April 19, 1932. C. L. STOKES 1,854,236

AUTOMATIC FUEL REGULATOR

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Fig. 1.

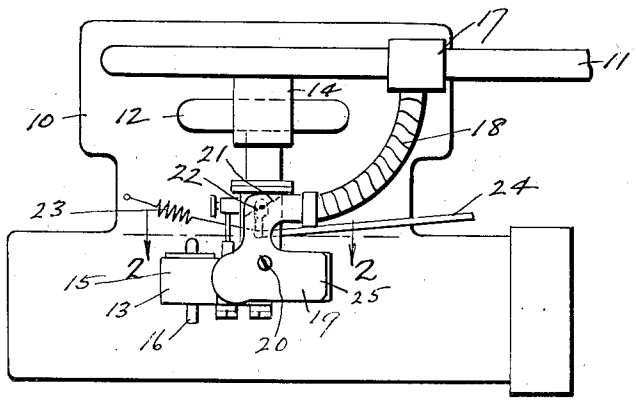


Fig. 2.

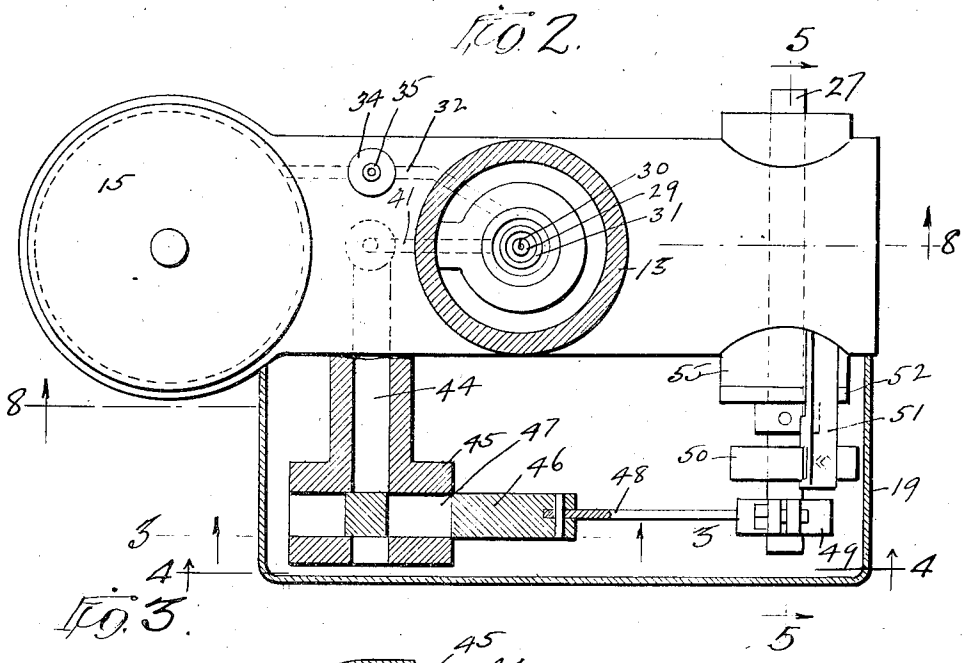
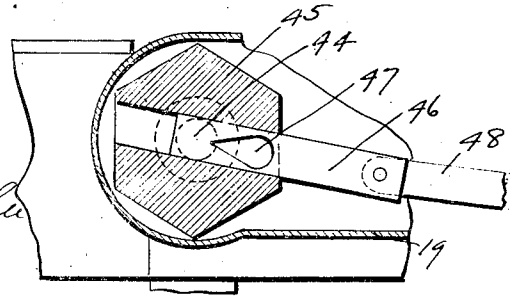


Fig. 3.



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AUTOMATIC FUEL REGULATOR

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Fig. 4.

