

Sept. 6, 1949.

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2,481,259

AUTOMATIC CHOKE FOR CARBURETORS

Filed Aug. 10, 1935

2 Sheets-Sheet 1

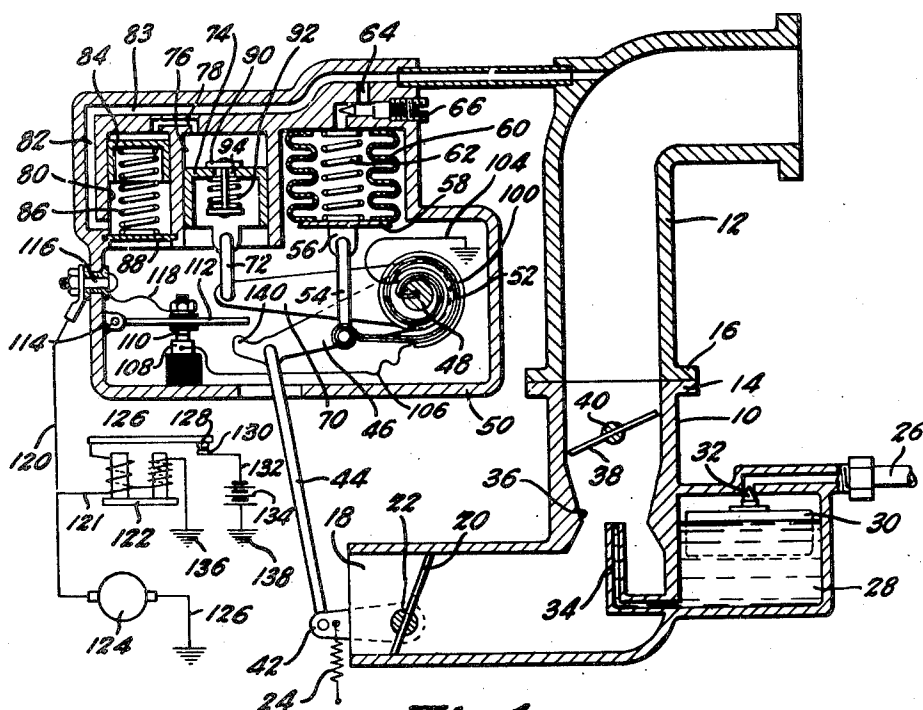


Fig. 1.

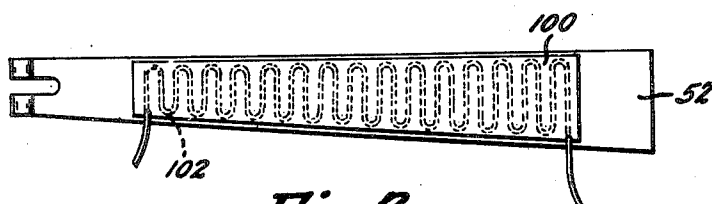


Fig. 2.

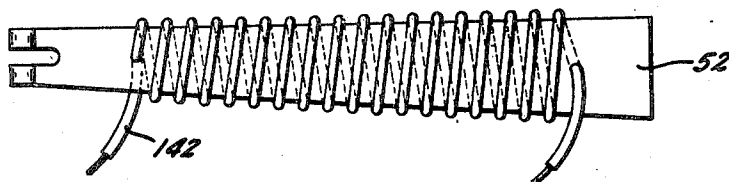


Fig. 3.

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2 Sheets-Sheet 2

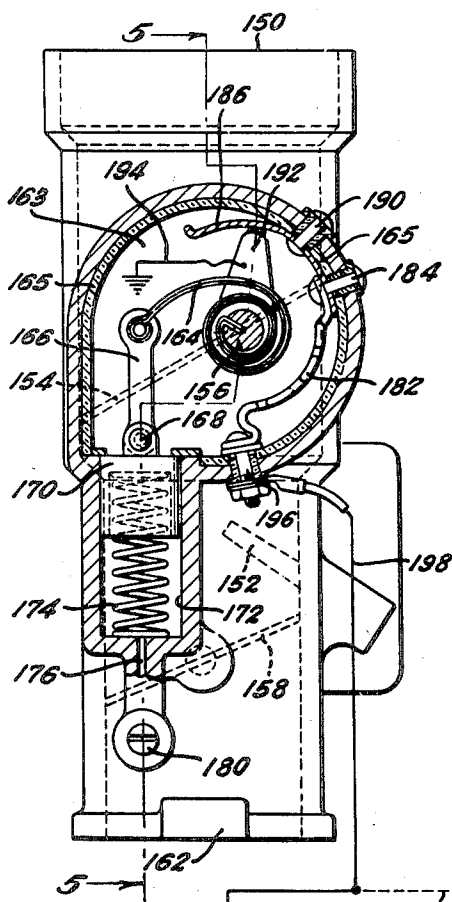


Fig. 4.

