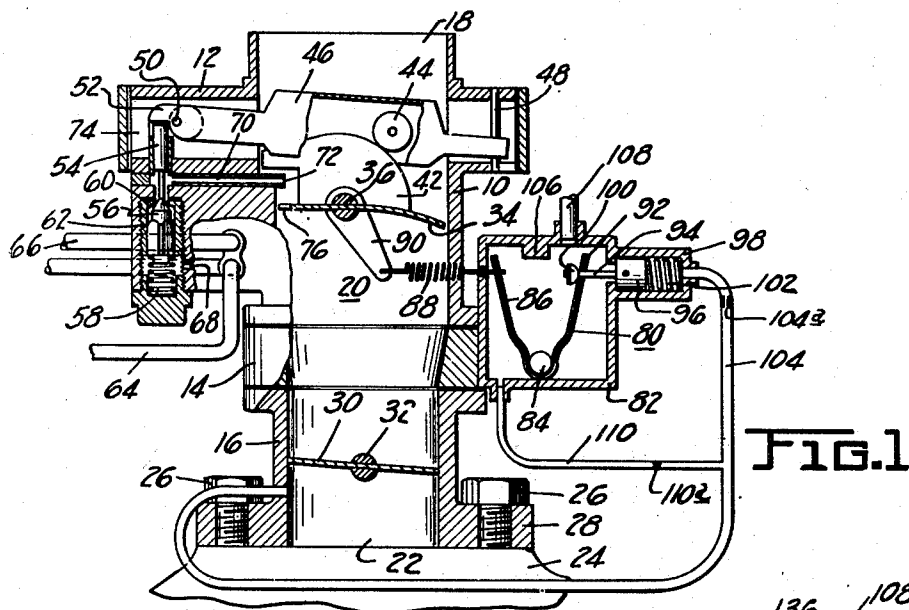
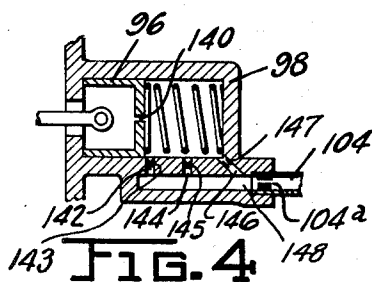
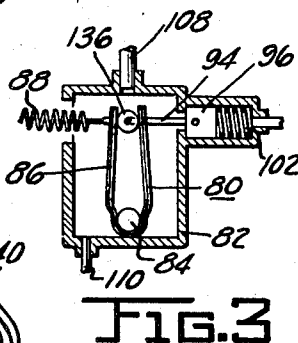
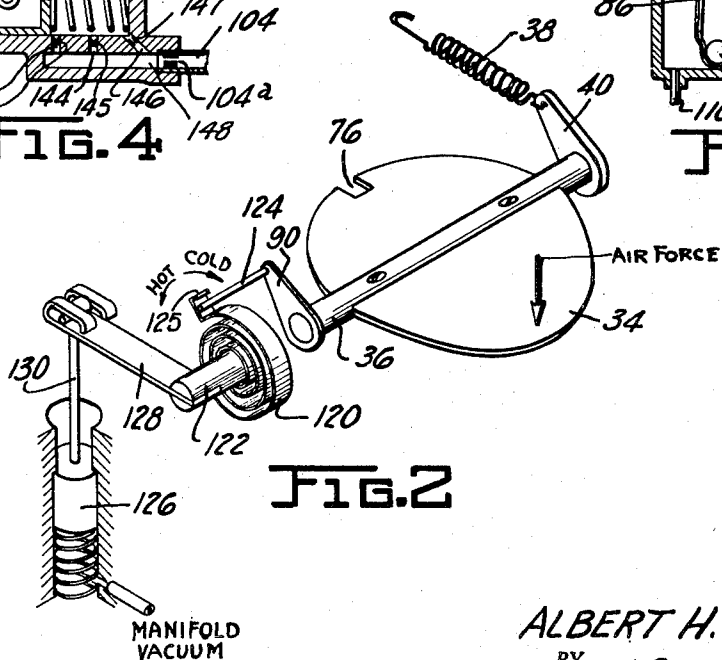


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A. H. WINKLER
CHARGE FORMING DEVICE

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CHARGE FORMING DEVICE

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This invention relates to fuel systems and more particularly to charge forming devices for internal combustion engines wherein a movable flow responsive member in the induction passage controls the inflow of fuel into the carburetor induction passage or engine cylinder.