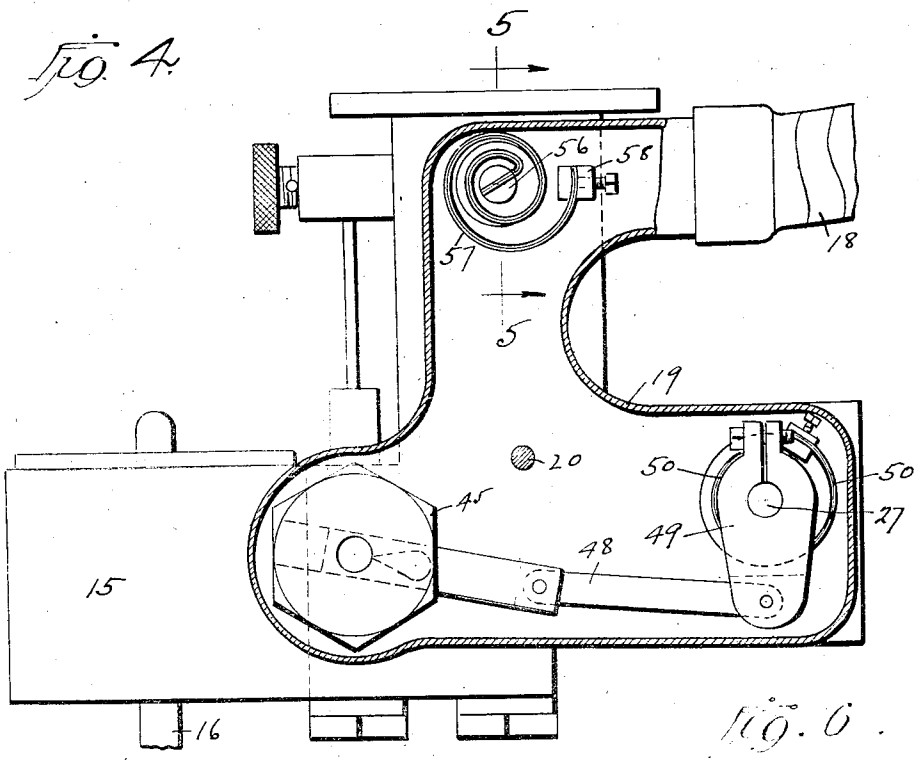
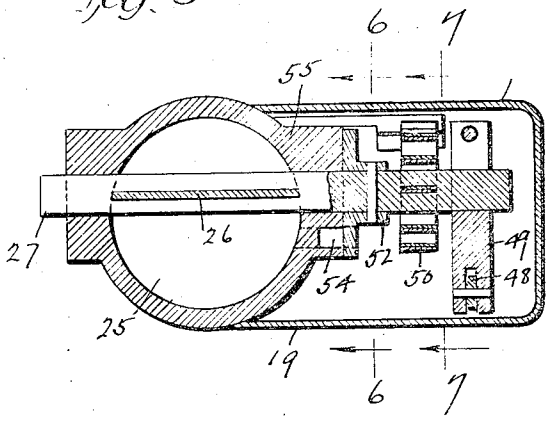


Fig. 6.

Fig. 5



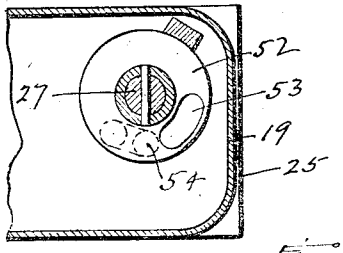
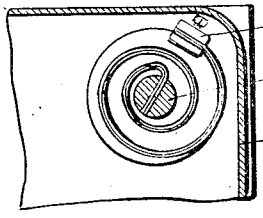


Fig. 7



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April 19, 1932. C. L. STOKES 1,854,236

AUTOMATIC FUEL REGULATOR

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Fig. 8.