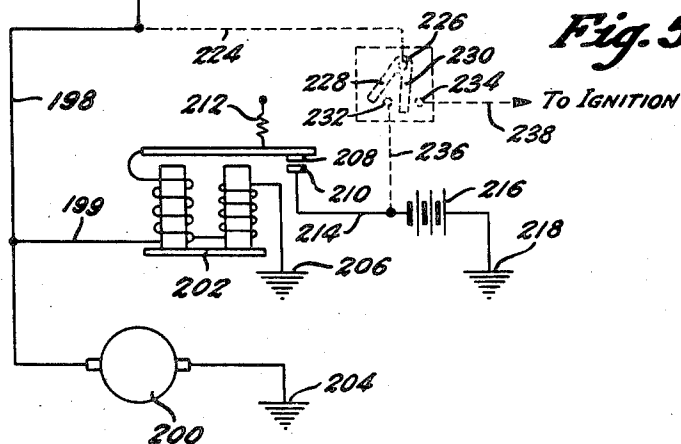


Fig. 5.

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2,481,259

AUTOMATIC CHOKE FOR CARBURETORS

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Application August 10, 1935, Serial No. 35,638

17 Claims. (Cl. 123—119)

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This invention relates to automatic choke devices for controlling the fuel mixture ratio formed by charge forming devices for internal combustion engines.

Choke mechanisms of the automatic type have been provided heretofore for the purpose of automatically increasing the fuel content in the mixture supplied to the engine when the latter is cold so as to facilitate starting and such devices have been provided with means for rendering them inoperative after the engine warms up to normal temperature so that after the warm up period has passed, the mixture provided for the engine by the charge forming device is of normal fuel content. These devices have, in general, been controlled by some thermally responsive means which, when cold, has been utilized either to hold an air valve closed, or a fuel valve open, and when the temperature adjacent such thermally responsive device increases, the device becomes ineffective to position the valves as described, so that the charge forming device thereafter provides its normal mixture.

Certain difficulties have been encountered heretofore in so constructing such device that the thermally responsive element heats up sufficiently rapidly to enable the valve controlled thereby to be so positioned as to supply a normal mixture sufficiently quickly after the engine begins to operate. In other words the rich mixture is provided for too long a time. Heretofore, the engine has been employed as a heating medium to supply heat to the thermally responsive element and even when the element is mounted on the manifold heater itself, the rise in temperature adjacent such thermal element has been somewhat slow to give the best results under all conditions and this difficulty is even more apparent when the thermally responsive element is mounted on or constructed as a part of the charge forming device itself, which is most desirable for manufacturing purposes.

It is the primary purpose of the present invention to provide improved means for heating the thermally responsive element of an automatic choke device so that such element is subjected to the proper degree of heat to give the best results under all conditions.

It is a further and more specific object of the invention to provide a means for heating the thermally responsive element of an automatic choke mechanism of the character described during the warm up period of the engine by a means other than the engine, itself, and further, to provide means for rendering this heating de-

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vice inoperative immediately after the warm up period has elapsed and the engine has attained its normal engine operating temperature.

It is a still further object of the invention to provide an automatic choke control mechanism which is built within the charge forming device itself and is provided with thermally responsive control means in combination with means for heating the thermally responsive control means which is effective to heat the thermally responsive means to the desired degree under all operating conditions.

According to the present invention, these objects are attained by the provision of an electrical heating device which is positioned immediately adjacent the thermostat, itself, and which is provided with a controlling circuit so arranged that the heating coil becomes effective immediately upon the starting of the engine and remains effective until the temperature adjacent the thermally responsive element reaches a predetermined degree when the circuit is broken and remains broken as long as the temperature adjacent such thermally responsive element is above the predetermined degree referred to.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is a diagrammatic view of a charge forming device provided with an automatic choke mechanism equipped with a heating device for the thermally responsive control element constructed in accordance with this invention.

Fig. 2 is a detailed, plan view of the thermally responsive element and a form of heating element associated therewith.

Fig. 3 is a view similar to Fig. 2 showing a modified form of heating device.

Fig. 4 is a section on the line 4—4 of Fig. 5, showing a down-draft type of carburetor provided with a modified form of choke device and heating element for the thermally responsive control member thereof and including a diagram of the control circuit.