An object of the present invention is to provide improved automatic control means for a charge forming device of the type wherein a movable flow responsive member in the induction passage control the inflow of fuel to said passage.

Another object of the invention is to provide a charge forming device of this character having means incorporated therein to facilitate starting of the engine by automatically providing an enriched fuel mixture for starting.

Still another object of the invention is to provide a device of this character wherein the fuel mixture is automatically enriched during relatively low suction operation of the engine.

A further object of the invention is to provide means controlled by engine operating conditions, including temperature and manifold vacuum to modify the richness of the mixture automatically in accordance with engine requirements.

A still further object of the invention is to provide a device of this character of simple construction and having improved performance and economy.

The characteristics and advantages of the invention are further sufficiently referred to in connection with the following detailed description of the accompanying drawings which represent certain preferred embodiments and alternatives thereof. After considering these examples, skilled persons will understand that many variations may be made in the invention without departing from the principles disclosed, and I contemplate the employment of any structures, arrangements, or modes of operation that are properly within the scope of the appended claims.

In the drawings:

Figure 1 is a diagrammatic view showing a charge forming device in section embodying the present invention;

Figure 2 is a perspective view of the movable flow responsive member and an alternative arrangement of the automatic control means therefor;

Figure 3 is a sectional view showing a modification of the temperature and suction responsive means controlling the movable flow responsive member in the induction passage; and

Figure 4 is a modification of the suction responsive control means.

While the present invention is shown and described in connection with a downdraft carburetor having metering means including a movable flow responsive member in the induction

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passage for controlling the inflow of fuel to said passage, it is to be understood that the present invention may be used in many other fuel systems, including those having other types of metering means, which means may include diaphragms or the like for controlling metering of the fuel. In connection with the carburetor induction passage, it may alternatively be of the updraft or horizontal delivery type instead of the downdraft type herein shown.

Throughout the drawings similar reference characters represent similar parts, although where such parts are modified in structure and operation they are given a further differing reference character.

The carburetor generally

The carburetor illustrated in the drawings comprises a main body section 10, which may be formed as a die casting and having a hollow integral extension 12. Below the body section 10 is mounted a gasket 14 formed of any of various well known heat insulating materials, which may be internally tapered as shown. Below the gasket is a throttle body 16, preferably formed as a metal casting. The body section, gasket and throttle body are internally bored to form an induction passage comprising an air inlet 18, a mixing chamber 20, and a mixture outlet 22 which communicates with the intake manifold 24 of the engine, not shown.

The air inlet is adapted to receive an air cleaner, not shown, of known construction. The parts 10, 14 and 16 are secured together by any suitable means such as machine screws, not shown, and bolts 26 are received in holes provided therefor in the lower flange 28 of the throttle body 16 for bolting the carburetor to the intake manifold.

A butterfly throttle valve 30 is mounted in the mixture outlet 22, on a throttle shaft 32, to control the flow of fuel mixture to the engine. The throttle is controlled by the operator in the usual manner, by means of an accelerator pedal and/or lever (not shown). Movement of the throttle in the closing direction is accomplished by means of the usual throttle return spring, not shown, and the usual throttle stops, not shown, may be used to limit movement of the throttle in both the opening and closing directions.

An air vane 34 is mounted in the induction passage and as shown is anterior to the throttle although it may be posterior thereto, and controls, by its movement, the rate of fuel flow to the carburetor, as hereinafter described. The air valve is fixed to an center shaft 36, so that flow of the air into the carburetor tends to rotate the vane and shaft in a clockwise direction, as viewed in Figures 1 and 2. Opening movement of the vane 34 is yieldably resisted by a spring

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of suitable character which, as shown in Figure 2, comprises a coil spring 38 having one end attached to a lever 40 secured to the shaft 36 and having its other end secured to some convenient fixed part, not shown. The vane 34 is provided with a cam 42 which engages a roller 44 mounted on a control lever 46. The right hand end (as shown in Figure 1) of the control lever 46 is bifurcated and straddles a guide pin 48 to maintain alignment of the lever. The lever 46 is pivoted by means of a pin 50 adjacent the left end thereof (as shown in Figure 1), said pin 50 being mounted in the extension 12. The last mentioned end of lever 40, indicated by reference numeral 52, is adapted to engage the upper end 54 of the stem of a fuel valve 56, said valve 56 being urged in the closing direction by a spring 58. The fuel valve 56 is formed with fluted sides to permit the passage of fuel therepast, and co-operates with the valve seat 60, formed as an integral shoulder in a plug 62. The fuel is delivered to the carburetor by a conduit 64 from a pump (not shown) adapted to supply fuel at a substantially constant pressure. A conduit 66 is provided for returning fuel and vapor to the fuel tank. The fuel system may be of the type shown in either the Leibing and Fageol application Serial No. 533,848, filed May 3, 1944, now abandoned, or the copending application of Emil O. Wirth Serial No. 555,077, filed September 21, 1944, now abandoned. The fuel valve controls the flow of fuel from a passage 68 past the valve seat and through a transverse conduit 70 through a discharge nozzle 72. One or more air bleed passages may connect the interior recess 74 in the extension 12, with the conduit 70 to form a fuel-and-air emulsion in the usual manner, if desired, but such passages are omitted in the embodiment shown.