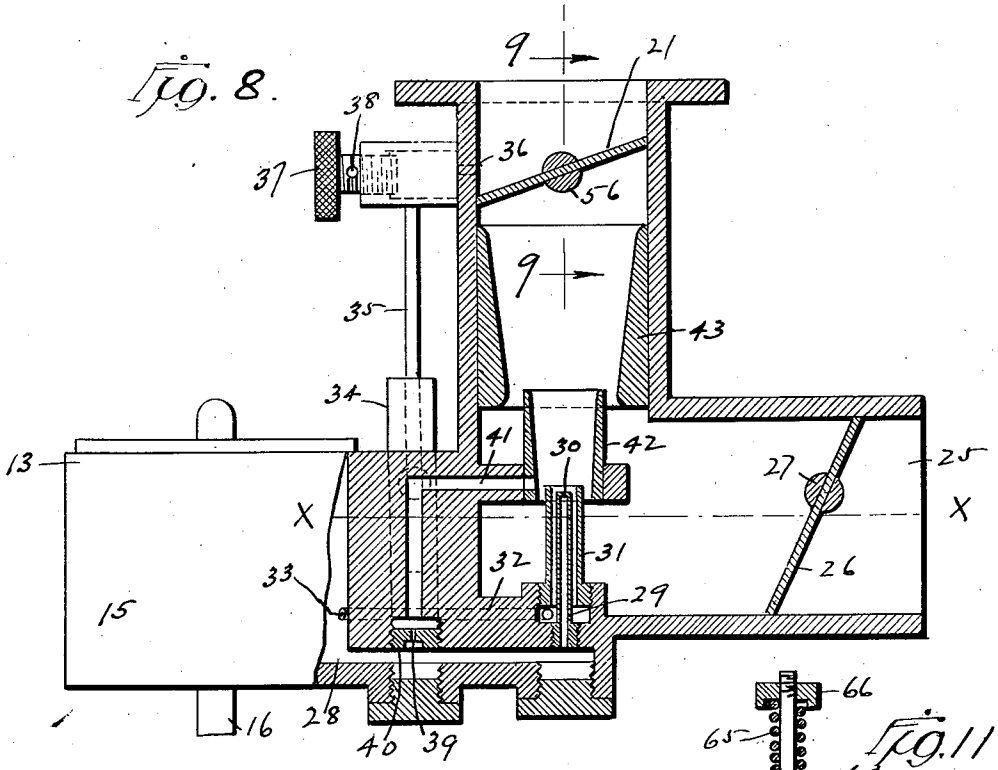


Fig. 9

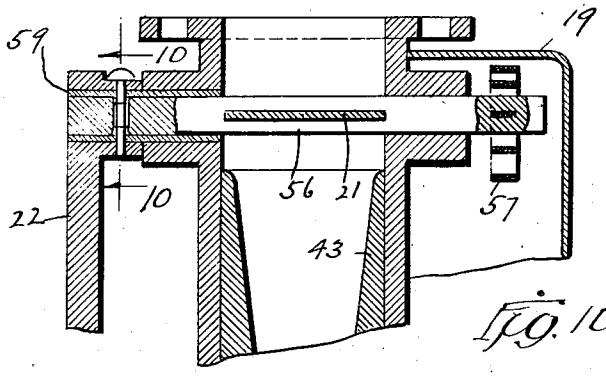


Fig. 10.

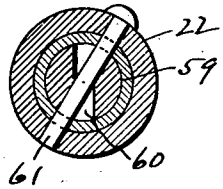
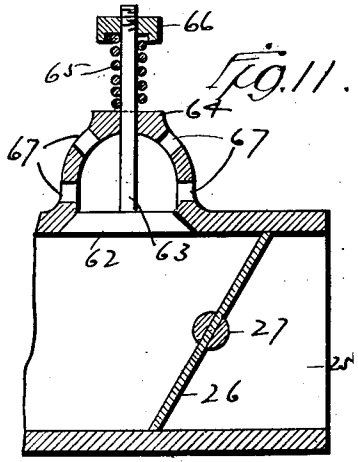


Fig. 11.



Witness

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April 19, 1932. C. L. STOKES 1,854,236

AUTOMATIC FUEL REGULATOR

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Fig. 12.