Fig. 5 is a vertical section on the line 5—5 of Fig. 4.

Referring to Fig. 1, the reference character 10 indicates a carburetor of the conventional plain tube type which is secured to the riser of an intake manifold 12 and provided with an attaching flange 14 adapted to be attached to a corresponding flange 16 on the manifold.

The carburetor, being of the conventional plain tube type, has a single air inlet 18 controlled by an unbalanced air valve 20 secured to a shaft 22, which is off center with respect to the valve. The valve may be held by a thermostat, later described, and a spring 24 shown diagrammatically in Fig. 1 may be used to aid the thermostat, but may be omitted if desired.

Fuel is supplied from a main fuel tank through a pipe 25 to a float chamber 28 of conventional type, having a float 30 therein which controls a valve 32 to regulate the addition of fuel to the float chamber. Fuel is supplied to the intake passage of the carburetor through a nozzle 34 which terminates in conventional manner within a Venturi tube 36, to create a suction at the end of the nozzle, the flow of mixture from the carburetor being controlled by a throttle valve 38 of conventional form which is secured to a shaft 40 journaled in the carburetor housing and adapted to be operated in the usual way.

The air inlet valve 20, previously referred to, is variably positioned under different operating conditions to control the ratio of fuel to air in the mixture which is supplied by the carburetor to the engine with which it is associated. Such valve is adapted to be held in closed position when the engine is cold so as to provide a rich mixture at such time to facilitate starting. As the engine warms up subsequent to its starting, the pressure of the thermostat to hold the valve closed is progressively reduced and finally the thermostat operates to move the valve to open position against the force of the spring which holds it closed.

Also in the form of the device shown, a suction operated element is provided to move the valve toward open position in the event that the engine fails to start immediately, so as to prevent flooding of the engine under such conditions, while a further suction operated member is adapted to move the valve temporarily toward closed position upon opening movement of the throttle, the last mentioned device being provided to prevent leaning of the mixture during the acceleration period.

These various control devices are all shown in the earlier application of Clarence H. Jorgensen and Peter J. Jorgensen, Serial No. 585,510, but so far as the present invention is concerned, such suction operated devices are not necessary, and the heating device which forms the present invention may be used without such suction operated device, but when the heating means and such suction operated device are employed in combination the control of the mixture under all conditions is more accurate than if the suction operated devices were omitted.

Referring now to the mechanism for operating the air valve 20, the shaft 22 has secured thereto an arm 42 and connected with the free end of the arm 42 is a link 44 which extends upwardly and is pivotally connected at its upper end to an arm 46, secured to a shaft 48, journaled for rotation in a housing 50, which is secured to the manifold in any desirable manner and in which is contained the control unit for operating the choke valve 20, said control unit comprising the thermostat and the suction operated devices previously referred to.

Connected at one end to the shaft 48 is a bimetallic thermostat 52 of the coil type, the free end of which is pivotally connected to a link 54 which, at its upper end, is secured to an ear 56 projecting from a plate 58 which forms one end of a bellows 60, preferably of metallic construc-

tion, and normally held in its expanded position by a compression spring 62 received within the bellows and engaging the top of the housing 50 at its upper end. The interior of the bellows communicates with a valve controlled suction passage 64 through which the suction of the intake manifold may be communicated to the interior of the bellows, the effective area of the suction passage being controlled by a manually adjustable needle valve 66 which is screwed into the housing 50.

Normally, when the device is cold, the parts are in the position shown in Fig. 1. The thermostat, when cold, and the springs 24 tend to hold the valve 20 in closed position with the arm 46 in the position shown. As the engine warms up the thermostat will, of course, expand and the expansion of the thermostat first reduces the force holding the valve closed and eventually causes a clockwise movement of the arm 46 which results in the opening of the valve 20 to a degree determined by the heat to which the thermostat is subjected. Therefore, in any position of the thermostat when the engine is at high temperature which subjects the thermostat, to relatively high temperature would be such as to position the valve either in full open, or in partially closed position dependent upon the degree of heat maintained adjacent the thermostat.

The action of the engine suction upon the bellows 60 is also utilized to move the valve 20 toward its open position under certain circumstances. The engine suction is communicated through passage 64 to the interior of the bellows as set forth previously and the air within the bellows is slowly exhausted thereby at a rate determined by the position of the valve 66. The flow of air from the bellows is necessarily very slow if the valve is properly adjusted so that there will be a material interval of time before the suction becomes sufficient to open the valve 20 against the closing pressure thereon. The action of the bellows is to lift the free end of the thermostat and through the medium of the latter, the shaft 48 is rotated so as to move the arm 46 in a clockwise direction as it is moved when the thermostat expands. This mechanism is provided to permit air to flow into the intake passage to prevent flooding in the event that the engine does not start within a very brief period after the cranking begins. The valve 66 should be adjusted to give whatever time interval is desired before the suction begins to be effective initially.

