Sept. 7, 1937. J. G. ALLEN 2,092,297

CARBURETOR AND CONTROL MEANS THEREFOR

Filed May 26, 1933 4 Sheets-Sheet 1

FIG. 1

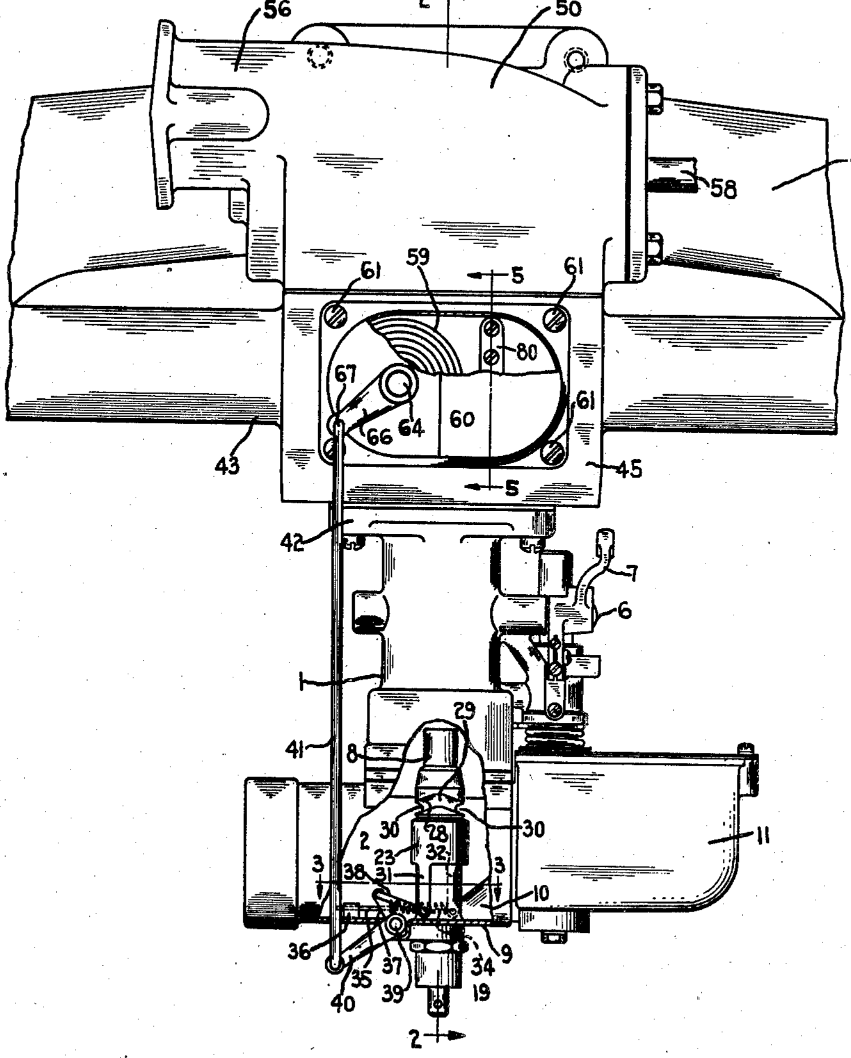

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FIG. 2

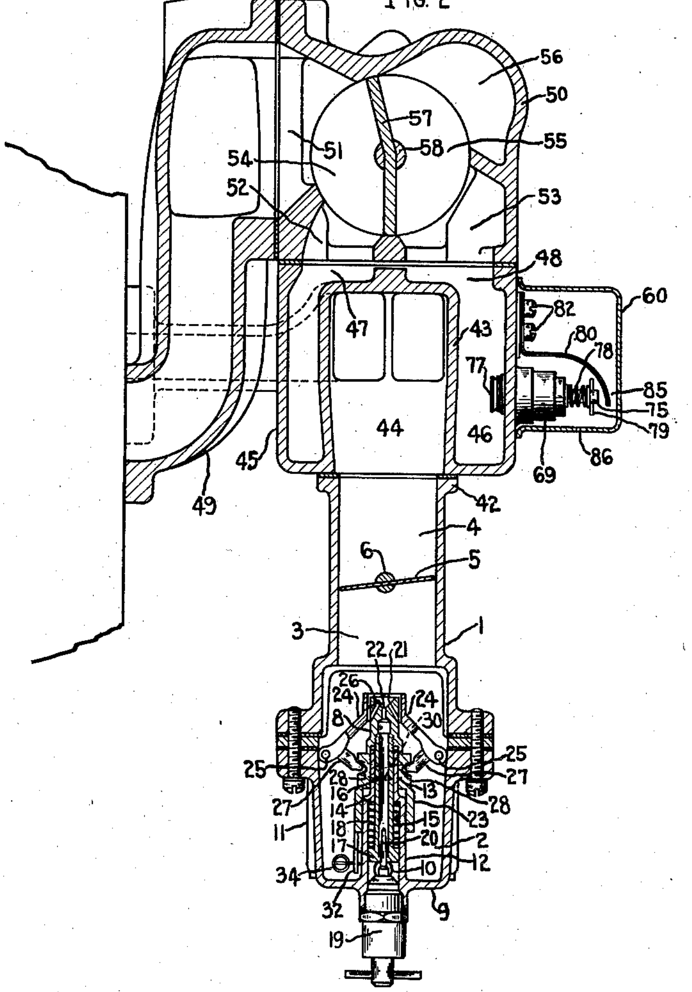

FIG. 3

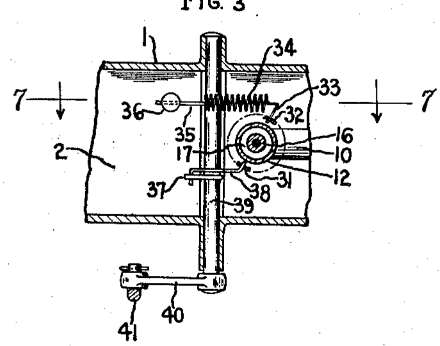

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FIG. 4

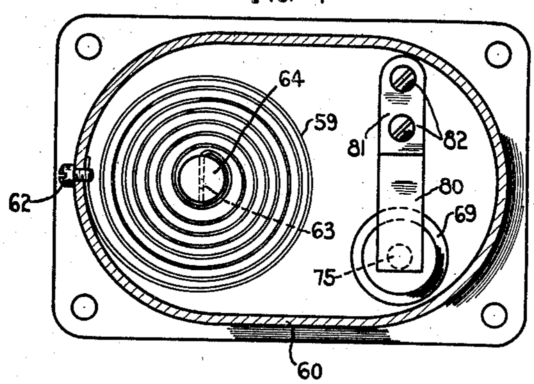

FIG. 5

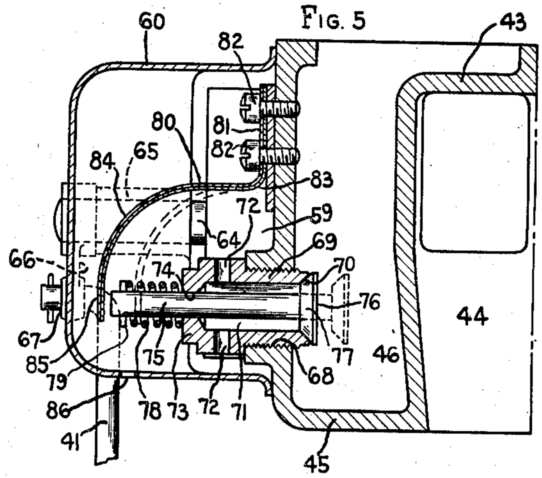

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FIG. 6

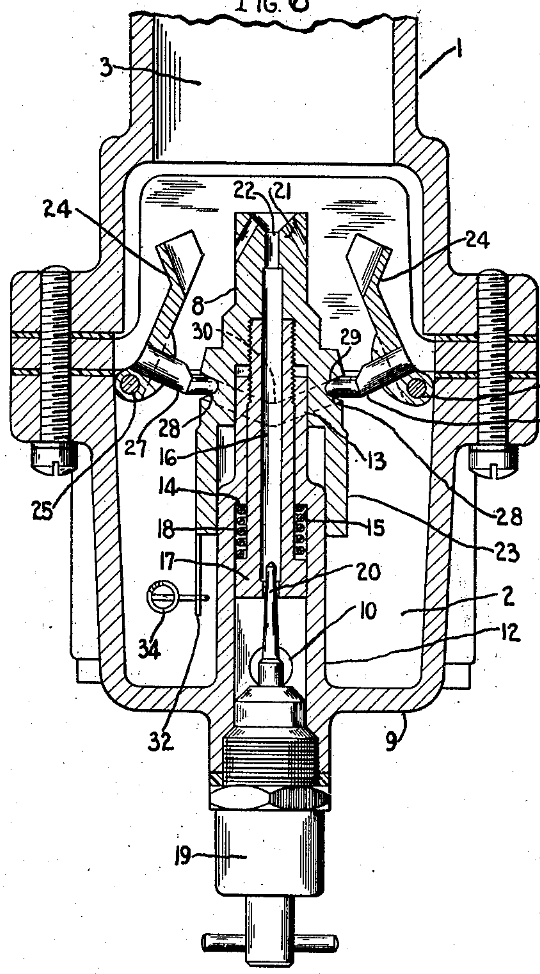
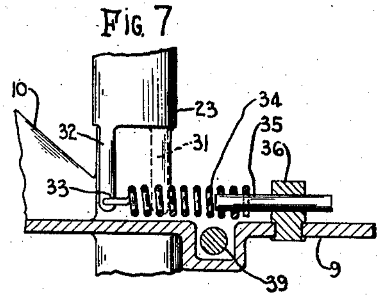


FIG. 7



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Patented Sept. 7, 1937 2,092,297

UNITED STATES PATENT OFFICE

2,092,297

CARBURETOR AND CONTROL MEANS THEREFOR

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Application May 26, 1933, Serial No. 672,993