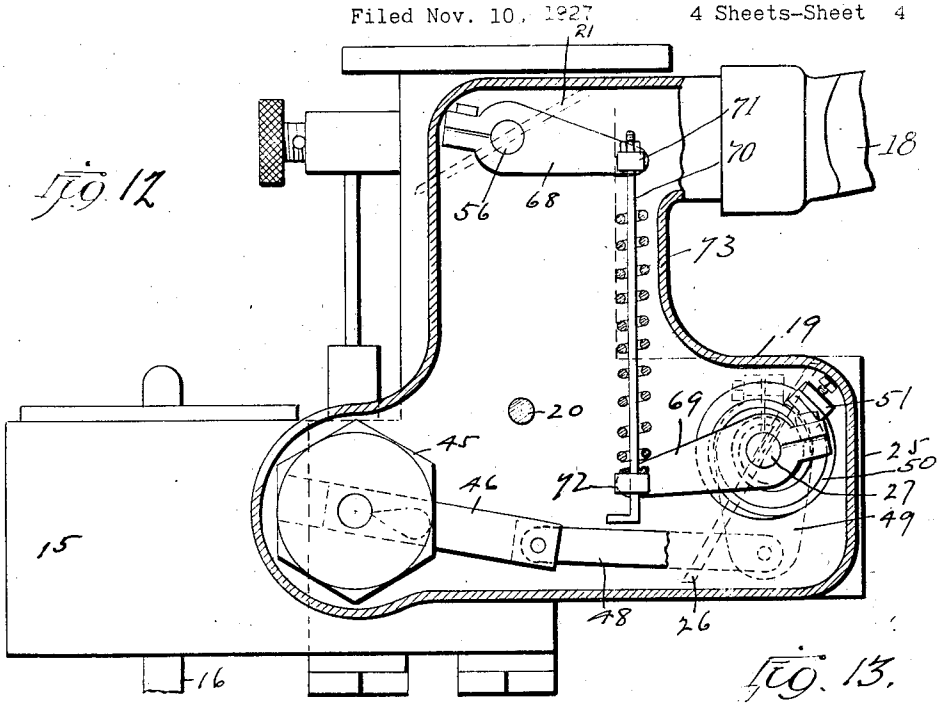


Fig. 13.

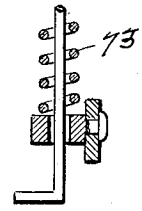


Fig. 14.

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Patented Apr. 19, 1932 1,854,236

UNITED STATES PATENT OFFICE

CHARLES L. STOKES, OF LOS ANGELES, CALIFORNIA, ASSIGNOR TO CURTIS B. CAMP, TRUSTEE, OF GLENCOE, ILLINOIS

AUTOMATIC FUEL REGULATOR

Application filed November 10, 1927. Serial No. 232,301.

This invention relates to improvements in automatic fuel regulators.

The principal object of the invention is to provide automatic fuel regulation through a carburetor for an internal combustion engine whereby the starting of the same will be facilitated and thereafter fuel will be added in the correct proportion to the air until a normal optimum operating temperature is reached.

Another object of the invention is to provide an automatic choke for a carburetor operated by engine vacuum and temperature.

Another object of the invention is to provide auxiliary fuel at starting which is supplied in accordance with the position of the automatic choke.

Another object of the invention is to provide a thermostatically operated auxiliary fuel supply for starting and running an internal combustion engine.

This application is an improvement upon my co-pending application, Serial No. 192,581, filed May 19, 1927.

Referring to the drawings in which the same numbers indicate like parts,

Fig. 1 is a view of an internal combustion engine having a carburetor with my improvements attached thereto;

Fig. 2 is a view, partly in section, along the lines 2—2 of Fig. 1;

Fig. 3 is a sectional view along the lines 3—3 of Fig. 2;

Fig. 4 is a side view, partly in section, of the carburetor shown in Figs. 1, 2, and 3;

Fig. 5 is a sectional view along the lines 5—5 of Fig. 2;

Fig. 6 is a detail along the lines 6—6 of Fig. 5;

Fig. 7 is a detail along the lines 7—7 of Fig. 5;

Fig. 8 is a vertical sectional view along the lines 8—8 of Fig. 2;

Fig. 9 is a transverse sectional view along the lines 9—9 of Fig. 8;

Fig. 10 is a sectional view along the lines 10—10 of Fig. 9;

Fig. 11 shows an alternative construction for part of Fig. 8;

Fig. 12 is a modification;

Fig. 13 is a sectional detail of Fig. 12; and

Fig. 14 is an alternative construction for Fig. 12.