The air vane 34 is formed with a slot 76 which receives or registers with the fuel nozzle 72 when the air vane has moved about 20 to 30 degrees away from its closed position. The operating surface of cam 42 may be empirically designed to give any desired ratio between the rate of air flow and the rate of fuel flow at different engine speeds and the vane 34, as it is moved in the clockwise direction by air flow through the induction passage, effects opening of the fuel valve 56. For a further description of the operation of the above described carburetor reference is made to the above noted Leibing and Fageol application, Serial No. 533,848, filed May 3, 1944, now abandoned.

Automatic control for the vane

The present invention deals more particularly with the automatic means for modifying the action of the above described fuel metering means under abnormal engine operating conditions such as when starting said engine cold or when the engine is running at subnormal operating temperatures. Referring more particularly to Figure 1 there is disclosed temperature and suction responsive means arranged in series for modifying the effective vane closing action of the spring 38. The temperature responsive means, as shown in Figure 1, comprises a bimetallic thermostat 80 of generally U-shaped form. The thermostat is mounted in a casing 82 and the closed end of said thermostat is so formed as to engage and pivot upon a shaft 84 mounted in the housing 82. There is a connection between arm 86 of the thermostat and the vane comprising a spring 88 attached to a lever 90 secured to the shaft 36

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of the vane. Arm 92 of the thermostat is connected by a rod 94 with a piston 96 slidably mounted in a cylinder 98 formed in an extension of the casing 82. The free end of the rod 94 is provided with a nut 100 having a hemispherical side adapted for engagement with the arm 92 of the thermostat. The piston 96 is urged to the left, as shown in Figure 1, by a calibrated spring 102 and is actuated in the opposite direction by suction posterior to the throttle, said suction being transmitted from the induction passage on the downstream side of the throttle by a conduit 104 having a calibrated restriction 104a therein. A stop member 106 extends into the casing between the arms 86 and 92 of the thermostat and is so located that the free ends of said arms are adapted to contact same under conditions hereinafter to be described. If desired, means for rapidly heating the thermostat may be provided and includes a hot air conduit 108 leading from a stove or the like on the exhaust manifold, not shown, and connected with the casing 82 and a conduit 110, having a calibrated restriction 110a therein, and which communicates with the casing on the side substantially opposite the point of entrance of the heated air and connected with the conduit 104 which is subject to engine suction posterior to the throttle so that heated air will be circulated through said casing 82. The conduit 108 is of greater capacity than conduit 110 so that there will be no adverse suction effect on the piston 96.

Operation

Assuming the temperature is low, and the engine is inoperative the parts of the device will be as shown in Figure 1. The device is now ready for a cold start, it being noted that the vane 34 is urged in the closing direction by primary spring 38, the vane closing force of spring 88 being very slight or at zero value under the above conditions. Upon starting of the engine, air flow through the induction passage will move the vane 34 to a part open position greater than under normal operating conditions (hereinafter described) for a given air flow through said induction passage. Thus relatively more fuel will be delivered to the induction passage to produce the required enriched mixture for starting. As soon as the engine begins to operate under its own power sufficient suction will be transmitted, from the induction passage posterior to the throttle valve 30, to the cylinder 98 to effect movement of piston 96 to the right, as shown in the Figure 1, and this movement will effect a clockwise rotation of the thermostat 80 as a whole thereby causing spring 88 to become energized and add to the vane closing force of spring 38. The result will be a lessening of the opening of the vane 34 for a given air flow through the induction passage thereby providing the proper mixture for initial operation of the engine as required. As the engine continues to operate and to warm up, heated air will be drawn through the casing 82 to warm the thermostat 80. The thermostat arms, as the thermostat warms up, are adapted to move toward each other so that the closing force of spring 88 on the vane 34 progressively increases as the thermostat warms up. When the engine reaches normal operating temperature the arms 86 and 92 of the thermostat will engage the stop 106. Thereafter normal operation prevails and the full effective combined forces of springs 38 and 88 will provide the required closing force for the vane 34 and the normal quantity of fuel for the nor-

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mal fuel to air mixture will be delivered to the engine for a given air flow into the induction passage. Even though the piston 96 may move arm 92 of the thermostat under some operating conditions when said thermostat is at normal engine operating temperatures neither the thermostat nor the piston will vary the effective vane closing force.