20 Claims. (Cl. 123—119)

My invention relates to new and useful improvements in carburetors and in an automatically acting control means which is particularly adapted among other uses for carburetor control.

An object of my invention is to provide a carburetor having novel means for regulating the richness of the mixture or fuel-air ratio supplied by the carburetor.

Another object is to provide means operable automatically in response to engine temperature for controlling the carburetor.

Another object is to provide automatically controlled means to subject the automatically responsive means directly to the temperature of engine exhaust gases.

The invention consists in the improved construction and combination of parts, to be more fully described hereinafter and the novelty of which will be particularly pointed out and distinctly claimed.

In the accompanying drawings, to be taken as a part of this specification, I have fully and clearly illustrated a preferred embodiment of my invention, in which drawings—

Figure 1 is a view in front elevation of a portion of an internal combustion engine embodying my invention, and having certain parts broken away to show the internal construction;

Fig. 2 is a view in section on the line 2—2 of Figure 1;

Fig. 3 is a detail view in section on the line 3—3 of Figure 1;

Fig. 4 is an enlarged detail view of the automatic control means, having the front wall of the casing or housing broken away;

Fig. 5 is a view in section on the line 5—5 of Figure 1;

Fig. 6 is an enlarged detail view in section on the line 2—2 of Fig. 1, showing the vane members in open position, and

Fig. 7 is an enlarged detail view on the line 7—7 of Fig. 3.