An internal combustion engine 10 has an exhaust pipe 11 and an inlet manifold 12 to which is attached a carburetor 13. A by-pass 14 from exhaust pipe 11 surrounds the inlet manifold 12 in order to form what is commonly known as a "hot spot" to the end that liquid fuel is rapidly vaporized in manifold 12 by the heat of the exhaust gases.

Carburetor 13 may be of a type having the usual float feed fuel chamber 15 open to atmosphere and supplied by liquid fuel through a pipe 16 in any well known manner. A hot air stove 17 surrounds exhaust pipe 11, and hot air is supplied therefrom through a flexible pipe 18 to a casing 19 applied to a flat side of carburetor 13 and held thereon by a screw 20. Carburetor 13 is provided with the usual throttle valve 21 operated by a throttle arm 22, and normally throttle 21 is held closed by a spring 23 and is opened from the dash of an automobile, or other conveyance, by throttle rod 24.

Referring now to Figs. 2, 3, 4, 5, 6, 7, 8 and 9, it will be seen that carburetor 13 is provided with the usual main air inlet 25 in which is placed a choker valve 26 mounted off center on a spindle 27. Liquid fuel is provided from chamber 15 through a passage way 28 to a nozzle 29 having a restricted discharge orifice 30. A second nozzle 31 surrounds nozzle 29 and is provided with liquid fuel from chamber 15 through a passage 32 having a calibrated entry orifice 33 therein, passage 32 connecting with a well 34 open to atmosphere at its upper end and in which depends a small tube 35 for providing idling fuel on the engine side of throttle 21 through a calibrated orifice 36 in the wall of the mixing chamber of carburetor 13. Idling air is supplied to the idling fuel by an adjusting screw 37 having an adjustable air vent 38 therein, and it will be noted that the bottom part of tube 35 is well below the normal liquid level X—X in chamber 15.

A calibrated orifice 39 passes through a plug 40 leading from passage 28 and discharging into a passage 41 for supplying

auxiliary fuel to engine 10 at starting periods.

Nozzles 29 and 31 discharge into the throat of a small venturi 42 which in turn discharges into the throat of a large venturi 43 and passage 41 is adapted to discharge into small venturi 42 above the liquid level X—X and at about the point of maximum constriction therein.

A large passage 44 is drilled through an extension 45 to connect with passage 41, and passage 44 is controlled by a valve 46 having a calibrated orifice 47 therein, the same being pivotally connected by a rod 48 to an adjustable lever 49 fastened on spindle 27, to the end that upon movement of spindle 27, orifice 47 will open passage 44 more or less to atmosphere and thereby reduce the suction on orifice 39 for supplying excess liquid fuel to engine 10 during the warming up period of engine 10.

A spring 50 of bi-metallic construction, wound spirally to form a thermostatic spring, is adjustably connected at one end to a shoulder 51 forming part of the carburetor casing, and at the other end is connected to a slot in spindle 27.

A disc 52 is also pinned to spindle 27 and has therein a slot 53 adapted to register at the proper time with a passage 54 drilled at an angle to pass through a boss 55 on the engine side of the valve 26, and disc 52 moves close to the face of the boss 55 to prevent much leakage of air therethrough except by way of slot 53 and passage 54.

The construction of carburetor 13 as disclosed is generally that of the well known Zenith carburetor with my improvements attached thereto, the main nozzle 29 providing fuel directly according to engine suction, and the nozzle 31 providing a set amount of fuel which is mixed with a variable proportion of air according to the engine suction, nozzle 31 forming what is known as an air bled compensating nozzle.

