July 12, 1932. S. ISHIKAWA 1,867,457

CHARGE FORMING DEVICE FOR INTERNAL COMBUSTION ENGINES

Filed March 13, 1931 2 Sheets-Sheet 1

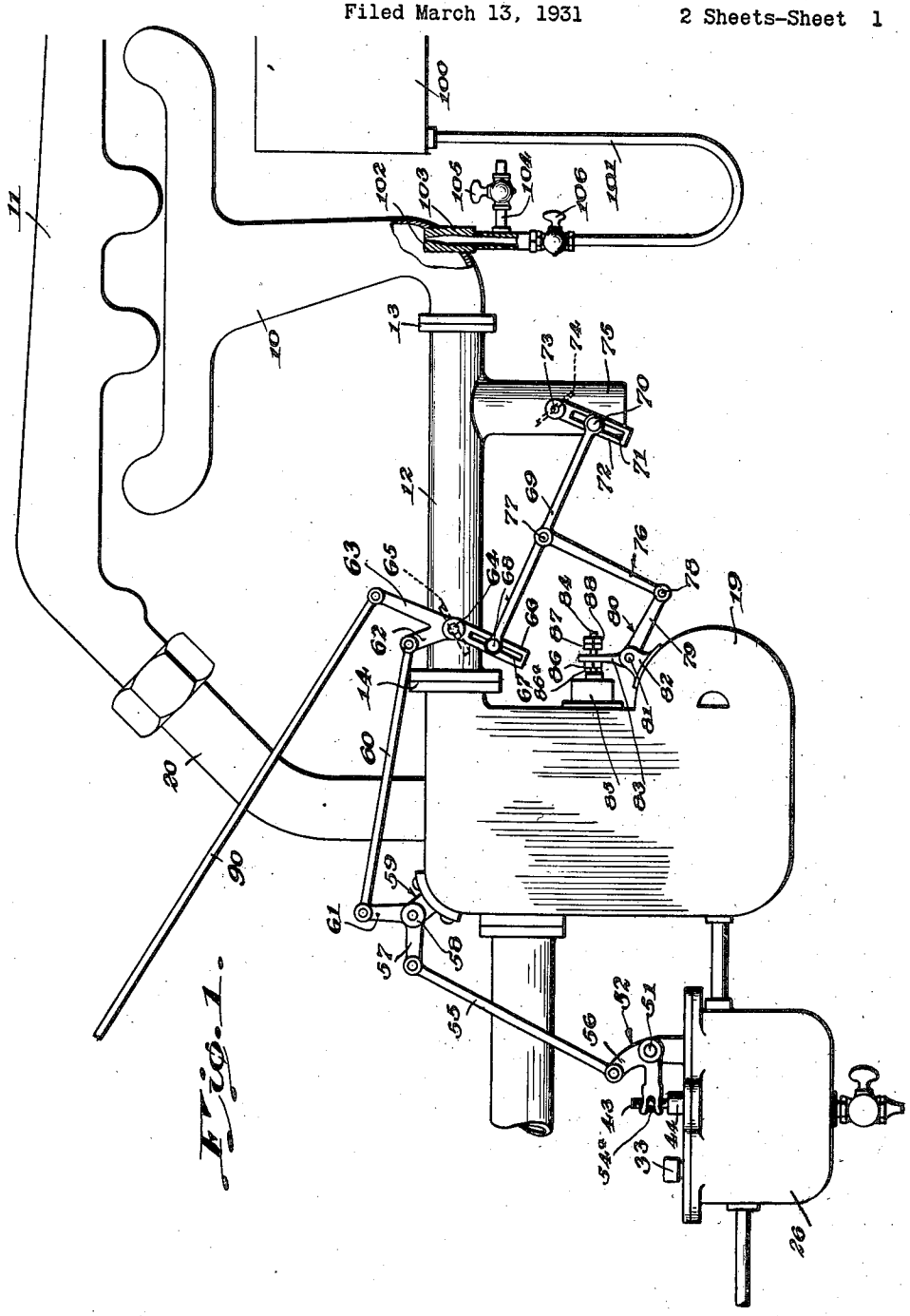


Fig. 1.

WITNESS

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Fig. 2.