Referring to the drawings by characters of reference, 1 designates generally a carburetor comprising a casing having a passageway therethrough including an air inlet 2, a mixing chamber 3, and a mixture outlet 4. Discharge of fuel mixture from the chamber 3 is controlled by a throttle valve 5, which may be of the usual butterfly type carried by an operating shaft 6 journaled in the side walls of the casing. One end of the shaft 6 which projects through the casing is provided with an operating arm or lever 7 by which the shaft 6 may be rotated and which may be connected by any suitable linkage to a remote point of operation. Within the air inlet 2 there is a reciprocable and rotatable fuel nozzle 8 discharging into the mixing chamber 3 and extending upwardly from the bottom wall 9 of the air inlet substantially concentric with the longitudinal axis of the mixing chamber. The nozzle 8 is supplied with fuel by a conduit 10 leading from a constant level float chamber 11 which may be of any well-known construction. The conduit 10 opens into the bore of a cylindrical, hollow supporting member 12 forming part of the nozzle 8 and extending upward from the bottom wall 9. The member 12 is provided with an upper portion 13 of reduced internal diameter providing a guide sleeve and a downward facing shoulder 14 forming the top wall of a dash-pot chamber 15 within the bore of member 12. Slidably fitting within the portion 13 there is a tubular member 16 which projects at its upper end from the portion 13 and which extends downward into the chamber 15. The member 16 is provided at its bottom end with an annular flange 17 substantially fitting the bore of chamber 15 and serving as a dash-pot piston. Positioned and held under compression between the shoulder 14 and the piston 17 there is a coil spring 18 which surrounds the member 16 and which normally tends to urge the piston 17 downward. The bore of member 12 opens downward through the bottom wall 9 and receives a closure member 19 which adjustably carries a metering pin or needle valve 20 which extends upward into the bore of member 16 to regulate or control flow of fuel therethrough, but which does not close the bore even when the piston is in its lowermost position. Secured on the upper projecting end of the member 16 there is a tubular nozzle member 21 having a calibrated fuel discharge orifice 22. The member 21 has a downward extending sleeve portion 23 which slidably and rotatably fits on the member 12. Within the casing 1 there is a valve means controlling air flow to the chamber 3 and preferably comprising pivoted valve plates or vane members 24 mounted on shafts 25 supported in the side walls of the casing. The members 24 are preferably substantially rectangular and are inclined upwardly toward each other for engagement substantially in the plane of the upper end of the nozzle member 21. Through the meeting edges of the members 24 there is an aperture 26 into which the upper end of the nozzle member 21 extends. The aperture 26 is of slightly larger diameter or cross-sectional area than the end of member 21, so that even with the vane members closed some air can flow from the inlet 2 to the mixing chamber 3. Extending from the underface of each of the vane members 24 and rigid therewith, there is an operating arm or finger 27, which are oppositely positioned and at their free ends extend into a circumferential, continuous cam groove 28 formed in the nozzle sleeve 23. The cam groove has oppositely positioned high points 29 from which the groove inclines downward to oppositely positioned low points 30, with the high points separated from the low points by substantially ninety degrees. Depending from the bottom edge of the nozzle sleeve 23 there are oppositely positioned fingers 31, 32 which extend downward substantially to the bottom wall 9. Secured to the lower end of the finger 32 is one end 33 of a laterally flexible and resilient helical coil spring 34 which at its other end is slidably supported on a rod 35 which extends longitudinally into the spring. The portion of the spring 34 which is not sleeved over the rod 35 may be bent or displaced in a direction transverse to the longitudinal center line of the spring. The rod 35 is rigidly supported in a post 36 secured to the bottom casing wall 9. The other finger 31 is connected at its lower end to a lever or crank arm 37 by a link 38. The arm 37 is rigidly fixed on an operating shaft 39 journaled in the side walls of the carburetor casing. One end of the shaft 39 projects from the casing and has an operating arm 40 rigidly fixed thereto. Secured to the free end of the arm 40 there is one end of a connecting rod or link 41 which is connected at its other end to an actuating or operating means to be described.

The carburetor casing is provided at its outlet end with a flange 42 bolted or otherwise secured to the engine inlet manifold 43, with the mixture outlet 4 opening into the manifold passage 44. Surrounding the inlet manifold 43 there is a casing 45 enclosing an exhaust gas heating chamber 46 having an inlet 47 and an outlet 48 through the top wall of the casing 45. The chamber 46 is supplied with exhaust gas from the exhaust manifold 49 through the exhaust outlet casing 50 secured to and communicating with the interior of the exhaust manifold through a port 51. The casing 50 seats on the casing 45 and has passageways 52, 53 through its bottom wall registering with the inlet 47 and outlet 48 respectively. The passageway 52 communicates through a valve port 54 with the inlet port 51 and the passageway 53 communicates through a valve port 55 with an outlet passage 56 for the casing 50. Within the casing 50 there is a rotary valve 57 carried by an operating shaft 58 which projects from the casing 50. The valve 57 is movable from the position shown to close the ports 54 and 55 and to establish communication directly between the inlet port 51 and the outlet passage 56 so as to cut off flow of exhaust gases through the chamber 46.