Throttle valve 21 is mounted on a spindle 56 to one side of which is attached one end of a spirally wound thermostat 57 of bi-metallic construction, the other end being adjustably fastened to a shoulder 58, and the cover 19 surrounds thermostat 57, extension 45, thermostat 50 and lever 49 completely.

The other side of spindle 56 is adapted to move in a sleeve 59 to which is firmly fastened throttle arm 22, a slot 60 being provided in spindle 56 whereby a pin 61 may pass through and provide a certain amount of lost motion between sleeve 59 and spindle 56; pin 61 being firmly fastened through sleeve 59 and throttle arm 22.

The operation of the device is as follows:

Assuming that the engine 10 and carburetor 13 are very cold, thermostat 50 will have closed valve 26 tight, while thermostat 57 will have opened throttle 27 a predetermined amount, and passage 44 will be closed to atmosphere, due to the position of valve 46 and orifice 47.

Now, upon cranking engine 10, a comparatively high vacuum will be induced upon nozzles 29 and 31 as well as passage 41 whereby a very rich priming charge will be drawn into engine 10 and fired therein. Engine 10 thereupon starts idling at a fast rate, and a higher vacuum is temporarily induced on nozzles 29 and 31 and passage 41, but the tension of thermostat 50, which is also a spring, is so calibrated that valve 26 will open a predetermined amount due to its off center position thereby permitting the entry of air and in the aggregate reducing the suction on nozzles 29 and 31 and passage 41 below the cranking suction. At the same time, orifice 47 will commence to open passage 44 to atmosphere thereby reducing the suction on orifice 39 and thus reducing the amount of auxiliary fuel passing therethrough.

As soon as engine 10 fires with the priming charge, heated exhaust gases will pass through pipe 11 and the air in stove 17 will become heated and will be drawn through pipe 18, cover 19, slot 53 and passage 54 to the interior of carburetor 13 responsive to the engine suction, because the initial jump of valve 26, as described, will put slot 53 in such position as to permit the passage of air through passage 54, it being noted that at low temperatures passage 54 is closed to the passage of air therethrough.

The influence of the heated air thus drawn into carburetor 13 causes an increasing expansion of thermostat 50 and an increasing contraction of thermostat 57 to the end that throttle 21 will gradually come to a normal closed idling position while valve 26 will gradually come to a normal wide open running position, and passage 44 will gradually come to be wide open to atmosphere whereby the supply of auxiliary fuel to passage 41 will be completely cut off.

When throttle 21 has arrived at said normal closed idling position, the lost motion between spindle 56 and throttle arm 22 will be completely taken up to the end that upon movement of throttle rod 24, throttle valve 21 may be normally operated and to this end, spring 23 is of much greater strength than thermostatic spring 57.

During the warming up of engine 10, valve 26 being gradually opened, it will be seen that upon suddenly opening throttle valve 21 wide, there will be increased suction placed upon nozzles 29 and 31 and passage 41 whereby a rich accelerating charge will be induced.

Referring to Fig. 11, it may be seen that a similar effect might be obtained by placing valve 26 on center with spindle 27 and in this case, it is advisable to provide an auxiliary air valve 62 having a stem 63 working through a bell-shaped portion 64 against the resistance of a spring 65 held by an adjusting nut 66.

Air ports 67 are provided in portion 64 for the admission of air.

The valve 62 is so arranged that at low temperatures, as already described, when valve 26 is closed, the resistance of spring 65 will be such that valve 62 remains closed when engine 10 is being cranked to start the same. As soon as the engine 10 starts, the increase in vacuum, as described, will cause valve 62 to open a predetermined amount and admit air, and thereafter as heat from the engine causes valve 26 to be opened, valve 62 will correspondingly close so that sufficient air will be provided for running the engine until the optimum temperature is reached.

