

June 21, 1949.

M. MALLORY
FUEL TEMPERATURE CONTROL FOR
INTERNAL-COMBUSTION ENGINES
Filed Jan. 10, 1946

2,473,808

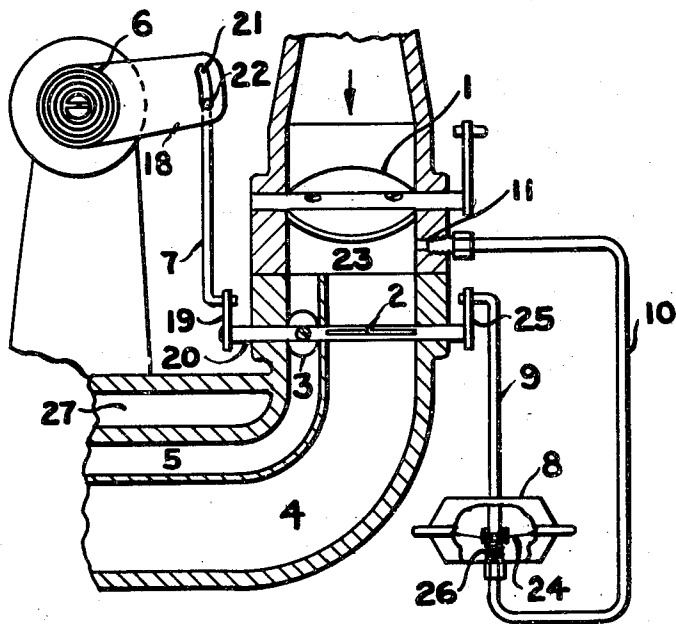


FIG-1

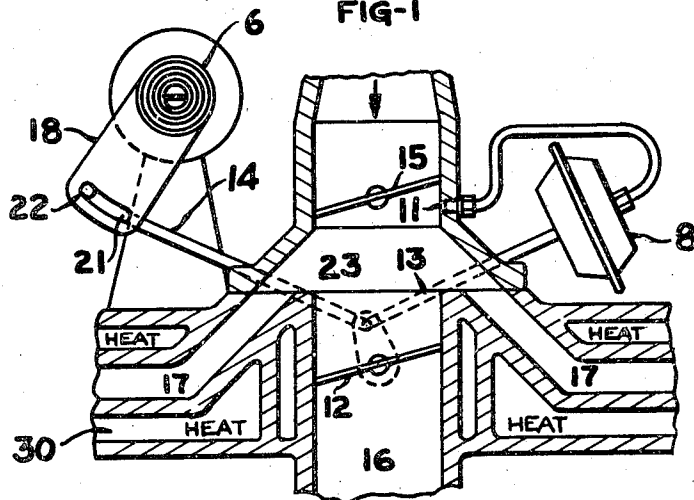


FIG-2

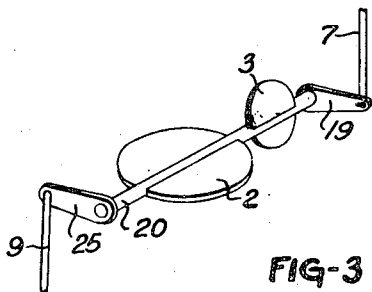


FIG-3

MARION MALLORY
INVENTOR

BY *Barnes, Kieule, Laughlin*
& Kirsch
 ATTORNEYS.

UNITED STATES PATENT OFFICE

2,473,808

FUEL TEMPERATURE CONTROL FOR
INTERNAL-COMBUSTION ENGINES

Marion Mallory, Detroit, Mich.

Application January 10, 1946, Serial No. 640,222

4 Claims. (Cl. 123—122)

1

This invention relates to a fuel temperature control for an internal combustion engine.

It is common practice in internal combustion engines to provide a hot spot under the carburetor over which the fuel passes. This hot spot assists in the atomization of the fuel. The hot spot is heated by the exhaust gases of the engine. In such a system a valve is located in the exhaust manifold for controlling the flow of exhaust gases so that a greater volume of exhaust gases pass around the hot spot when the engine is cold than when the engine is hot. In some cases the heating of the hot spot is regulated by the velocity of the exhaust gases and in other cases by thermostatic means which control the opening and closing of the valve. In such system the valve shafts often overheat due to the excessive heat in the exhaust gases and the valves stick. If the valve shafts are mounted loose enough to avoid sticking, then exhaust gases escape under the engine hood which find their way into the vehicle. If the control valve is operated by exhaust velocities and the engine is operated under part throttle, the valve will be almost closed due to the low exhaust velocities and the hot spot will get hot, but if the throttle is suddenly opened for full charge, the hot spot will not cool off quickly enough. This causes the charge to be expanded and in turn cause detonation and lost power. After the hot spot cools off when operating under wide open throttle and the carburetor throttle is brought to a part throttle condition, then the hot spot is cold and will take too long to warm up.