The actuating means for controlling the carburetor and which is connected to the link 41 preferably comprises a thermostat 59 formed by a bimetal coil responsive to engine temperature. The thermostat 59 is positioned within a housing 60 which is secured by screws 61 to the front wall of the casing 45. One end of the thermostat 59 is fixed against movement and is fastened by a screw, or the like, 62 to the side wall of the housing 60. The other end of the thermostat 59 is fixed, as at 63, to an operating shaft 64, preferably by inserting the end of the thermostat in a longitudinal slot in the shaft. The shaft 64 is journaled in a bearing sleeve 65 which projects from and is rigid with the housing 60. Rigidly secured on the outer end of the shaft 64 which projects from the sleeve 65 there is an operating arm or lever 66 to which the link 41 is connected, as at 67. Through the front wall of the housing 45 there is an aperture 68 which opens into the housing 60 at one side of the thermostat 59 and adjacent the bottom wall of the housing 60. Secured in the aperture 68 there is a substantially cylindrical, hollow fitting or plug member 69 preferably screw-threaded into the aperture 68. The member 69 projects into the chamber 46 and terminates therein in a substantially conical, outward flaring valve seat 70 having its longitudinal bore 71 communicating with the interior of the housing 60 through one or more laterally directed ports 72 in the side wall of the member 69. Within the housing 60 the member 69 has an end wall 73 closing the bore 71 and through which there is a guide aperture 74. Supported in the aperture 74 and longitudinally reciprocable therein there is a valve stem 75 which extends through the bore 71 into the chamber 46 and on which a valve member 76 positioned in the chamber 46 is rigidly secured. The valve member 76 has a substantially conical face 77 cooperable with the seat 70 to control communication between the chamber 46 and the housing 60 through the passageway 71, 72. Surrounding the other end of the stem 75 which projects from the fitting or member 69 into housing 60, there is a helical coil spring 78 which normally tends to urge the valve member 77 to closed position, and which is held under compression between an abutment member 79 rigid with the stem 75, preferably in the form of a cross pin, and the end wall 73. Also in the housing 60 there is a thermostat 80, preferably a bimetal element having one end portion 81 rigidly fixed to the front wall of the casing 45 by screws 82. The thermostat 80 is bent or turned outward, as at 83, to lie substantially at right angles to the portion 81, and then curves or turns downward, as at 84, so that the free end portion 85 lies in opposed abutting relation to the end face of the stem 75 for cooperable engagement therewith. The housing 60 is preferably provided with an outlet port or aperture 86 for the passage of exhaust gases therefrom to atmosphere.

