May 16, 1950 S. M. UDALE 2,508,312

MANIFOLD INJECTION CARBURETOR

Filed May 18, 1946

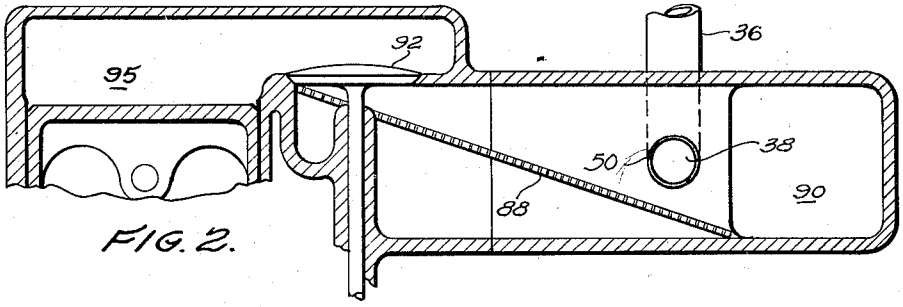


FIG. 2.

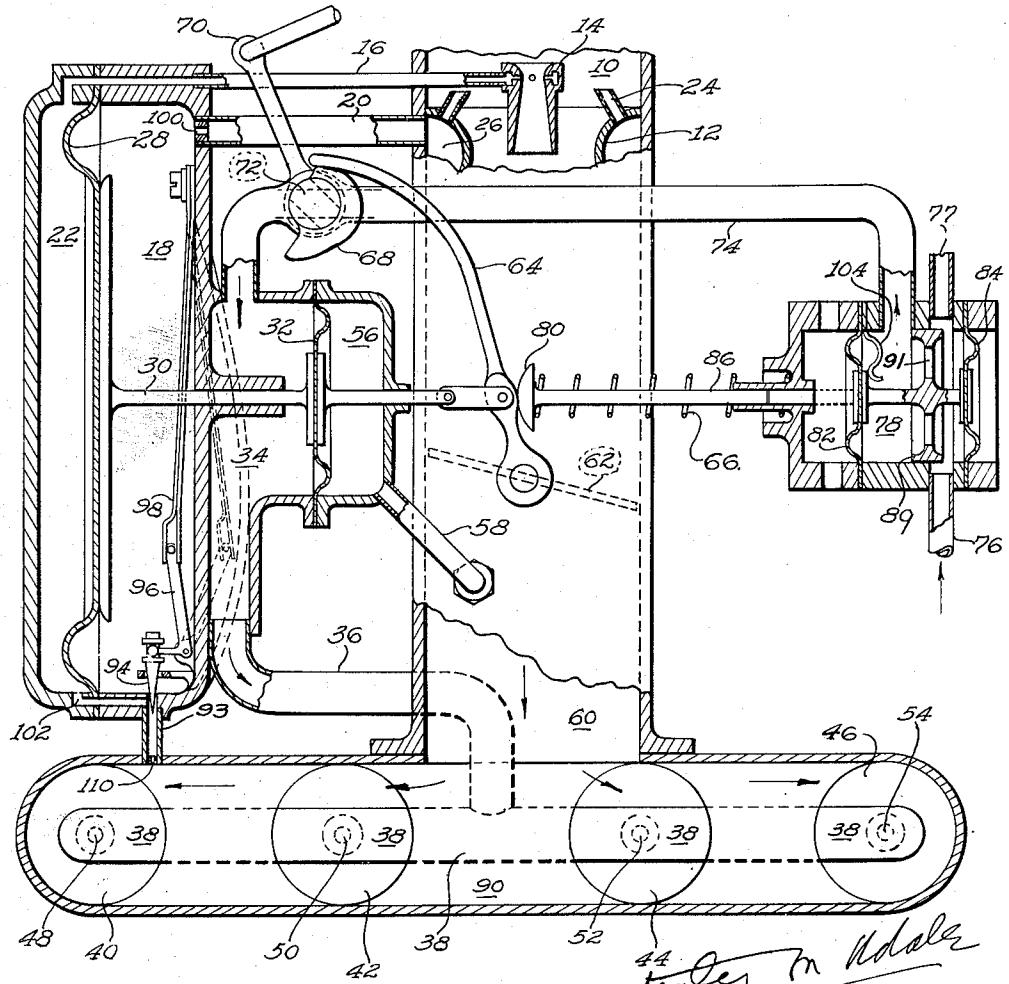


FIG. 1.

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MANIFOLD INJECTION CARBURETOR

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2 Claims. (Cl. 123—119)

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The object of this invention is to simplify the means shown in my Patent No. 2,399,077 issued April 23, 1946, for aircraft and to apply them to carburetors for ordinary automotive vehicles, boats, and stationary engines.

The idea is briefly to throttle on the fuel and not on the air so that the problem of acceleration is largely eliminated.

Another object is to correct for temperature.

Another object is to provide means whereby the fuel is discharged simultaneously at all ports and uniformly distributed without the use of a distributor. During the interval between induction strokes in the combustion chamber 95 the fuel is caught on a screen and removed from the screen when it is the inlet valve's turn to open. By this means it is possible to obtain the result heretofore only obtainable by the use of a distributor. Fig. 1 shows in partial cross-sectional elevation a view of the fuel/air ratio controlling means. Fig. 2 shows a cross-sectional elevation through an inlet manifold and one cylinder of a multicylinder engine.