Figure 2

In Figure 2 the spring 38 is calibrated to provide the proper closing force for valve 34 for normal operation of the engine. In this arrangement a coiled thermostat 120 is provided and has one end connected to a stubbed shaft 122, independent of the shaft 36 of the vane 34. The other end of the thermostat has a portion 125 adapted to provide a one-way connection with a pin 124 of lever 90 to urge the vane in the opening direction when the temperature of said thermostat is low, that is subnormal. Thus the effective closing force of spring 38 is reduced so that the vane 34 will open to a greater extent for a given air flow when the engine is cold than when the engine is operating at normal temperatures. As soon as the engine begins to operate under its own power, after a cold start, the piston 126 is drawn downwardly by manifold vacuum and as said piston is connected with a lever 128 secured to shaft 122, by a rod 130, the shaft 122 is moved in a counterclockwise direction to thereby partially relieve the effective force of thermostat 120 on the vane 34. The fuel mixture now provided is richer than normal but leaner than that required for cold starting of the engine or low manifold operation thereof. Thereafter as the engine warms up and thermostat 120 correspondingly warms up, said thermostat tends to coil upon itself until the end 132, which engages the pin 124 when the thermostat is cold, moves away from said pin when the thermostat reaches normal engine operating conditions and the vane is then urged in the closing direction by the full force of spring 38. The normal fuel to air ratio of the fuel mixture is then supplied for normal operation of the engine.

Figure 3

In Figure 3 the stop 106 of Figure 1 is eliminated and the thermostat 80, when hot, is adapted to assume the position shown in Figure 3. It will be noted that both arms of the thermostat engage a roller 135 connected to the rod 94 of the piston 96. With this arrangement, after the engine reaches normal operating temperatures, the vane closing force of spring 88 is varied in accordance with the engine suction and particularly, as shown herein, in accordance with suction posterior to the throttle valve. This arrangement may be used to provide an economizer function for the charge forming device. For example, should the throttle valve 30 be partially closed and the engine in operation, the piston 96 will be drawn to its suction actuated limit of movement as said suction will then be at substantially its maximum value. Consequently the vane closing force of spring 88 will also be at its maximum value. Should the throttle be opened, suction posterior to the throttle will drop in value and when said throttle is opened to a position whereat power enrichment is desired the piston 96 will be urged in the opposite direction by spring 102 thereby at least partially relieving the vane closing force of spring 88 and permitting the vane to open to a greater extent for a given air flow and thus provide additional fuel for an

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enriched fuel mixture such as is required for relatively low suction operation of the engine.

Figure 4

A modification of the suction responsive device is shown in Figure 4. The piston 96 is provided with a calibrated bypass 140 in the head thereof and there are a plurality of passages, indicated by the respective reference numerals 142, 144 and 146, having respective calibrated restrictions 143, 145 and 147 therein, and which communicate with the interior of the cylinder 98 and are spaced longitudinally of said cylinder behind the piston. These passages are connected with a passage 148 which communicates with the conduit 104. Thus the piston may be subjected to various predetermined suctions according to its position in the cylinder, an arrangement that may be desirable for some installations.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description and though said invention has been illustrated and described in connection with a plurality of desirable embodiments it will be apparent that various other changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the forms hereinabove described being merely preferred arrangements.

I claim:

1. In a charge forming device comprising an induction passage: a member therein movable in response to air flow and having a no-flow position; a fuel valve mechanically connected with and controlled by movement of said member for controlling the flow of fuel to the charge forming device; yielding means urging the member toward the no-flow position; and temperature responsive means adapted when at normal engine operating temperatures to add a force to the yielding means urging the member toward its no-flow position.

2. The device defined by claim 1 including means responsive to suction in the induction passage adapted to at least at time augment the force of the temperature responsive means urging the member toward the no-flow position.