When the engine begins to run the increase of vacuum effective upon the bellows is very considerable by comparison to the vacuum during cranking and this increased vacuum is effective to operate the arm 46 to move the valve 20 still farther toward open position so as to provide a still leaner mixture after the engine begins to run on its own power. The bellows during normal operation of the engine is, of course, effective to hold the free end of the thermostat in whatever position is determined by the degree of suction effective on the bellows.

As indicated previously, means are also provided to control the action of the valve 20 during the acceleration period and for this purpose the shaft 48 has secured thereto an arm 70 one end of which is pivotally connected to a link 72, pivotally connected to a piston 74 slidable in a cylinder 76, formed in the housing 50. The top of the cylinder 76 is connected by a passage 78 with another cylinder 80, also formed within the housing 50. The cylinder 80 is connected at its

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lower end to a suction passage 82 which, at its upper end, connects with the suction passage 83, leading to the intake manifold and communicating with the suction passage 64 previously referred to. A piston 84 is slidable within the cylinder 80 and is normally held in its upper position by a spring 86 received between the piston and a closure plate 88 at the bottom of the cylinder 80. A valve 90 normally held in closed position by a spring 92 closes a port 94 in the piston 74, and permits the piston to have a dash pot action.

Obviously, the piston 74 will be moved downwardly if the pressure above the piston is increased and on such downward movement of the piston, the valve 20 will be moved toward closed position because the arm 70 is secured to the shaft 48 to which the arm 46 is also secured. The high vacuum existing in the intake manifold when the throttle is closed or partially closed is communicated through the passages 83 and 82 to the cylinder 80 and pulls the piston 84 downwardly against the pressure of the spring. Any reduction in this vacuum will cause the piston 84 to move upwardly and force air from the cylinder 80 through the passage 78 to increase the pressure above the piston 74 and close the valve 20 as previously described. This action takes place upon any opening of the throttle valve which causes a reduction in the vacuum between said throttle valve and the engine, such reduction occurring during the acceleration period and the valve 20 is moved by the mechanism just described to compensate for the effect of this decrease in vacuum, which otherwise would cause a leaner mixture to be supplied by the carburetor as is well known in the art.

All of the construction previously described is generally similar in design and function to that shown in the joint application of Clarence H. Jorgensen and Peter J. Jorgensen, which has been referred to above.

In the earlier application above referred to, the housing corresponding to the housing 50 is secured directly against the heating chamber for the carburetor, which is customarily known as a "hot spot." Exhaust gases are passed through this chamber which heats relatively rapidly as the engine begins to run and such chamber being relatively close to the thermostat, the latter heats up relatively rapidly. It has been found, however, that it does not heat sufficiently rapidly under all circumstances and, moreover, it has also been found that it is somewhat less expensive to manufacture a device in which the choke unit and control unit were constructed as a part of the carburetor than as a separate unit relatively remote therefrom. To overcome these difficulties, the present applicant has provided a heater comprising an electrical heating element which, in the form shown in Fig. 1, is a form of asbestos strip cemented or otherwise secured to the thermostat itself, and indicated in the drawings by the reference character 100. Incorporated within this strip is a resistance element or wire 102 which comprises an electrical heater. One end of the wire 102 is grounded as indicated at 104 and its other end is connected by a wire 106 to a contact 108 suitably insulated from the housing 50 and adapted to be engaged by a movable contact 110 carried by and suitably insulated from an arm 112 pivoted at 114 to a lug projecting from the housing 50. Connecting this contact with a binding post 116 suitably insulated from the housing 50 is a wire 118 and also con-

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nected with the binding post is a wire 120 which extends to the generator. Extending from wire 120 to the cut-out relay is wire 121. The cut-out relay is of ordinary conventional construction and need not be described specifically more than to say that it comprises a magnet which operates an arm 126 carrying a movable contact 128, adapted to engage a contact 130 connected by the wire 132 to the battery 134 whenever the generator is operating above a predetermined very low speed. The contacts 128 and 130 are, however, separated whenever the generator is not running to prevent a discharge from the battery back through the generator to ground in a manner well known in the art. The winding of the magnet of the relay is grounded at 136 and the battery is grounded at 138, as indicated in the drawing.