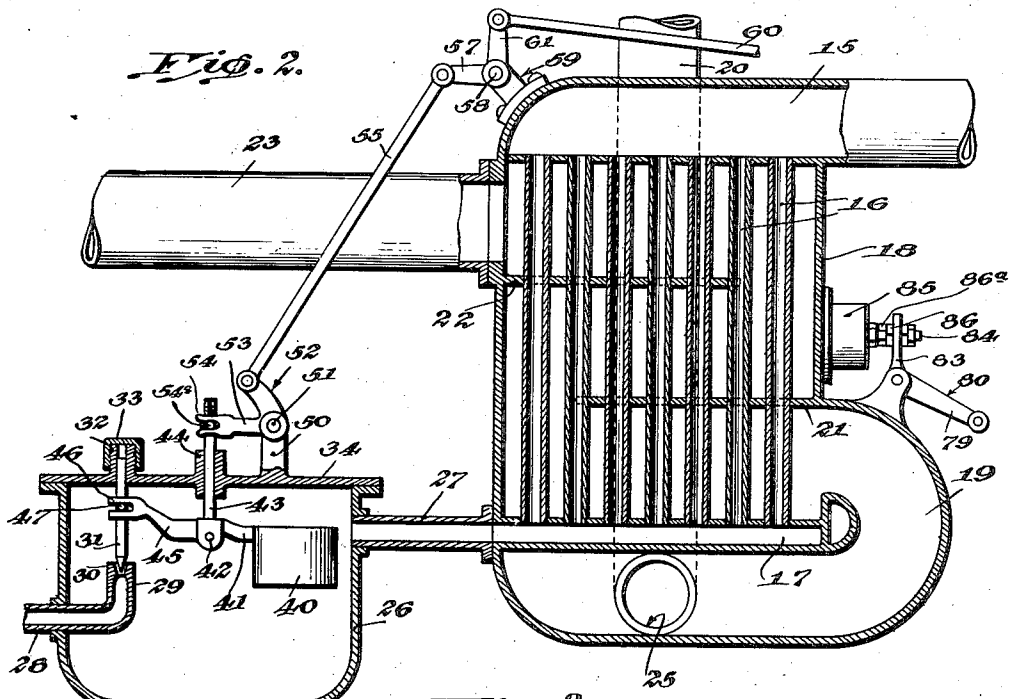


Fig. 3.

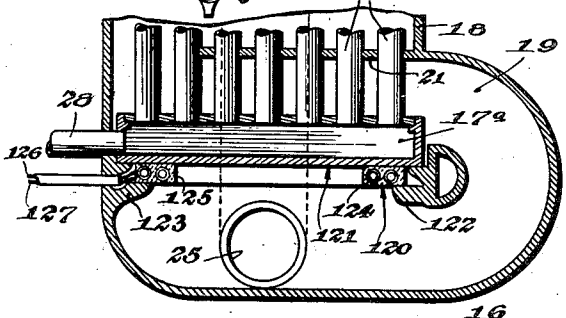
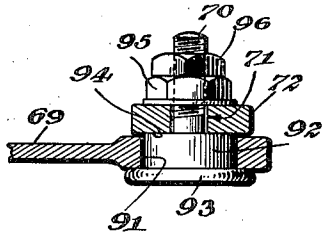


Fig. 5.



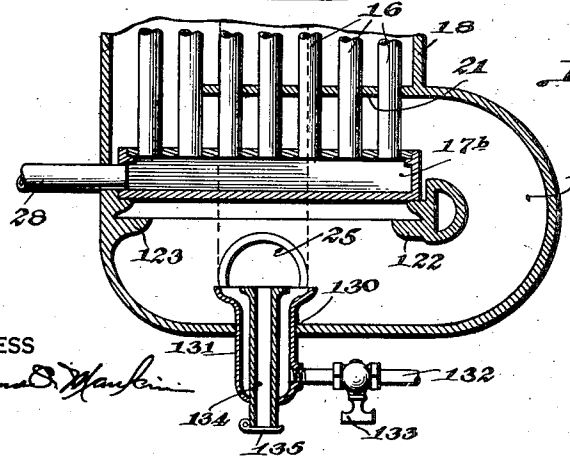


Fig. 4.

WITNESS

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UNITED STATES PATENT OFFICE

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CHARGE FORMING DEVICE FOR INTERNAL COMBUSTION ENGINES

Application filed March 13, 1931. Serial No. 522,413.

This invention relates to a charge forming device for using a plurality of fuels.

An object of the invention is the provision of a charge forming device in which a light fuel is used for initially starting the engine and which may be cut off to permit a supply of vapor to be drawn into the engine cylinders from a source of heavy fuel so that the engine may be operated upon the vapors of a heavy fuel when the exhaust gas has heated a vaporizing chamber sufficiently to create the vapors.

Another object of the invention is the provision of a charge forming device which will permit an initial starting on light hydrocarbon and the general operation of the engine may be continued with the vapors from the heavy oil which has passed through a vaporizing chamber heated by the exhaust gases which controls from the usual accelerator pedal for varying the mixture of air and vapor during the general operation of the engine.