The operation of my carburetor and the automatic means for controlling the operation thereof is as follows: In the drawings, the parts are shown in the positions which they will assume when the engine has been thoroughly warmed up. Assuming that the engine is running at idling speed, the throttle valve 5 being opened to idling position, air from the inlet 2 will pass through the aperture 26 into the mixing chamber 3 together with fuel from the nozzle 8 discharging through orifice 22. If the throttle is now moved further open to increase the engine speed, the increased suction in the mixing chamber 3 will move the valve members 24 toward open position. As the valve members 24 move upwardly and outwardly away from each other to increase air flow from the inlet 2, the operating members or fingers 27 engaged in the high points 29 of cam groove 28 will lift the nozzle 8 relative to the fuel valve 20 to increase the area of the inlet port to the bore of member 16 and the supply of fuel which can discharge from the nozzle 8 into the mixing chamber. Opening movement of the valve members 24 is opposed by the spring 18 and the dash-pot piston 17. The spring 34 will also offer some resistance to upward movement of the nozzle 8 and opening movement of the valve members, but due to the fact that the spring has been slid substantially to the free end of the rod 35 the resistance of the spring to lateral flexing thereof will be very slight. Should the engine be stopped and permitted to cool down, the free end portion 85 of the thermostat 80 will move into engagement with the valve stem 75 and overcome the spring 78, moving the valve member 77 out of engagement with its seat 70 and toward open position. When the engine has become cold, the thermostat 80 and valve member 77 will have moved substantially to the position shown in dotted lines in Fig. 5. Simultaneously with the movement of thermostat 80, the cooling of the engine will cause the thermostat 59 to uncoil, rotating the shaft 64 clockwise of Figs. 1 and 4. This movement of shaft 64 will pull upward on the arm 40 through the rod 41 and arm 66 to rotate the shaft 39 also in a clockwise direction of Fig. 1. The shaft 39, being connected to the nozzle 8 by the arm 37, link 38, and finger 31, will act as it rotates to rotate the nozzle 8 about its supporting member 12. As the nozzle rotates, it will be lifted on the fingers 27 by means of the cam groove 28 since the fingers 27 are held against downward movement by engagement of the vane members 24 with each other. As the nozzle is lifted by this cam action, the spring 18 will be compressed, thereby increasing its resistance to opening movement of the vane members 24, and also the area of the fuel orifice to the bore of the member 16 surrounding the valve 20 will be increased. The rotation of the nozzle will also act through finger 32 to move the spring 34 onto the rod 35 and the lifting of the nozzle will bend or flex the spring upwardly or transverse to its longitudinal axis, which movements of spring 34 will decrease the lateral flexibility thereof, thereby increasing its opposition to upward movement of the nozzle and to opening movement of the vane members 24 by both decreasing its effective length, i. e., the length not sleeved over or surrounding rod 35, and increasing its tension by bending the turns out of line so that the vane members will be additionally loaded by the increased resistance of the spring 34. When the thermostat 59 is cold, the nozzle will have been rotated substantially ninety degrees until the fingers 27 lie in the cam groove low points 30. If the engine is now cranked with the parts in the position just described, the carburetor will supply an overrich fuel mixture which is sufficiently rich in fuel relative to the air supplied to provide for starting or priming the engine when cold. Due to the increased resistance of the spring 18 and the additional resistance offered by the spring 34 due to its shortened free length and its initial bent or displaced position, the vane members 24 will be held closed so that air for starting or priming will be admitted to the mixing chamber only through the aperture 26. As soon as the engine fires and starts to run under its own power, the chamber 46 will be supplied with hot exhaust gases from the exhaust manifold 49. A portion of the exhaust gases entering the chamber 46 will pass into the housing 60 through the conduit or passageway 71, 72 to subject the thermostat 59 directly to the temperature of the exhaust gases. This will result in the thermostat 59 responding almost instantly to operation or running of the engine so that the thermostat will turn the shaft 64 counter-clockwise to move the link 41 downward toward the position of Fig. 1. Downward movement of the link 41 will pull on the nozzle finger 31 through its connection thereto to rotate the nozzle toward the position shown in Fig. 1. This will result in movement of the cam groove 28 on the fingers 27 to permit the spring 18 to move the nozzle 8 downward decreasing the area of the fuel inlet at valve 20 and will also move the spring 34 toward the free end of the rod 35 and position of Fig. 3 in which the resistance of the spring 34 to upward movement of the nozzle and opening of the vane members is decreased. This initial movement of the thermostat 59 will not result in a complete movement of the parts to the positions shown but only sufficiently toward such positions as will cut down the exceedingly rich starting mixture to a mixture which will maintain operation of the engine during the warming-up period. The exhaust gases entering the housing 60 will also act on the thermostat 80 to expand the same toward its full line position shown in Figs. 2 and 5 so that the spring 78 will be free to move the valve member 77 to closed position. The operation of the thermostat 80 through its control of the valve member 77 acts to control the operation of the thermostat 59 and therefore of the carburetor. The thermostat 80 is preferably adjusted to cut off the inlet or exhaust gases to the housing 60 when the thermostat 59 has operated the carburetor control means to a position for supplying warming-up mixture to the engine. With the inlet of exhaust gases to the housing 60 cut off, the thermostat 59 will respond to the temperature of the engine transmitted through the engine walls and particularly to the temperature adjacent the heating chamber 46 transmitted through the front wall of casing 45 to gradually move the link or rod 41 downward as the engine warms up to normal operating temperature. As the rod or link 41 moves downward, the nozzle 8 will be further rotated and will move downward as permitted by the cam groove under the force of springs 18 and 34, the movement of the nozzle being relative to the valve 20 and the vane members 24, so that for any given position of the vane members 24 the ratio of fuel to air supplied to the mixing chamber 3 will be decreased as the engine warms up. Downward movement of the rod 41 by the heating of the thermostat 59 will also decrease the resistance to opening movement of the vane members 24, so that the vane members 24 can move to a further open position as engine temperature increases for any given subatmospheric pressure in the mixing chamber 3. When the engine has completely warmed up to normal operating temperature, the thermostats will have moved to the positions shown in which the carburetor is operable to supply the normal fuel mixture to the engine.

What I claim and desire to secure by Letters Patent of the United States is:

1. An apparatus of the character described, comprising a carburetor for supplying fuel to an internal combustion engine, a thermostat controlling said carburetor, means to subject said thermostat directly to exhaust gas from the engine, and automatically operable means acting prior to complete controlling operation of said thermostat to discontinue direct subjection of said thermostat to exhaust gas.

2. An apparatus of the character described, comprising a carburetor for supplying fuel to an internal combustion engine, a thermostat controlling said carburetor, means to subject said thermostat directly to exhaust gas from the en-

gine, and a second thermostat controlling said last-named means, said second thermostat acting prior to complete controlling operation of said first-named thermostat to discontinue direct subjection of said first-named thermostat to exhaust gas.