It will be understood that instead of connecting the terminal 116 in the manner described it might be connected directly with the battery through the medium of the ignition switch if so desired since such switch is normally open when the engine is not running.

The above described heating device operates as follows. As previously pointed out, the switch comprising contacts 108 and 110 is normally closed as shown in Fig. 1 when the engine is not running, but the switch comprising contacts 128 and 130 is open so that no current can flow from the battery through the heating element under normal conditions when the engine is not running. As soon as the engine is started, however, and reaches a predetermined speed, which is relatively low speed, such as the normal idling speed, the contacts 128 and 130 are closed, at which time current will flow from the battery through the wire 132, contacts 128 and 130, arm 126, the winding of the cut-out relay and wire 120 to the binding post 116 from which it flows through wire 118, switch contacts 110 and 108, and wire 106 to the heating coil 102 and thence to ground through the connection 104, and from ground back to the battery through the connection 138. Thus the circuit through the heating element will be established when the motor begins to run at a speed even as low as idling and current will continue to flow through the heating element so as to heat up the thermostat quite rapidly, and more rapidly than has been heretofore possible, until the expansion of the thermostat lifts the arm 46, which through the medium of a toe 140 formed thereon lifts the arm 112 to break the circuit by separating the contacts 108 and 110. Obviously, these contacts will remain separated as long as the heat to which the thermostat is subjected is enough to cause sufficient expansion of the thermostat to lift the arm 112 as described. This degree of heat which is maintained by the engine, itself, after the latter heats up and is operating normally will maintain the contacts 108 and 110 open as long as the engine continues to run under its own power under normal circumstances. With this arrangement, therefore, the electrical heating device is effective only during the warm up period of the engine, is operative to cause the thermostat to open the valve 20 very soon after the engine becomes self-operative, and prevents the formation of a too rich mixture within the carburetor for too long a period of time, a difficulty heretofore encountered during the operation of the engine with automatic choke mechanism of this general character.

The form of invention shown in Fig. 3 is very similar to that previously described and the only

change is in the heating element itself, which in this form consists merely of a heating wire 142 wrapped around the thermostat.

In the form of the invention shown in Figs. 4 and 5, a somewhat different arrangement of control means for the choke valve is shown and the control mechanism is incorporated as a part of a down-draft carburetor instead of being an entirely separate unit secured to the manifold as in the form of the invention previously described. The carburetor illustrated comprises an intake passage indicated generically by the number 150 to which fuel is fed by a nozzle 152, while air is admitted at the upper end of the passage 150 and is controlled by an unbalanced choke valve 154 secured to the shaft 156 which is suitably journaled in the walls of the intake passage and is off center with respect to the valve as shown. The flow of mixture from the carburetor is controlled by a throttle valve 158 of the usual construction secured to a shaft 160 journaled in the housing and adapted to be manually operated by any suitable mechanism. This carburetor is positioned above the manifold to which it is adapted to be attached by means of flange 162 which engages a corresponding flange on the manifold.

The choke valve may be held closed by a spring, not shown, and a thermostat comprising the bi-metallic coil 164 or the spring may be omitted and the thermostat, itself, may constitute the only means for holding the valve in closed position. The thermostat is positioned in a chamber 163 which is lined with cork or other suitable material as indicated at 165 and is provided with a detachable cover 167. This thermostat is connected at one end directly to the shaft 156, which extends into chamber 163 as indicated in Fig. 4, and at its other end is connected to a link 166 which extends downwardly and is positively connected at 168 to a lug projecting from a piston 170 slidable in a cylinder 172 formed in the carburetor housing and normally held in its upper position as shown in Fig. 4 by a spring 174 which is received between the piston and the bottom of the cylinder.

Communicating with the bottom of the cylinder is a suction passage 176 which communicates with another suction passage 178 leading to the intake passage 150 at a point between the throttle valve 158 and the engine. The effective area of this suction passage is controlled by a manually operable needle valve 180 screwed into the housing as indicated in Fig. 5.

The operation of this device is similar to that of the device previously described except for the fact that no means is shown to compensate for acceleration corresponding to the pistons 84 and 74 of the device shown in Fig. 1. When the device is cold and the engine is stationary, the piston 170 is held in its upper position. When the thermostat heats up and expands the expansion thereof will open the valve 154 to an amount dependent upon the heat to which the thermostat is subjected until the valve 154 is eventually fully open.