It is the object of this invention to overcome the delay in heating the fuel charges when the throttle is moved from a wide open position toward a closed position and to overcome the delay in cooling the fuel charges when the throttle is moved from part open position to wide open position, and at the same time to increase the velocities of the charge going to the engine cylinders when the engine is operating on part throttle.

In the drawing:

Fig. 1 is a fragmentary cross-sectional view of the carburetor and intake passageway of an internal combustion engine showing my control mechanism mounted therein.

Fig. 2 is a view similar to Fig. 1 but showing a modified form of my device.

Fig. 3 is a detail showing the cranks and links which actuate the shaft for the valves.

In the drawing the elements are referenced as follows: carburetor throttle valve 1 of the butterfly type, auxiliary throttle valves 2 and 3 of the butterfly type controlling the main fuel in-

2

take passageway 4 and the auxiliary fuel intake passageway 5. Valves 2 and 3 are mounted on a common shaft and positioned in perpendicular planes so that valve 2 opens as valve 3 closes and vice versa. Valves 2 and 3 are located between carburetor throttle 1 and the engine. Thermostat 6, which is a helical coil bimetal type thermostat, connected by link 7 to crank arm 19 fixed on valve shaft 20 which carries valves 2 and 3. Link 7 is connected to arm 18 of thermostat 6 with a lost motion connection in the form of an elongated slot 21 in which the bent end 22 of link 7 slides. Suction device 8 is connected to orifice 11 in the intake passageway 23 on the engine side of valve 1 by conduit 10. Diaphragm 24 of suction device 8 is connected by link 9 with crank 25 mounted on the end of shaft 20 opposite crank 19. Spring 26 acts against diaphragm 24 and through link 9 tends to hold valve 2 open.

The operation of my system is as follows: Assuming that the engine is cold, thermostat 6, acting through the lower end of slot 21, link 7, crank 19 and shaft 20, will tend to hold auxiliary valve 3 open and valve 2 closed and the fuel will now pass through manifold 5 which is in heat exchange relation with the exhaust gases flowing through chamber 27. Arm 18 of thermostat 6 moves clockwise as the temperature rises and counterclockwise as the temperature falls. Thermostat 6 will be positioned in heat exchange relation with the engine and for this purpose can be mounted on the carburetor or on the engine block or on the exhaust manifold. Spring 26 tends at all times to open valve 2 and close valve 3. After the engines get hot thermostat 6 will have moved arm 18 down or clockwise sufficiently so that end 22 of link 7 will be free or above the lower end of slot 21 and thermostat 6 will have no further effect on valves 2 and 3 as long as the engine remains hot. However, suction device 8 will now operate throttles 2 and 3 in accordance with the pressure conditions in the intake passageway 23 on the engine side of valve 1; for example, if throttle 1 is wide open, the pressure will be high at orifice 11, which pressure will become established in the suction chamber of suction device 8 so that suction device 8 will hold valve 2 open and close valve 3. When throttle 1 is moved toward closed position, the pressure at orifice 11 will drop, that is, the vacuum at orifice 11 in passageway 23 will rise thereby causing suction device 8 to move throttle 2 toward closed position and throttle 3 toward an open position. Thus, in my device the heat exchange between the exhaust gases 27 and auxiliary

manifold 5 is continuous so that manifold 5 is never cooled down. Thus, when the engine is cold, as shown in Fig. 1, or operating under light load or part throttle, Fig. 1, the fuel charge is passed through the hot spot or heated passageway 5 preparatory to entering the engine combustion chamber and when the engine is operating at wide open throttle or is hot, then valve 3 is closed and the fuel passes through the main intake passageway 4 preparatory to entering the combustion chamber and hot spot passageway 5 is bypassed.

By this operation I obtain immediate response or change in fuel temperatures in changing the load of the engine by throttle operation and I also increase the velocity and the temperature of the fuel charge when the engine is cold or working under light load. When the engine is cold and throttle valve 1 is open wide, then thermostat 6 will oppose suction device 8 so that valve 2 will remain closed and valve 3 open. In other words, bimetal coil 6 is more powerful than spring 26 in suction device 8 so that spring 26 cannot open valve 2 as long as the engine temperature is such that coil 6 opposes opening of valve 2. When the engine is cold, end 22 of link 7 will be positioned at the bottom of slot 21 so that any torque applied on shaft 20 by spring 26 will be ineffective to rotate valve shaft 20 and arm 19 downwardly which would be necessary to the opening of valve 2 and the closing of valve 3. However, as soon as the engine gets hot, arm 18 moves clockwise to bring end 22 of link 7 adjacent the upper end of slot 21 so that under such condition spring 26 of suction device 8 can open valve 2 whenever throttle valve 1 is opened to raise the intake passageway pressure at orifice 11.