3. An apparatus of the character described, comprising a carburetor for supplying fuel to an internal combustion engine, means to control the fuel-air ratio supplied by said carburetor, a thermostat responsive to engine temperature, means operatively connecting said thermostat to said control means whereby said thermostat determines the fuel-air ratio supplied by said carburetor, means to convey exhaust gases from the engine to said thermostat whereby to subject said thermostat directly to the temperature of the exhaust gases, and an automatically operated valve controlling said last-named means, said valve being operated to discontinue subjection of said thermostat to exhaust gases prior to complete operation of said ratio controlling means by said thermostat whereby said thermostat completes the operation of said ratio controlling means in response to engine temperature.

4. An apparatus of the character described, comprising a carburetor for supplying fuel to an internal combustion engine, a thermostat responsive to engine temperature, control means for said carburetor, means operatively connecting said thermostat to said control means, a housing for said thermostat, means to convey exhaust gases from the engine into said housing, and a thermostat controlling said last-named means.

5. An apparatus of the character described, comprising a carburetor for supplying fuel to an internal combustion engine, means to control the fuel-air ratio supplied by said carburetor, a thermostat, means operatively connecting said thermostat to said control means, a housing having an inlet and enclosing said thermostat, means to convey exhaust gases from the engine to said inlet, a valve controlling said inlet, and a thermostat cooperable with said valve.

6. An apparatus of the character described, comprising a carburetor for supplying fuel to an internal combustion engine, means to control the fuel-air ratio supplied by said carburetor, a thermostat, means operatively connecting said thermostat to said control means, a housing having an inlet and enclosing said thermostat, means to convey exhaust gases from the engine to said inlet, a valve controlling said inlet, a spring normally acting to move said valve in one direction, and a thermostat operable to overcome said spring and move said valve in the opposite direction.

7. In an internal combustion engine, an inlet manifold having a heating chamber, an exhaust manifold communicating with said chamber, a carburetor connected to said inlet manifold, means to control the fuel-air ratio supplied by said carburetor, a housing carried by a wall of said chamber, a thermostat in said housing, means operatively connecting said thermostat to said control means, a passageway connecting said chamber to said housing, a valve controlling said passageway, and thermostatic means operable upon decrease of temperature in said housing to open said valve.

8. In an internal combustion engine, an inlet manifold having a heating chamber, an exhaust manifold communicating with said chamber, a carburetor connected to said inlet manifold, means to control the fuel-air ratio supplied by said carburetor, a housing carried by a wall of said chamber, a thermostat in said housing, means operatively connecting said thermostat to said control means, a passageway connecting said chamber to said housing, a valve controlling said passageway, a spring normally tending to close said valve, and thermostatic means operable upon decrease of temperature in said housing to overcome said spring and open said valve.

9. A carburetor comprising a casing having a mixing chamber with an air inlet, a reciprocable and rotatable fuel nozzle discharging into said chamber, a valve controlling flow through said nozzle, valve means controlling air flow to said chamber and operatively connected to said nozzle, cam means operable upon rotation of said nozzle to move said nozzle longitudinally relative to said valve and said valve means, and means to rotate said nozzle.

10. A carburetor comprising a casing having a mixing chamber with an air inlet, a reciprocable and rotatable fuel nozzle discharging into said chamber, a valve controlling flow through said nozzle, valve means controlling air flow to said chamber and operatively connected to said nozzle, cam means operable upon rotation of said nozzle to move said nozzle longitudinally relative to said valve and said valve means, and temperature responsive means to rotate said nozzle.

11. A carburetor comprising a casing having a mixing chamber with an air inlet, a reciprocable fuel nozzle discharging into said chamber, a valve controlling flow through said nozzle, valve means controlling air flow to said chamber and operatively connected to said nozzle, means resisting opening movement of said valve means, means to move said nozzle relative to said valve and said valve means, and means acting upon operation of said last-named means to increase the resistance to said valve means.

12. A carburetor for supplying fuel to an internal combustion engine comprising a casing having a mixing chamber with an air inlet, a reciprocable fuel nozzle discharging into said chamber, a valve controlling flow through said nozzle, valve means controlling air flow to said chamber and operatively connected to said nozzle, temperature responsive means to move said nozzle relative to said valve and said valve means, means to subject said temperature responsive means directly to exhaust gases from the engine, and means controlling said last-named means.