The piston 170 and the suction connections 176 and 178 perform substantially the same function as previously described with respect to bellows 60 and the suction connection communicating therewith. If the valve 154 is held closed by the thermostat as previously described with the engine cold the starting motor becomes effective to crank the engine, suction is communicated to the piston 170 which gradually builds up sufficiently to pull the piston 170 downwardly and

so through the medium of the thermostat opens the valve 154 to an extent dependent upon the suction and the force of the thermostat which is effective on the valve. This device operates to prevent flooding in exactly the same manner as previously described.

The heating element disclosed in this form of the invention comprises a heating coil 182, which is of somewhat arcuate form so as to lie somewhat parallel to the surface of the thermostat in the chamber 163, as shown in Fig. 4. One end of coil 182 is connected by a binding post 184, suitably insulated from the housing, in contacting relation with a metallic contact piece of arcuate form 186, which is also suitably insulated from the housing by means of the cork lining 165 of the chamber in which the thermostat is positioned. This contact piece is also secured in position by a rivet 190 so as it will be rigidly held in place. Secured to one end of the shaft 156 is a contact arm 192 grounded at 194, which is adapted to wipe over the surface of the contact piece 186, as the arm is moved during movement of the choke valve. The other end of the heating element 182 is connected to a binding post 196 which is suitably insulated from the housing and at its other end is connected to a wire 198 which extends to the generator 200. A wire 199 connects the cut-out relay, indicated generically by the reference number 202, which is of substantially the same form as that disclosed in Fig. 1, with the wire 198. The generator is grounded at 204 while one end of the winding of the relay magnet is grounded at 206. The contacts of the relay are indicated at 208 and 210 and are normally held open by a spring 212. The contact 210 is connected by the wire 214 with the battery 216 which is grounded at 218.

In Fig. 4 is shown the alternate control circuit employing the ignition switch. When this circuit is used the wire 198 connects with a wire 224 leading to the movable contact 226 of the ignition switch instead of extending to the generator and cut-out relay as previously described. The contact 226 is provided with two arms 228 and 230 adapted to engage fixed contacts 232 and 234 from wires 236 and 238 which lead respectively to the battery and to the ignition system of the engine. The path of current from the battery to the heating element 182 is deemed obvious and need not be discussed.

The operation of this heating element is substantially the same as that previously described. When the engine is at rest, if the thermostat is cold, the contact arm 192 engages the contact piece 186 but the circuit is broken because of separation of the contacts 208 and 210 of the cut-out relay as previously described. When the engine starts to run under its own power these contacts 208 and 210 are closed and current will flow from the battery through the relay, the wire 198, and binding post 196 to the heating element 182, thence through contact piece 186, arm 192 and the connection 194 to ground, and back to the battery through the connection 218. As the thermostat warms up and expands to open the valve 154 as previously described, the contact arm 192 is moved in a counterclockwise direction and finally is moved entirely out of engagement with the contact piece 186 so as to break the circuit of the heating element at such point and such circuit will remain broken until the thermostat is again sufficiently cool for the arm to engage the contact piece 186. As long as the engine runs

under its own power after the warm up period is over, the heat which the thermostat gets from the engine, itself, is sufficient to keep the circuit of the heating element open so that it is not effective until after the thermostat again cools down subsequent to the stopping of the engine.

While the embodiments of the present invention as herein disclosed, constitute preferred forms, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A choke mechanism for the charge forming device of an internal combustion engine having in combination means for varying the fuel to air ratio in the mixture formed by said charge forming device, a thermostat for operating said ratio varying means, relatively remotely located with respect to the engine, heating means for raising the temperature adjacent the thermally responsive means more rapidly than the temperature adjacent the engine is raised and means other than the thermostat for rendering the heating means inoperative after a predetermined effect on the thermally responsive means.

2. A choke mechanism for the charge forming device of an internal combustion engine having in combination means for varying the fuel to air ratio in the mixture formed by said charge forming device, thermally responsive means for operating said ratio varying means, relatively remotely located with respect to the engine, heating means for raising the temperature adjacent the thermally responsive means more rapidly than the temperature adjacent the engine is raised, means operable when the engine operates at a predetermined speed for rendering the heating means inoperative after a predetermined effect on said thermally responsive means.

3. A choke mechanism for the charge forming device of an internal combustion engine having in combination means for varying the fuel to air ratio in the mixture formed by said charge forming device, a thermostat for operating said ratio varying means, an electric heating device for heating the thermostat, and means comprising an element separate from but operable by the thermostat for rendering the said heating device inoperative.

4. A choke mechanism for the charge forming device of an internal combustion engine having in combination means for varying the fuel to air ratio in the mixture formed by said charge forming device, thermally responsive means for controlling the position of said ratio-varying means, means for heating said thermally responsive means, means for rendering said heating means inoperative after its heating effect on said thermally responsive means reaches a predetermined degree, and suction operated means also controlling the position of said ratio varying means, effective on the latter during the entire operation of the engine under its own power.