Referring now to Figs. 12 and 13, it will be seen that an adjustable lever 68 is fastened to spindle 56, and another lever 69 is fastened to spindle 27, the ends of levers 68 and 69 being flexibly connected by a rod 70 having one end passing through a revolving socket 71 moving on lever 68, the other end passing through a revolving socket 72 moving on lever 69, rod 70 being surrounded by a spring 73.

The operation of this device is as follows: Spindle 56 now has no thermostat connected thereto and has throttle arm 22 fastened directly thereto, and lever 69 is operated by thermostat 50 according to the description already supplied. However, it is sometimes desirable to open and close throttle valve 21 rapidly and this is now permitted by this construction whereby sufficient lost motion is provided below socket 72 in the rod 70 that upon opening throttle valve 21, choker valve 26 will be only partially opened.

In this manner, a draft of air past throttle valve 26 can be positively provided for blowing the priming charge into engine 10. Also, sometimes moisture closes and freezes throttle 26 to air passage 25 so that the differential pressure on valve 26 is insufficient to break the same, but by the improved construction described, this may now be manually done by the movement of throttle rod 24.

Spring 73 is provided so that when throttle 21 is closed, as shown, and throttle 26 comes wide open due to the influence of heat, spring 73 will then tend to maintain the throttle 26 in a substantially horizontal position so that excess heat will not permit the same to open more than wide open and thus not restrict air passage 25 when optimum operating temperature is reached.

Referring to Fig. 14, it will be seen that the thermostatic spring 50 is now placed in another position. Instead of being fastened to spindle 27, spring 50 is now fastened to spindle 56 and is surrounded by a small casing 73 fastened to carburetor 13, the interior of which is connected by a pipe 74 to the interior of exhaust pipe 11 whereby heated exhaust gases may be conveyed directly for influencing thermostat 50. The other end of thermostat 50 is connected to yoke 75 forming one end of an adjustable rod 76, the other end being connected to a yoke in lever 69.

A sector 77 is fastened to spindle 56 and arranged to rotate therewith to the end that as thermostat 50 expands, the entry of pipe 74 to casing 73 will be gradually closed until at maximum engine operating temperatures, the entry of pipe 74 to casing 73 will be closed except for a calibrated opening 78.

The operation of this device is as follows: At low temperatures, the tension of thermostat 50, which works through a slot 79 in one face of casing 73, casing 73 being closed except for slot 79, pipe 74, and a drainage port 81, causes valve 26 to be held closed. Upon manually operating spindle 56, directly fastened to throttle arm 22, valve 26 may be opened a small predetermined distance.

At optimum operating temperatures, when thermostat 50 has opened valve 26 wide, throttle 21 being closed, the tendency of valve 26 to be moved beyond wide open when throttle 21 is opened wide is prevented by a stop 80 on valve 46 coming in contact with a face of extension 45. The movement of throttle 21 in this case causes a positive contraction of thermostat 50 against the resistance caused by heat, but such contraction is well within the permissible elastic limits of thermostat 50.

It is desirable, if possible, to influence thermostats 50 and 57 with heated exhaust gases in direct contact because quick heat is initially required, but such heat must be controlled by sector 77 as described.

Also cover 19, or casing 73, may be constructed of very heavy metal to the end that when optimum temperature conditions are reached and engine 10 is stopped, the residual heat in cover 19, or casing 73 will be gradually lost and thus gradually permit valve 26 to close in proportion to the loss of heat from engine 10.

By the means described, quick starting and running is accomplished, and the proportions of fuel to air are varied not only in accordance with engine temperature conditions, but also partly in accordance with atmospheric temperature conditions. To this end, inasmuch as there is a time factor to be considered in the use of heat, especially exhaust gas heat, with thermostats, the length and internal diameter of pipe 74 must be considered. If pipe 74 be of great length, it may be insulated to prevent loss of heat by radiation.