In Fig. 2 the elements are numbered as follows: auxiliary valve 12 of the butterfly type connected by link 13 with suction device 8 and by link 14 with arm 18 of thermostat 6, carburetor throttle valve 15 of the butterfly type, auxiliary passageways 17 leading to the intake ports of the engine. Passageways 17 are surrounded by chamber 30 through which the hot exhaust gases from the engine flow.

In the form shown in Fig. 2, when the engine is cold thermostat 6 will tend to hold valve 12 closed and the fuel charge will be passed through the heated intake passageways 17 preparatory to entering the combustion chamber. Here again under such conditions, even though throttle 15 be opened wide, the coil spring 26 in suction device 8 cannot open valve 12 because bimetal coil 6 is more powerful and will oppose such opening. As soon as the engine gets hot, thermostat 6 will move arm 18 clockwise causing the end 22 of link 14 to move relatively downwardly in slot 21 and the thermostat will have no effect on valve 12. Valve 12, as long as the engine is hot, will be opened and closed in response to pressure conditions in the intake passageway 23 at orifice 11 on the engine side of valve 15 and suction device 8 will open valve 12 as the pressure rises at orifice 11 due to the opening of throttle 15 and suction device 8 will move valve 12 toward closed position as throttle valve 15 is moved toward closed position and the pressure falls at port 11. When valve 12 is wide open substantially all the charge flowing to the combustion chamber of the engine will pass through main intake passageway 16 and will be a relatively cool charge, but when valve 12 is closed then all of the charge will pass through auxiliary passageway 17 and

will be preheated by heat exchange with the exhaust gases preparatory to entering the engine combustion chambers.

For purposes of description, I have shown the heating of the charge by heat exchange with the exhaust gases because this is the most economical way of heating the charge. However, any other manner of heating the charge in auxiliary passageways 5 or 17 could be used.

From the above it will be seen that my device transfers the fuel charge into a cold intake manifold for wide open throttle operation when the engine is hot and transfers the fuel charge into a hot manifold for part throttle operation and for part and full throttle operation when the engine is cold. Since the passageways 5 and 17 are always hot, the temperature change of the fuel for different throttle positions is immediately changed and there is no sticking of the controls. With my device the charge can be heated to a much higher degree or temperature than in other systems because it is immediately changed from a hot manifold to a cold manifold at wide open throttle which gives the highest volumetric efficiency for wide open throttle and makes possible a colder charge at higher compression for wide open throttle and a hotter charge for part throttle operation which, in effect, gives higher compression at part throttle.

Preferably passageway 5 is smaller in cross section than passageway 4. Therefore, when valve 3 is open and valve 2 closed, the velocity of the fuel charge will be greater than when the charge is passing through passageway 4. Hence, at part throttle and when the engine is cold, the velocity of the fuel charge passing through the intake passageway 5 in my engine will be higher than when the engine is hot and the throttle is wide open, in which case the fuel charge will be flowing through the main intake passageway 4. The direction of flow of the charge is indicated by the arrows in Figs. 1 and 2.

I claim:

1. In an internal combustion engine having an intake passageway for supplying motive fluid to said engine, a throttle valve controlling the flow of motive fluid therethrough, heating means, a second passageway for supplying motive fluid to the engine in heat exchange relation with said heating means and communicating with the first intake passageway on the engine side of said throttle valve, valve means independent of said throttle valve for controlling the flow of motive fluid through said intake passageways on the engine side of the throttle valve, said valve means being constructed and arranged to decrease the flow of motive fluid through the first mentioned intake passageway as it increases the flow through the heated passageway, a thermostat in heat exchange relation with said engine and having a lost motion connection with said valve means whereby said thermostat when the engine is cold controls said valve means to increase the flow of motive fluid through said second passageway and when the engine is hot the thermostat owing to its lost motion connection is ineffective to actuate said valve, and a fluid pressure motor actuated in response to changes of pressure in the intake passageway on the engine side of said throttle valve and between said throttle valve and said valve means whereby said pressure actuated means when the engine is hot responds to a rise in intake passageway pressure to increase the flow of motive fluid through the first intake passageway and decrease the flow through the heated

passageway and responds to a fall in intake passageway pressure to increase the flow of motive fluid through the heated passageway and decrease the flow through the other passageway.