13. A carburetor for supplying fuel to an internal combustion engine comprising a casing having a mixing chamber with an air inlet, a reciprocable fuel nozzle discharging into said chamber, a valve controlling flow through said nozzle, valve means controlling air flow to said chamber and operatively connected to said nozzle, temperature responsive means to move said nozzle relative to said valve and said valve means, means to subject said temperature responsive means directly to exhaust gases from the engine, and a thermostat responsive to exhaust gas temperature and controlling said last-named means.

14. In a carburetor, a fuel nozzle member, a fuel metering valve member cooperable with said nozzle member and controlling discharge therefrom, one of said members being longitudinally reciprocatory relative to the other, means to move one of said members relative to the other, a laterally flexing spring external of and resisting relative movement of said members, and means

cooperable with said spring to vary its lateral free flexing length whereby to regulate the resistance of said spring.

15. In a carburetor, a fuel nozzle member, a fuel metering valve member cooperable with said nozzle member and controlling discharge therefrom, one of said members being longitudinally reciprocatory relative to the other, means to move one of said members relative to the other, means to rotate one of said members, a helical coil spring secured at one end to the rotatable one of said members and having its longitudinal axis transverse to the plane of reciprocation of the reciprocatory one of said members whereby said spring is laterally flexed, and means slidably receiving the other end of said spring whereby upon rotation of the rotatable one of said members said spring will have its effective free flexing length varied thereby to vary the resistance of said spring.

16. In a carburetor, a fuel nozzle member, a fuel metering valve member cooperable with said nozzle member and controlling discharge therefrom, one of said members being longitudinally reciprocatory relative to the other, means to move one of said members relative to the other, means to rotate one of said members, a helical coil spring secured at one end to the rotatable one of said members and having its longitudinal axis transverse to the plane of reciprocation of the reciprocatory one of said members whereby said spring is laterally flexed, and a rod extending into the other end of said spring whereby upon rotation of the rotatable one of said members the resistance of said spring to lateral flexing will be varied.

17. A carburetor comprising a casing having a mixture passageway, fuel supply means for said passageway, an air valve controlling air flow through said passageway, a laterally flexible spring supported at one portion of its length and having another portion of its length displaceable laterally of its longitudinal center line, said other portion having operative connection to said air valve and by its resistance to such lateral displacement acting to oppose opening movement of said air valve, and means to vary the effective length of said other portion of said spring to regulate the resistance offered by said spring to opening movement of said air valve.

18. A carburetor of the character described, comprising a casing having a passageway therethrough, suction operated valve means controlling air flow through said passageway, a fuel nozzle discharging into said passageway, means controlling the fuel supplied to said nozzle, means resisting opening movement of said valve means, and temperature responsive means operable simultaneously to increase the resistance to opening movement of said valve means and to actuate said control means to increase the quantity of fuel supplied to said nozzle.

19. A carburetor of the character described, comprising a casing having a mixing chamber with an air inlet, valve means controlling admission of air to said chamber, a longitudinally reciprocable fuel nozzle having a stem and discharging into said chamber, said nozzle and said stem being fixed relative to each other, a fuel metering valve cooperable with the bore of said stem, means connecting said air valve means and said nozzle whereby movement of said valve means will move said stem relative to said fuel valve, said nozzle and stem being movable longitudinally of said fuel valve independent of movement of said air valve means, and an operating member in said casing and engaging said nozzle to move said stem independently of movement of said air valve means to increase the ratio of fuel to air supplied to said chamber.

20. A carburetor of the character described, comprising a casing having a mixing chamber with an air inlet, valve means controlling admission of air to said chamber, a longitudinally reciprocable fuel nozzle having a stem and discharging into said chamber, said nozzle and said stem being fixed relative to each other, a fuel metering valve cooperable with the bore of said stem, means connecting said air valve means and said nozzle whereby movement of said valve means will move said stem relative to said fuel valve, said nozzle and stem being movable longitudinally of said fuel valve and independently of movement of said air valve means, an operating member in said casing and engaging said nozzle to move said stem independently of movement of said air valve means to increase the ratio of fuel to air supplied to said chamber, and temperature responsive means for actuating said operating member.

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