One great advantage of the construction shown in Fig. 14 is that the journals of spindle 27 are never gummed up by carbon deposits or dirt, the positive and continuous manual operation of spindle 56 also preventing such occurrences, the net result being that thermostat 50 is thus permitted to be calibrated for properly actuating the freely

moving valve 26. At the same time, it is obvious that one end of thermostat 50 may be fastened to a shoulder instead of yoke 75, the other end being fastened to spindle 56 and thus it is useful in connection with any carburetor at starting periods.

I claim as my invention:

1. A carburetor having an air passage, a choke valve controlling the entry to the air passage, a fuel nozzle discharging into the air passage, a throttle valve controlling the discharge from the air passage, and thermostatic means adapted to open the throttle valve and close the choke valve when the engine is at its normal inoperative temperature.

2. A carburetor having an air passage, a choke valve, controlling the entry to the air passage, a throttle valve controlling the discharge from the air passage, a fuel nozzle discharging into the air passage between said valves, and thermostatic means controlling the position of said valves.

3. A carburetor having an air passage, a fuel nozzle discharging into the air passage, a throttle valve controlling the discharge from the air passage, a spindle for holding the throttle valve and extending through the walls of the passage, a throttle arm and connected sleeve surrounding one exterior end of the spindle, a lost motion connection joining the throttle arm and spindle, and a thermostatic spring on the other exterior end of the spindle.

4. The combination with an internal combustion engine of a carburetor having an air passage, a main fuel nozzle discharging into the air passage, an auxiliary fuel nozzle discharging into the air passage, thermostatic means controlling the discharge from the auxiliary fuel nozzle, means to apply engine generated heat to the thermostatic means, and means for controlling the application of said heat.

5. The combination with an internal combustion engine of a carburetor having an air passage, a choke valve in the air passage, a main fuel nozzle discharging into the air passage, an auxiliary fuel nozzle discharging into the air passage, and thermostatic means actuated by engine generated heat for controlling the choke valve and auxiliary fuel nozzle.

6. The combination with an internal combustion engine of a carburetor having an air passage, a choke valve in the air passage, a main fuel nozzle discharging into the air passage, an auxiliary fuel nozzle discharging into the air passage, thermostatic means actuated by engine generated heat for controlling the choke valve and auxiliary fuel nozzle, and means for controlling the application of said heat.

7. The combination with an internal combustion engine of a carburetor having an air passage, a fuel nozzle discharging into the air passage, a throttle valve controlling the discharge from the air passage, a spindle for holding the throttle valve and extending through the walls of the passage, a throttle arm and connected sleeve surrounding one exterior end of the spindle, a lost motion connection joining the throttle arm and spindle, a thermostatic spring on the other exterior end of the spindle, and means to apply engine generated heat to the thermostatic spring.

8. The combination with an internal combustion engine of a carburetor having an air passage, a fuel nozzle discharging into the air passage, a throttle valve controlling the discharge from the air passage, a spindle for holding the throttle valve and extending through the walls of the passage, a throttle arm and connected sleeve surrounding one exterior end of the spindle, a lost motion connection joining the throttle arm and spindle, a thermostatic spring on the other exterior end of the spindle, means to apply engine generated heat to the thermostatic spring, and means for controlling the application of said heat.

9. The combination with an internal combustion engine of a carburetor having an air passage, a fuel nozzle discharging into the air passage, a throttle valve controlling the discharge from the air passage, a spindle for holding the throttle valve and extending through the walls of the passage, a throttle arm and connected sleeve surrounding one exterior end of the spindle, a lost motion connection joining the throttle arm and spindle, a thermostatic spring on the other exterior end of the spindle, and means to apply the engine exhaust gases to the thermostatic spring.

10. The combination with an internal combustion engine, of a carburetor having an air passage, a valve located at the entrance end of said air passage, thermostatic means for controlling said valve, a main fuel supply nozzle and auxiliary fuel supply nozzle, means for controlling the auxiliary fuel supply nozzle, means for interconnecting said controlling means with said valve, a throttle valve at the exit end of the air passage, and thermostatic means for controlling said throttle valve.

In testimony whereof I affix my signature.

CHARLES L. STOKES.