2. In an internal combustion engine having a main intake passageway for supplying motive fluid to said engine, a throttle valve in said passageway controlling the flow of motive fluid therethrough, heating means, a bypass passageway communicating with the intake passageway on the engine side of said throttle valve for conducting motive fluid to said engine, said bypass passageway being in heat exchange relation with said heating means, two separate valves one mounted in the heated passageway and the other in the main intake passageway and constructed and arranged so that as the one valve closes the other opens, temperature responsive means in heat exchange relation with said engine, a lost motion connection between said temperature responsive means and said two last mentioned valves, said temperature responsive means responding to a fall in engine temperature to increase the flow of motive fluid through said bypass passageway and decrease the flow through the main intake passageway, and means actuated by changes in intake passageway pressure on the engine side of said throttle valve and a connection between said pressure actuated means and said last two mentioned valves for controlling said valves and the flow of motive fluid through said passageways in response to changes in intake passageway pressure when the engine is operating above a predetermined temperature, said temperature responsive means due to said lost motion connection being ineffective to control said valves and the flow of motive fluid through said passageways when the engine is operating above said predetermined temperature whereby said pressure actuated means in response to a fall in the intake passageway pressure moves the valve in the main intake passageway toward closed position and the valve in the heated passageway toward open position.

3. In an internal combustion engine having an intake passageway for supplying motive fluid to said engine, a throttle valve in said passageway controlling the flow of motive fluid therethrough, heating means, a bypass passageway communicating with the intake passageway on the engine side of said throttle valve for conducting motive fluid to said engine, said bypass passageway being in heat exchange relation with said heating means, valve means in said bypass passageway and intake passageway on the engine side of said throttle valve for controlling the flow of motive fluid through said passageways separate from the throttle valve, temperature responsive means in heat exchange relation with said engine, a lost motion connection between said temperature responsive means and said valve means whereby said temperature responsive means is ineffective to actuate said valve means when the engine is operating above a predetermined temperature and whereby upon a fall in engine temperature, the temperature responsive means actuates the valve means to increase the flow of motive fluid through said bypass passageway and decreases the flow through said main intake passageway, and means actuated by changes in intake passageway pressure on the engine side of said throttle valve having a connection with said valve means for controlling said valve means in response to changes in intake passageway pressure when the engine is operating above a predetermined tem-

perature whereby as said intake passageway pressure rises the valve means tends to decrease the flow of motive fluid through said bypass passageway and increase the flow of motive fluid through the intake passageway, said temperature responsive means due to said lost motion connection being ineffective to control the flow of motive fluid through said passageways when the engine is operating above said predetermined temperature and said temperature responsive means being more powerful than said pressure actuated means whereby said pressure actuated means is ineffective to control the flow of motive fluid through said passageways when the engine is operating below another lower predetermined temperature, said temperature responsive means and said pressure actuated means both influencing said valve means in the temperature range between said predetermined temperatures.

4. In an internal combustion engine having an intake passageway for supplying motive fluid to said engine, a throttle valve in said passageway controlling the flow of motive fluid therethrough, heating means, a bypass passageway communicating with the intake passageway on the engine side of said throttle valve for conducting motive fluid to said engine, said bypass passageway being in heat exchange relation with said heating means, a valve for controlling the flow of motive fluid through said bypass passageway, a second valve for controlling the flow of fluid through the intake passageway, said last two mentioned valves being positioned on the engine side of said throttle valve and constructed and arranged so that as the one valve opens the other valve closes their respective passageways, thermostatic means in heat exchange relation with said engine, a lost motion connection between said thermostatic means and said last two mentioned valves whereby the thermostat when the engine is cold closes the valve in the intake passageway and opens the valve in the bypass passageway and when the engine is hot the thermostat owing to its lost motion connection is ineffective to actuate said valves, a fluid pressure motor connected to said last two mentioned valves, a conduit connecting said fluid pressure motor with the intake passageway on the engine side of the throttle valve whereby when the engine is operating above a predetermined temperature said fluid pressure motor responds to a rise in intake passageway pressure to open said intake valve and close said bypass passageway valve, the said thermostat when the engine is cold being constructed and arranged so that it exerts greater power on said valves than the said fluid pressure motor whereby the said fluid pressure motor is ineffective to control said valve.

MARION MALLORY.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,415,086	Church	May 9, 1922
1,448,008	Smith	Mar. 13, 1923
2,004,093	Dean et al.	June 11, 1935
2,082,397	Hiscock	June 1, 1937

FOREIGN PATENTS

Number	Country	Date
222,765	Great Britain	Oct. 9, 1924