A further object of the invention is the provision of a charge forming device for generally operating the engine upon the vapors of heavy oil, manual means being employed through a series of levers to control the mixture of air and heavy oil vapors to the intake of the engine, a thermostat control being employed in connection with the manual control which will automatically take care of the mixture of air and heavy oil vapors in accordance with the need of the engine.

This invention will be best understood from a consideration of the following detailed description, in view of the accompanying drawings forming a part of the specification; nevertheless it is to be understood that the invention is not confined to the disclosure, being susceptible of such changes and modifications which shall define no material departure from the salient features of the invention as expressed in the appended claims.

Figure 1 is a side view in elevation of a charge forming device constructed in accordance with the principles of my invention;

Figure 2 is an enlarged vertical section of a vaporizing member in communication with a heavy oil supply;

Figure 3 is a fragmentary vertical section of a modified form of the vaporizing chamber;

Figure 4 is a fragmentary vertical section of a further modified form of the vaporizing chamber; and

Figure 5 is a vertical section, showing the method of connecting the links with operating levers.

Referring more particularly to the drawings, 10 designates an intake manifold and 11 an exhaust manifold. An intake conduit 12 is connected at one end, as shown at 13, to the intake manifold 10 and at its other end, as shown at 14, to a header 15 of a vaporizing chamber which includes vertical pipes 16 and a lower header 17. The pipes 16 are in direct communication with the headers 15 and 17.

A heating chamber consists of a housing 18 having an enlarged portion 19 at its lower end, into which are discharged the exhaust gases from an exhaust pipe 20 which is connected with the exhaust manifold 11. Baffles 21 and 22 extending partially across the heating chamber 18 with their ends in staggered relation tend to cause the exhaust gases to have a tortuous path through the heating chamber 18 and around the tubes 16 before they are discharged into an exhaust pipe 23 which terminates at the rear end of the automobile. In view of the fact that the exhaust gases are muffled in the heating chamber 18 and in the enlargement 19, the usual muffler may be dispensed with in order to eliminate back pressure on the engine.

The lower header 17, is directly above a port 25 which provides the communication between the exhaust pipe 20 and the enlargement 19 of the heating chamber. The bottom of the header 17 is directly in contact with the hot gases so that vaporization of the heavy oil from the float tank 26 are initiated so that in effect the header 17 forms the principal element of the vaporizing chamber.

The float tank 26 is connected by means of a conduit 27 with the header 17. A pipe 28 is in communication at one end with a source of supply of heavy oil, while the other end,

as shown at 29, projects upwardly into the float tank 26 into a nozzle 30 which is controlled by a needle valve 31. The upper end of the needle valve is slidably mounted in a hollow boss 32 embraced by a cap 33 to guide and limit upward movement of the needle valve. The boss 32 is mounted upon a closure 34 which is secured in any approved manner to the top of the float tank 26. A drain 35 controlled by a valve 36, is connected with the bottom of the tank.

A float 40 carried by an arm 41, which is pivoted at 42 upon a rod 43 is slidably mounted within a boss 44 carried by the cover 34. The arm 41 has an extension 45, which is provided with a fork 46 embracing a pin 47 secured to the needle valve 31, so that when the rod 43 is elevated the needle valve will likewise be elevated.

A bracket or arm 50 is carried by the cover plate 34 and has pivoted thereon at 51 a bell crank lever 52 having one arm 53 provided with a fork 54 which embraces a flat wing nut 54*a* adjustably threaded on the rod 43.

A link 55 connects an arm 56 of the bell crank lever 52 with an arm 57 of a bell crank lever 58 pivotally mounted upon a bracket 59 which is secured to the header 15. A link 60 connects the other arm 61 of the bell crank lever 58 with an arm 62 projecting at an acute angle from a lever 63 which is secured rigidly to a shaft 64 which is carried by the conduit or pipe 12. Fixed to the shaft 64 is a valve or throttle 65, which is adapted to control the passage of vapors through the pipe 12 from the vaporizing chamber.

The lever 63 has an extension 66 which is provided with a longitudinal slot 67 in which is mounted a pin 68 carried by one end of a link 69. The other end of the link also carries a pin 70, which is mounted within a slot 71 formed longitudinally of a lever 72. This lever is rigidly mounted upon a shaft 73 which carries a throttle 74 mounted within a conduit 75 which is in open communication with the conduit 12 at one end and open to the atmosphere at the other.