10 is the air entrance, 12 is a venturi therein, 14 is a small venturi discharging into the throat of the larger venturi, 16 is a pipe connecting the throat of the small venturi 14 with the chamber 22, 24 are impact tubes carried by the venturi 12, 20 is a pipe connecting the chamber 26 to the chamber 18, 28 is a diaphragm separating the chamber 22 from the chamber 18, 30 is a small rod engaging with and connected to the large diaphragm 28 and to the smaller diaphragm 32 which forms the right-hand wall of a chamber 34, which is connected through a pipe 36 with a fuel manifold 38, which discharges fuel into the ports 40—42—44—46 through the orifices 48—50—52—54.

To the right of the diaphragm 32 is a chamber 56 connected through a pipe 58 with an inlet passage 60 on the engine side of a throttle 62. A throttle lever 64 is rotated anti-clockwise by a compression spring 66 and engages with the cam 68, which is moved anti-clockwise to open by a manually-controlled lever 70. A valve 72 controls the flow of fuel through a passage 74. 76 and 77 are inlet fuel passages which deliver fuel to a chamber 78 past a balanced valve 89. The valve 89 is supported at both ends by two diaphragms 82 and 84. A relatively weak spring 104 is provided to open the valve 89 slightly so that at low fuel flows the full fuel pressure is applied to the manually operated valve 72 when this valve 72 is in the position shown, that is, when it is almost closed. A rod 86, which is pushed

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to the left by the spring 66 engages with the head 80 of the rod 86 so as to engage with the lever 64. Lever 64, thus engages with the cap 82 of the rod 86 which engages with the diaphragm 82 when it is pushed to the right, that is, when the throttle 62 is wide open so that the valve 80 is moved away from the open position when the throttle 62 opens to the wide-open position, when throttle 62 is moved beyond the wide-open position the valve 89 is moved towards the closed position. The valve 89 is perforated with openings 91.

In Fig. 2, the fuel inlet manifold 38 is shown discharging fuel against a perforated screen 88. The air inlet manifold 90, which is shown in cross-section, delivers air both across the perforated screen 88 and through the perforated screen 88. Vaporized fuel therefore arrives at the opening around the engine inlet valve 92 and thus enters the combustion chamber 95 in condition to be exploded.

In order to make some correction for temperature, no correction being made for pressure, a passage 102 is provided connecting the chamber 22 and 18 together. A passage 93 with a restricted outlet 110 acts as a drain for both chambers 18 and 22. The valve 94 is controlled by a lever 96 which is moved by the thermostatic bimetal element 98. A restriction 100 in the passage 20 renders the valve 94 effective at high temperature to vary the pressure in the chamber 18 so that when the air density falls by reason of an increase in temperature the mixture tends to remain approximately constant. The thermostat 98 thus prevents the mixture becoming rich at high temperature. At high temperatures the density of the air falls and without a thermostat the mixture would become rich. If the valve 94 is made to open at high temperature then there is less pressure difference acting on diaphragm 28 at any given air flow, which thus calls for less fuel so that the fuel/air ratio is maintained constant. The passage 93 maintains air flow over the thermostat 98 so that the temperature in the chamber 18 is approximately the temperature in the air entrance 10.

Operation

The fuel valve 89 is a balanced valve, hence when it is moved to the right, due to a reduction in airflow, a reduction in fuel flow to balance the reduced air flow causes valve 89 to move to the left in response to an increase in suction in the small venturi 14 so that then the valve 89 admits more fuel to balance the increase

in air flow. Generally speaking these are the mechanical and aerodynamic means now in almost universal use for controlling the fuel/air ratio at a predetermined value for airplanes using reciprocating engines. The drop in pressure between the fuel chamber **34** and the inlet manifold **60** causes a flow through the restricted orifices **48—50—52—54**. This drop in pressure also acts on the diaphragm **32** which diaphragm **32** is moved thereby to oppose the motion referred to of the airflow responsive diaphragm **28**.

At idle the cam **68** determines the opening of the air throttle **62**. Another purpose for the cam **68** is to open the air throttle **62** when the fuel throttle **72** is first opened. The air throttle **62** should only be opened slightly under this condition as it is necessary to give the fuel time to get ahead of the air during acceleration.

Once the fuel throttle **72** stops moving the air throttle continues to move under the influence of the increased fuel pressure in the chamber **34**. The air throttle **62** is thus moving at the moment when the automatic means take over and it continues to move until checked by the suction in the air chamber **22** acting on the diaphragm **28**. During the interval when the inlet valve **94** is closed the fuel continues to discharge on to the screen **88**. When the valve **94** opens the fuel deposited on the screen **88** is picked up and vaporized. The valve **89** admits fuel through openings **91** from pipes **76** and **77** to the pipe **74**. The restriction formed to the right of the lip of the valve **89** restricts the flow of fuel automatically once the empirical control responsive to the valve **72** admits sufficient fuel to allow the diaphragms **28, 32, 82** and **84** to function.

What I claim is:

1. Means for fuel distribution in an internal combustion engine of the multi-cylinder type having a plurality of intermittently opened inlet valves and inlet ports associated therewith comprising means for continuously injecting a metered quantity of fuel into each port, a screen adjacent to each port adapted to absorb the fuel deposited thereon, said screens being so located that the air flowing through and over the screens absorbs the fuel deposited on said screens in the periods when the inlet valves are closed and the screen permits the air to respray the fuel back into the air stream during the periods when the inlet valves are open.

2. A multi-cylinder internal combustion engine, an air inlet, an air inlet manifold connected thereto having a plurality of air ports, a fuel inlet manifold having fuel discharge ports continuously open and discharging into each air port, a source of fuel under pressure, a venturi in the air inlet, automatic fuel flow restricting means responsive to the suction in said venturi and in which there is a screen in each air inlet port so located that the fuel discharged during the period that the engine inlet valve is closed is caught on said screen.

STANLEY M. UDALE.

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