5. A charge forming device for an internal combustion engine having, in combination, means for varying the fuel to air ratio of the combustible mixture formed by said charge forming device and comprising a choke valve adapted to variably restrict the air inlet of said charge forming device and movable to different positions in response to variations in temperature and engine suction, a thermostat for controlling the position of the choke valve, an operative connection between the thermostat and the choke valve, means for rendering said thermostat effective to hold the choke

valve closed at low temperatures and to move said valve to open position as the temperature is increased, heating means other than the engine for heating the thermostat when the engine is in operation, and means for rendering said heating means ineffective as the choke valve is moved toward open position by the thermostat.

6. A charge forming device for an internal combustion engine having, in combination, means for varying the fuel to air ratio of the combustible mixture formed by said charge forming device and comprising a choke valve adapted to variably restrict the air inlet of said charge forming device and movable to different positions in response to variations in temperature and engine suction, a thermostat for controlling the position of the choke valve, an operative connection between the thermostat and the choke valve, means for rendering said thermostat effective to hold the choke valve closed at low temperatures and to move said valve to open position as the temperature is increased, an electric heating device for heating the thermostat when the engine is in operation and means for opening the circuit of said heating device to render said device inoperative as the choke valve is moved toward open position by the thermostat.

7. A charge forming device for an internal combustion engine having, in combination, means for varying the fuel to air ratio of the combustible mixture formed by said charge forming device and comprising a choke valve adapted to variably restrict the air inlet of said charge forming device and movable to different positions in response to variations in temperature and engine suction, a thermostat for controlling the position of the choke valve, an operative connection between the thermostat and the choke valve, means for rendering said thermostat effective to hold the choke valve closed at low temperatures and to move said valve to open position as the temperature is increased, heating means other than the engine for heating the thermostat when the engine is in operation, and means operable by the thermostat to render the heating means ineffective when the choke valve is moved by said thermostat toward open position through a predetermined distance.

8. A charge forming device for an internal combustion engine having, in combination, means for varying the fuel to air ratio of the combustible mixture formed by said charge forming device and comprising a choke valve adapted to variably restrict the air inlet of said charge forming device and movable to different positions in response to variations in temperature and engine suction, a thermostat for controlling the position of the choke valve, an operative connection between the thermostat and the choke valve, means for rendering said thermostat effective to hold the choke valve closed at low temperatures and to move said valve to open position as the temperature is increased, an electric heating device for heating the thermostat when the engine is inoperative, and means operable by the thermostat to open the circuit of the electric device to render said device inoperative when the choke valve is moved by said thermostat through a predetermined distance toward open position.

9. A charge forming device for an internal combustion engine having, in combination, means for varying the fuel to air ratio of the combustible mixture formed by said charge forming device and comprising a choke valve adapted to variably restrict the air inlet of said charge forming device and movable to different positions in response to

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variations in temperature and engine suction, a thermostat for controlling the position of the choke valve, an operative connection between said thermostat and the choke valve, means for rendering the thermostat effective to move said choke valve toward both closed and open positions, a heating means other than the engine for heating the thermostat during engine operation, and means also operated by the thermostat for rendering said heating means ineffective when the choke valve is moved a predetermined distance toward open position.

10. A charge forming device for an internal combustion engine having, in combination, means for varying the fuel to air ratio of the combustible mixture formed by said charge forming device and comprising a choke valve adapted to variably restrict the air inlet of said charge forming device and movable to different positions in response to variations in temperature and engine suction, a thermostat for controlling the position of the choke valve, an operative connection between said thermostat and the choke valve, means rendering the thermostat effective to hold the valve closed at low temperatures, to move the valve toward open position upon increase of temperature and to hold said valve in relatively wide open position as long as normal or higher engine operating temperatures are maintained, heating means other than the engine for heating the thermostat during engine operation, and means operable by the thermostat for rendering the heating means ineffective as the choke valve is moved by said thermostat a predetermined distance toward open position.