A link 76 is pivotally connected at 77 with the link 69 and intermediate the ends of said link. The link is also pivotally connected at 78 with one arm 79 of a bell crank lever 80, which is pivotally mounted at 81 upon a bracket 82 carried by the enlargement 19 of the heating chamber 18. The other arm 83 of the bell crank lever 80 is slotted to receive a rod 84 which is connected with a thermostat 85. The thermostat is adapted to be affected by the heat of the heating chamber 18 in order to move the rod 84 outwardly. A nut 86 provided with a locknut 86*a* is threaded onto the rod 84 and is located between the arm 83 and the thermostat 85. A nut 87 is arranged upon the rod at the opposite side of the arm 83 and a lock nut 88 maintains the nut 87 in position. A throttle rod 90 is connected with the outer end of the lever 63 and extends to a point adjacent the dash of the automobile, so that the rod may be operated by either the hand or the foot.

Referring more particularly to Figure 5 the particular construction of either the pin 68 or 70 is disclosed. The link 69 has an opening, as shown at 91 to receive the enlarged portion 92 of the pin 70. The pin is provided with a shoulder 93 which engages the outer face of the link 69. Where the pin 70 is connected with the enlargement 92 is formed a shoulder 94 which is engaged by the lever 72. The pin it will be seen passes through the elongated slot 71 of the lever 72. A nut 95, which is threaded onto the pin 70, engages the lever 72, while a lock nut 96 engages the nut 95 and retains it against movement.

A tank 100 is adapted to be filled with gasoline, and has an outlet pipe 101 connected with a nozzle 102 which projects into the intake manifold 10. Embracing the nozzle is a sleeve 103, which is adapted to supply air in embracing relation with the nozzle 102 and a pipe 104 connects the sleeve with the atmosphere. A valve 105 controls the flow of air through the sleeve 103, while a valve 106 controls the flow of gasoline from the tank 100 to the nozzle 102.

Figure 3 shows a modified form of the invention, and an electrical heater, generally designated by the numeral 120, is located within the enlargement 19 of the heating chamber 18, and is held in place upon the bottom 121 of a header 17ª by means of flanges 122 and 123 formed integrally on the inner wall of the enlargement 19. Resistance wires 124 are set in insulated material 125 and are connected with wires 126 and 127 which lead through a switch, not shown, to the battery of the automobile, likewise not shown. In this construction when the current is turned on the electrical heater 120 will heat the header 17ª and aid in the initial vaporization of the heavy oil from the float tank 26.

In Figure 4 is shown a heating chamber 19ª, which is a modified form of the heating chamber 19 in that it has an opening 130 in the bottom thereof in which is inserted a gasoline burner 131. This burner is connected with a pipe 132 which supplies gasoline from a suitable source and is controlled by a valve 133. An air intake 134 controlled by a gate valve 135, is adapted to supply air to the burner when it is desired to heat the header 17ᵇ. This header is supported upon flanges 122 and 123 formed integral with the enlargement 19ª. In starting the engine, the burner may be lighted so that the header 17ᵇ is heated in order to vaporize the heavy oil coming from the float tank 26.

The operation of my device is as follows:

In the ordinary operation of the engine the valves 105 and 106 are opened in order to

permit air and gasoline to be drawn as a mixture into the intake manifold and into the engine so that when the engine is turned over by the usual starter the engine will be operated upon the mixture of gasoline and air. When the engine has been sufficiently heated, exhaust gases passing into the chamber 18 for heating the header 17 and the pipe 16, the oil from the float tank 26 will be vaporized and will be drawn into the header 15, the conduit 12 and the intake manifold 10. During the manual control of the valves 65 and 74 the pins 68 and 70 are located approximately centrally of the respective slots 67 and 71 so that the valves 65 and 74 will be operated simultaneously and approximately through the same angles. Where conditions require a variation between the operation of the valve 65 and the valve 74, the nuts 95 and 96 may be loosened and the position of the pins 68 and 70 may be adjusted toward or away from the respective shafts 64 and 73 in order to increase or decrease the amount of closing the valves 65 and 74 or of opening the valves. It is also possible to adjust the pins 68 and 70 along their respective slots in order to create a variation of the relative opening and closing of the valves 65 and 74. These valves and the levers 63 and 72 are manually operated by the rod 90. When the levers are actuated the bell crank 58 is rocked, and likewise the bell crank 52, so that the rod 43 in the float tank 26 may be elevated or lowered to raise or lower the float controlling the needle valve 31 in order to permit more oil to flow into the tank 26 or to cut off the supply of the oil. In other words actuation of the rod 90 varies the flow of the heavy oil to the tank 26 while controlling the operation of the valves 65 and 74.

