel connection 18 into the second inlet port 52. A substantially similar connection 64 provides an outlet port connected into the valve chamber 48 and connects the valve chamber 48 to the vapor supply line 26.

The body 40 is likewise provided with a cooling fluid chamber 70 which is preferably closed by means of a suitable plug 72 so that the chamber 70 is readily accessible for various purposes. The circulating cooling fluid conduit 34 connects into the chamber 70 so that the cooling fluid circulates through the chamber 70.

The operating device for the valve proper comprises a reciprocating valve element 72 having valve closure disks 74 and 76. An actuating rod 78 is connected to the reciprocating valve element 72 by any suitable means such as the threaded connection 80. The actuating rod 78 extends through a suitable guide 82 in the body 40 and extends into a thermostatic device 84 having an expansible fluid 86 which operates on rod 78 as a piston to cause motion of the rod 78 upon expansion of the fluid 86. Preferably, the thermostatic device 84 is threadedly connected into the body 40 as at 88, and suitable fluid seal such as the O-ring 90 is provided between the thermostatic device 84 and the body 40. A

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spring seat 92 is provided on the reciprocating valve member 72 and an offset valve seat 94 is provided in the top of the chamber 72 and a biasing spring 96 is provided between the seats 92 and 94 and yieldingly urges the reciprocating valve element 72 into closing relation with the valve seat 54.

In the operation of this form of the device, while the cooling fluid in the chamber 70 is sufficiently cold, the fluid 86 will be contracted so that the spring 96 will cause the valve element 72 to close the aperture 50 and prevent the flow of liquid through the chamber 48. This likewise opens the second port 52 so that vapor may flow from the vapor phase 14 of the fluid supply source, and if the valve 22 is open, vapor may flow through this device through the cold vaporizer 28 in the valve 30 to the carburetor 32, from whence it will be supplied to the prime mover (not shown). At the time of starting the prime mover, valves 20 and 22 will normally both be opened and the flow of fuel will be in the vapor state because of the closing of the valve 72 on the seat 54. As the prime mover warms up, the cooling fluid circulating through the conduit 34 and the chamber 70 will likewise increase in temperature until such time as the increase in temperature causes the fluid 86 to expand, forcing the rod 78 upwardly to compress the spring 96 and open the first inlet port 50 so that liquid from the liquid stage 12 of the fuel source will go through the port 50 and the outlet port 64 into the supply line 26, where the temperature of the circulating cooling fluid in the heat exchanger or vaporizer 28 will cause vaporization of the liquid fuel to provide a flow of vapor through the automatic valve 30 and the carburetor 32.

It will thus be seen that the device automatically provides fuel in the vapor phase for initial starting operation but after the motor or prime mover has warmed up, will supply fuel in the liquid stage to be properly vaporized so that the vapor pressure in the source 10 will be maintained to properly force liquid material through the vaporizer 28.

In the exemplification according to Figure 4, the valve is constituted as a lower body member 100 to which is connected an upper body member 102 by means of a threaded connection 104. The first inlet port 106 is provided in a valve chamber 108 and a second inlet port 110 is provided in spaced opposed relation to the inlet port 106. The valve seat 112 is provided about the inlet port 106 and a valve seat 114 is provided about the inlet port 110. The compression coupling 116 connects the first fuel connection 16 into the first inlet port 106 and a similar compression union 118 will connect the second fuel connection 18 to the inlet port 110. The chamber 108 is provided with an outlet port 120 which will be connected to the fuel supply conduit 26 by means of a compression union 122. A reciprocating valve element 124 is positioned for movement between the valve seats 112 and 114 and is maintained in proper relation by means of a valve guide 126 secured in the chamber 108 preferably by being secured between the sections 100 and 102. The guide member 126 is provided with a plurality of ports 128 so that fluid may readily pass from the inlet 106 through the guide plate 126 and out through the outlet port 120.

The valve element 124 is provided with an enlarged end 128 in which is seated a compressible valve material 130. The top end of the valve element 124 is provided with a threaded aperture 132 into which is threaded a valve end 134 having a compressible valve material 136 therein. A biasing spring 138 is mounted about the valve element 124 and seats on the guide 126 and the enlarged end 128 to resiliently urge the valve into seating relation with the seat 112. A valve actuating rod 140 is threadedly engaged with the valve member 124 and extends through the first inlet port 106 and is provided with a head 142.

The actuating device for the valve element 124 com-

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prises a thermostatic element 144 having an expansible liquid 146 therein and mounted on a suitable plug member 148 by means of a perforated housing 150. An extending neck 152 provides an actuating cylinder in which is mounted an actuating piston 154 which terminates in an actuating head 156. To provide a suitable fluid-tight seal between the valve chamber and the cooling fluid chamber, an auxiliary chamber 158 is provided and a bellows-type seal 160 is connected between the chamber 158 and the cooling fluid chamber 162. The head 156 of the actuating piston 154 will contact one side of the bellows seal, while the head 142 of the actuating rod 140 will contact the opposite side of the device so that the devices are in substantial opposition and the spring 138 will return the piston 154 upon the contraction of the fluid 146.