11. A charge forming device for an internal combustion engine having, in combination, means for varying the fuel to air ratio of the combustible mixture formed by said charge forming device and comprising a choke valve adapted to variably restrict the air inlet of said charge forming device and movable to different positions in response to variations in temperature and engine suction, a thermostat for controlling the position of the choke valve, an operative connection between said thermostat and the choke valve, means rendering the thermostat effective to hold the valve closed at low temperatures, to move the valve toward open position upon increase of temperature and to hold said valve in relatively wide open position as long as normal or higher engine operating temperatures are maintained, heating means other than the engine for heating the thermostat during engine operation, means operable by the thermostat for rendering the heating means ineffective as the choke valve is moved by said thermostat a predetermined distance toward open position and for preventing operation of the heating means as long as the choke valve remains open to an extent equal or greater than said predetermined distance.

12. A charge forming device for an internal combustion engine having, in combination, means for varying the fuel to air ratio of the combustible mixture formed by said charge forming device and comprising a choke valve adapted to variably restrict the air inlet of said charge forming device and movable to different positions in response to variations in temperature and engine suction, a thermostat for controlling the position of the choke valve, an operative connection between said thermostat and the choke valve, means rendering the thermostat effective to hold the valve closed at low temperatures, to move the valve toward open position upon increase of temperature and

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to hold said valve in relatively wide open position as long as normal or higher engine operating temperatures are maintained, an electric heating device for heating the thermostat during engine operation and means operable by said thermostat for opening the circuit of said heating device as the choke valve is moved a predetermined distance toward open position by said thermostat.

13. A charge forming device for an internal combustion engine having, in combination, means for varying the fuel to air ratio of the combustible mixture formed by said charge forming device and comprising a choke valve adapted to variably restrict the air inlet of said charge forming device and movable to different positions in response to variations in temperature and engine suction, a thermostat operatively connected to said valve, said thermostat being effective to hold the valve closed at low temperatures so as to form a rich mixture, to move the valve toward open position upon increase of temperature in order to lean the mixture and to hold said valve in relatively wide open position as long as normal or higher engine operating temperatures are maintained, an electric heating device for heating the thermostat during engine operation, means operable by said thermostat for opening the circuit of said heating device as the choke valve is moved a predetermined distance toward open position by said thermostat, and for maintaining said circuits open as long as the choke valve remains open to an extent equal or greater than said predetermined distance.

14. A charge forming device for an internal combustion engine having, in combination, means for varying the fuel to air ratio of the combustible mixture formed by said charge forming device and comprising a choke valve adapted to variably restrict the air inlet of said charge forming device and movable to different positions in response to variations in temperature and engine suction, a thermostat for positioning said choke valve and operatively connected to an operating arm whereby said arm is moved in response to variations in temperature, a suction operated element movable in response to variations in engine suction and connected to said arm through the medium of said thermostat, so as to move the arm upon variations in suction, means connecting said operating arm to the choke valve so that movements of said arm bring about movements of the choke valve, a heating device for heating the thermostat during engine operation, and means also operable by said arm for rendering said heating device ineffective as said choke valve is moved toward open position.

15. A charge forming device for an internal combustion engine having, in combination, means for varying the fuel to air ratio of the combustible mixture formed by said charge forming device and comprising a choke valve adapted to variably restrict the air inlet of said charge forming device and movable to different positions in response to variations in temperature and engine suction, a thermostat for positioning said choke valve and operatively connected to an operating arm whereby said arm is moved in response to variations in temperature, a suction operated element movable in response to variations in engine suction and connected to said arm through the medium of said thermostat, so as to move the arm upon variations in suction, means connecting said operating arm to the choke valve so that movements of said arm bring about movements of the choke valve, an electric heating device for heat-

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ing the thermostat during engine operation, a switch for controlling said electric heating device and means also operable by said arm for opening said switch as the choke valve is moved toward open position.

16. A charge forming device for an internal combustion engine having, in combination, means for varying the fuel to air ratio of the combustible mixture formed by said charge forming device and comprising a choke valve adapted to variably restrict the air inlet of said charge forming device and movable to different positions in response to variations in temperature and engine suction, a thermostat for controlling the position of said choke valve in accordance with temperature variations, an electric heating device for heating said thermostat during engine operation, a circuit for said heating device lying entirely outside the thermostat, whereby the current for heating said thermostat does not pass therethrough and means for controlling said circuit.

17. A charge forming device for an internal combustion engine having, in combination, means for varying the fuel to air ratio of the combustible mixture formed by said charge forming device and comprising a choke valve adapted to variably restrict the air inlet of said charge forming device

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and movable to different positions in response to variations in temperature and engine suction, a thermostat for controlling the position of said choke valve in accordance with temperature variations, an electric heating device for heating said thermostat during engine operation, a circuit for said heating device lying entirely outside the thermostat, whereby the current for heating said thermostat does not pass therethrough, a switch for controlling said circuit and means operated by the thermostat for controlling operation of the switch.

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