When it is desired to operate the charge forming device by means of the thermostat 85, it is only necessary to adjust the nuts 86, 87 and 88. The nuts on the pin 68 are likewise loosened in order to permit the pin 68 to be free to move up and down within the slot 67 of the extension 65 of the lever 66. The pin 70 however is placed midway between the end of the lever 71 and secured in this position. The arm 79 of the bell crank lever 80 is moved towards the thermostat 85 so that the arm 79 will be elevated to substantially the highest point with the pin 68 being located at the extreme upper or inner end of the slot 67 in the extension 66 of the lever 63.

When the heat of the heating chamber 18 is sufficient to operate the thermostat 85, the rod 84 is moved outwardly thereby moving the arm 83 away from the thermostat and thereby lowering the arm 79. At this time the pin 68 will be moved downwardly in the slot 67 of the arm 66, thereby slightly moving the throttle valve 65. This downward swinging movement of the pin 68 and the arm 79, the link 76 and the rod 69 will likewise tend to move downwardly thereby moving the lever 72 toward the left in Figure 1 so that the throttle valve 74 will be opened a greater degree. In other words, when the engine is hot, a greater percentage of air will be required in proportion to the amount of vapors entering the engine for the proper operation of said engine thus a leaner mixture will be provided.

When the thermostat is thus in operation and the pin 68 has been drawn down in the slot 67 by the action of the arm 79 upon the attached rods 76 and 69, the effect will be to increase its radial distance from the center of rotation of the throttle valve at 64, thus lengthening the arc of motion and increasing the motion of rod 69 in operating lever 72 and air throttle valve 74, so that when rod 90 is operated manually the effect will be to produce a greater range of motion in the air throttle 74 in relation to the opening of the gas throttle 65.

I claim:

1. A charge forming device for internal combustion engines comprising an intake manifold, a vaporizing chamber, an exhaust heater embracing the vaporizing chamber, a conduit connecting the chamber with the intake manifold, an air inlet connected with the conduit, a valve for controlling the air inlet, a throttle valve in the conduit, means operatively connecting the air inlet valve with the throttle valve for manual actuation, means for supplying the vaporizing chamber with a heavy fuel, means included in the operative connection between the air inlet and throttle valve for causing a differential movement between the air inlet valve and the throttle valve.

2. A charge forming device for internal combustion engines comprising an intake manifold, a vaporizing chamber, an exhaust heater embracing the vaporizing chamber, a conduit connecting the chamber with the intake manifold, an air inlet connected with the conduit, a valve for controlling the air inlet, a throttle valve in the conduit, means operatively connecting the air inlet valve with the throttle valve for manual actuation, means for supplying the vaporizing chamber with a heavy fuel, a thermostat associated with the exhaust heater, means operatively connecting the thermostat and the valves for automatically controlling the valves in accordance with the temperature of the exhaust heater.

3. A charge forming device for internal combustion engines comprising an intake manifold, a vaporizing chamber, an exhaust heater embracing the vaporizing chamber, a conduit connecting the chamber with the intake manifold, an air inlet connecting with the conduit, a valve for controlling the air inlet, a throttle valve in the conduit, means

operatively connecting the air inlet valve with the throttle valve for manual actuation, means for supplying the vaporizing chamber with a heavy fuel, a valve for controlling the supply of heavy fuel, means operatively connecting the supply valve with the throttle valve and the air inlet valve for simultaneous operation of said valve, a thermostat associated with the exhaust heater, means operatively connecting the thermostat with the connecting means between the throttle valve and the air inlet valve for automatically actuating all of the valves.

4. In a charge forming device, a vaporizer comprising a heating chamber, means for supplying exhaust gases from an internal combustion engine to the bottom of the heating chamber, a header extending across the bottom of said chamber, adjacent to where the exhaust gases enter the chamber, a header at the top, pipes connecting the two headers, and means for supplying the lower header with a heavy fuel, the heating chamber having an enlarged portion embracing the bottom header, spaced baffles in the heating chamber, one of the baffles extending from the upper end of the enlarged portion.

5. A charge forming device comprising a heating chamber, a vaporizing chamber in the heating chamber, a flow tank in communication with the vaporizing chamber, means for supplying the tank with heavy fuel, a valve for controlling the supply of fuel to the tank, a float for controlling the actuation of the valve, and manual means for moving the valve to an inoperative position, a conduit leading from the vaporizing chamber, a throttle in the conduit, an air inlet connected with the conduit, a valve for controlling the admission of air to the conduit, means connecting the throttle and air inlet valves together, means connecting the fuel supply valve with the throttle valve, and means included in the operative connections between the air inlet valve and the throttle valve for causing a differential movement between the air inlet valve and the throttle valve.

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