In the operation of this embodiment of the invention, the spring 138 will maintain the valve element 130 in contact with the seat 112 during the cold periods of the prime mover, and after the prime mover is warmed up the expansion fluid 146 will move the actuating piston 154 to actuate the actuating rod 140 to lift the valve 124 off of the seat 112 and to close the valve element 136 onto the seat 114 so that after the prime mover has reached a sufficient temperature, the fluid control will be switched from the vapor phase to the liquid phase, which will properly supply the desired quantity and quality of fuel to the various operating conditions of the device.

For purposes of exemplification, particular embodiments of the invention have been shown and described according to the best present understanding thereof. However, it will be apparent to those skilled in the art that various changes and modifications may be made in the construction and arrangement of the various parts thereof without departing from the true spirit and scope of the invention.

What is claimed as new is as follows:

1. A feed valve for a vapor burning, fluid cooled prime mover comprising a valve body having a fluid chamber and a valve chamber therein, a first inlet port in said valve chamber adapted to be connected to the liquid stage of a source of vaporizable fuel, a second inlet port adapted to be connected to the vapor stage of a source of vaporizable fuel, an outlet port adapted to be connected to a fuel vaporizer, said first and second inlet ports being arranged in opposition, a double ended valve element mounted for movement between said first and second inlet ports, valve seats about said inlet ports, means adapted to circulate the cooling fluid of the prime mover through said fluid chamber, a temperature responsive device mounted in said fluid chamber, an actuating rod operatively connecting said temperature responsive device to said valve element.

2. A vapor feed system for a vapor burning prime mover having a circulating fluid cooling system, comprising a source of vaporizable liquid fuel, a first connection supplying liquid from said source, a second connection supplying vapor from said source, a vaporizer, a selector valve operable to selectively communicate said vaporizer with said first or second connection, means responsive to the temperature of the circulating cooling fluid operative to determine the operation of said selector valve.

3. A vapor feed system for a vapor burning prime mover having a circulating fluid cooling system, comprising a source of vaporizable liquid fuel, a first connection supplying liquid from said source, a second connection supplying vapor from said source, a vaporizer, a selector valve including a valve body having a valve chamber and a cooling fluid chamber therein, a first and second inlet port in said valve chamber, said first port being communicated with said first connection, said second port being communicated with said second connection, an outlet port communicated with said vaporizer, means communicating said cooling fluid chamber with the circulating cooling

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fluid system, thermostatic actuating means responsive to the temperature of the fluid in said cooling fluid chamber, a valve element in said valve chamber operatively connected to said thermostatic actuating means to open one of said ports and close the other.

4. A vapor feed system for a vapor burning prime mover having a circulating fluid cooling system, comprising a source of vaporizable liquid fuel, a first connection supplying liquid from said source, a second connection supplying vapor from said source, a vaporizer, a selector valve including a valve body having a valve chamber and a cooling fluid chamber therein, a first and second inlet port in said valve chamber, said first port being communicated with said first connection, said second port being communicated with said second connection, an outlet port communicated with said vaporizer, means communicating said cooling fluid chamber with the circulating cooling fluid system, said inlet ports being in spaced opposed relation, a valve seat about each of said inlet ports, a valve element selectively movable into and out of closing relation with said inlet ports, an expanding thermostat responsive to the temperature of the fluid in said cooling fluid chamber, an actuating rod operatively connected between said valve element and said expanding thermostat.

5. A vapor feed system for a vapor burning prime mover having a circulating fluid cooling system, comprising a source of vaporizable liquid fuel, a first connection supplying liquid from said source, a second connection supplying vapor from said source, a vaporizer, a selector valve including a valve body having a valve chamber and a cooling fluid chamber therein, a first and second inlet port in said valve chamber, said first port being communicated with said first connection, said second port being communicated with said second connection, an outlet port communicated with said vaporizer, means communicating said cooling fluid chamber with the circulating cooling fluid system, said inlet ports being in spaced opposed relation, a valve seat about each of said inlet ports, a valve element selectively movable into and out of closing relation with said inlet ports, an expanding thermostat respon-

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sive to the temperature of the fluid in said cooling fluid chamber, an actuating rod operatively connected between said valve element and said expanding thermostat, spring means yieldingly urging said valve element into closing relation with said first inlet port.

6. A vapor feed system for a vapor burning prime mover having a circulating fluid cooling system, comprising a source of vaporizable liquid fuel, a first connection supplying liquid from said source, a second connection supplying vapor from said source, a vaporizer, a selector valve including a valve body having a valve chamber and a cooling fluid chamber therein, a first and second inlet port in said valve chamber, said first port being communicated with said first connection, said second port being communicated with said second connection, an outlet port communicated with said vaporizer, means communicating said cooling fluid chamber with the circulating cooling fluid system, said inlet ports being in spaced opposed relation, a valve seat about each of said inlet ports, a valve element selectively movable into and out of closing relation with said inlet ports, an expanding thermostat responsive to the temperature of the fluid in said cooling fluid chamber, an actuating rod operatively connected between said valve element and said expanding thermostat, spring means yieldingly urging said valve element into closing relation with said first inlet port, a fluid-tight seal between said actuating rod and said body.

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