3. In a charge forming device comprising an induction passage and an air inlet and a mixture outlet controlled by a throttle valve: an unbalanced air vane in the induction passage anterior to the throttle movable in response to air flow through the induction passage and having a closed position; a fuel valve mechanically connected with and controlled by movement of the vane for controlling the flow of fuel to the charge forming device; yielding means urging the vane toward the closed position; and temperature and suction responsive means arranged in series relative to each other and adapted to augment the action of said yielding means.

4. In a charge forming device comprising an induction passage having an air inlet and mixture outlet controlled by a throttle: a member in the induction passage responsive to air flow and having a no-flow position; a fuel valve; means interconnecting the member and fuel valve whereby the latter is controlled by said member; yielding means urging the member toward no-flow position, said yielding means being so calibrated as to permit said member to open a sufficient amount to provide an enriched fuel mixture when the engine is operating at subnormal temperatures; temperature responsive means adapted to

yieldably urge the member toward the no-flow position with increasing force as the temperature thereof rises; and stop means for said temperature responsive means, adapted to limit the effective force of the temperature responsive means urging the member toward the no-flow direction when the engine reaches normal temperature to thereby provide a normal mixture.

5. The invention defined by claim 4 including a device responsive to suction posterior to the throttle for varying the action of the temperature responsive means at least at subnormal engine temperatures.

6. In a charge forming device comprising an induction passage having an air inlet and a mixture outlet controlled by a throttle: an unbalanced air vane in the induction passage anterior to the throttle and having a no-flow position; a fuel valve controlled by movement of the vane and controlling the flow of fuel to the charge forming device; yielding means urging the vane toward the no-flow position; a substantially U-shaped thermostat pivotally mounted adjacent its closed end; a yielding connection between one arm of the thermostat and the vane; and a device responsive to engine suction posterior to the throttle and connected to the other arm of the thermostat.

7. The invention defined by claim 6 including a stop member so positioned as to limit the movement of the arms of the thermostat when the latter reaches normal engine operating temperature.

8. The invention defined by claim 6 wherein the connection between the suction responsive device and the thermostat arm is a one-way connection.

9. The invention defined by claim 6 wherein the connection between the suction responsive device and the thermostat includes a member so curved as to maintain the leverage of said suction responsive device substantially uniform relative to the thermostat.

10. The invention defined by claim 6 wherein the connection between the suction responsive device and the thermostat arm comprises a rod and a member carried thereby and disposed between the arms of the thermostat, said member being adapted to be engaged by both arms of the thermostat when at substantially normal engine temperatures thereby providing a substantially direct connection between the suction responsive device and the yielding connection between the thermostat and the vane.

11. In a charge forming device comprising an induction passage having an air inlet and a mixture outlet controlled by a throttle: a member in the induction passage responsive to air flow therein and having a no-flow position; a fuel

valve controlled by movement of the member and controlling the flow of fuel to the charge forming device; a substantially U-shaped thermostat; means for pivoting the thermostat adjacent its closed end; a yielding connection between one arm of the thermostat and the member urging the member toward the no-flow position, said yielding connection attached to said arm adjacent the free end thereof; a suction responsive device connected to the other arm of the thermostat adjacent the free end thereof and having a suction connection with the induction passage posterior to the throttle; said thermostat and suction responsive device being so constructed and arranged that at subnormal temperatures the thermostat forms an effective portion of the connection between the suction responsive device and the member for varying the effectiveness of said yielding connection and at normal temperatures said thermostat ceases to be effective in varying the effectiveness of said yielding connection.

12. In a charge forming device comprising an induction passage having an air inlet and a mixture outlet controlled by a throttle: a member therein responsive to air flow and having a no-flow position; a fuel valve controlled by movement of the member for controlling the flow of fuel to the charge forming device; yielding means urging the member toward the no-flow position; a thermostat adapted to modify the action of the yielding means; and a suction responsive device adapted to modify the action of the thermostat, said suction responsive device including a movable wall having a calibrated vent there-through, and a suction connection with the induction passage posterior to the throttle for subjecting one side of the movable wall to suction posterior to the throttle, said connection including a plurality of calibrated ports so arranged that movement of the movable wall in one direction will progressively render ineffective at least some of said ports.

ALBERT H. WINKLER.

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Certificate of Correction

Patent No. 2,523,798

September 26, 1950

ALBERT H. WINKLER

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 1, line 11, for the word "control" read *controls*; column 6, line 46, for "time" read *times*;

and that the said Letters Patent should be read as corrected above, so that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 19th day of December, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.