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2,698,168

CARBURETOR

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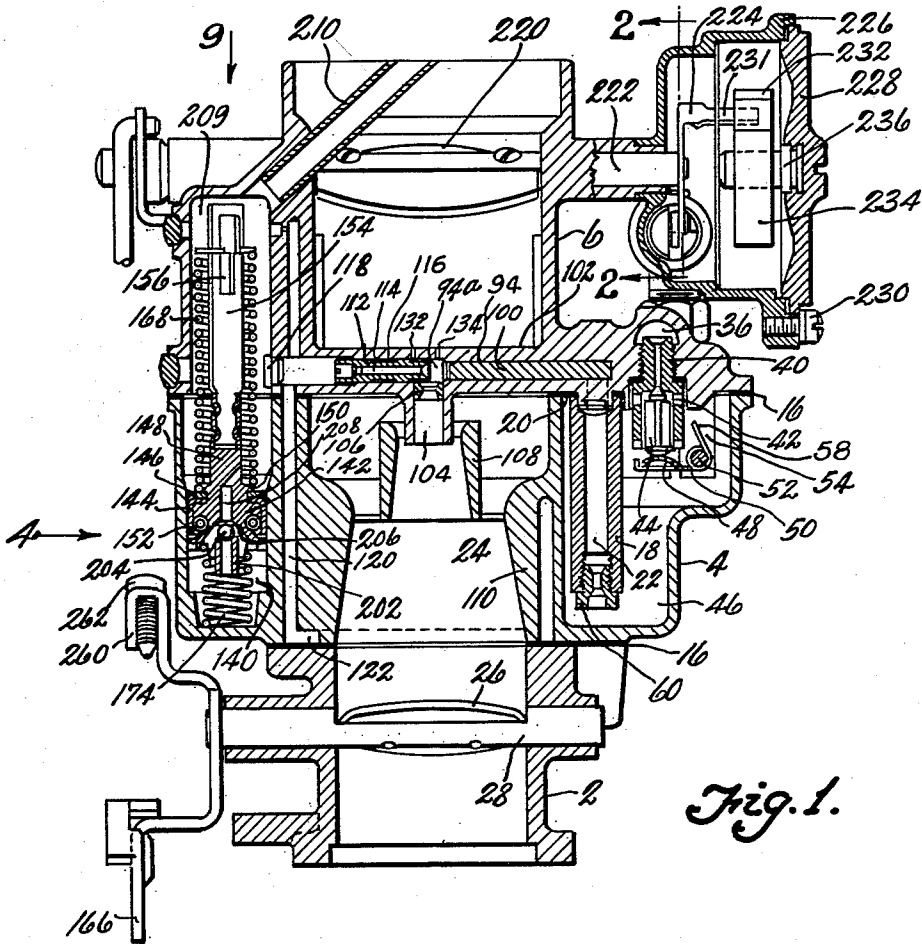


Fig. 1.

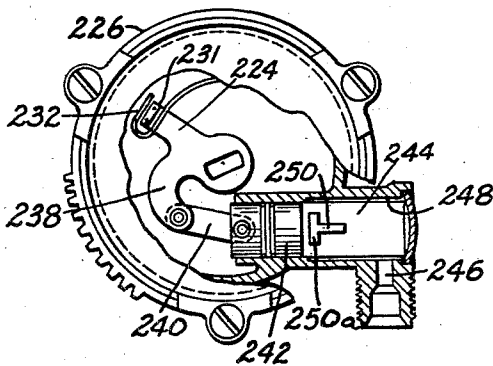


Fig. 2.

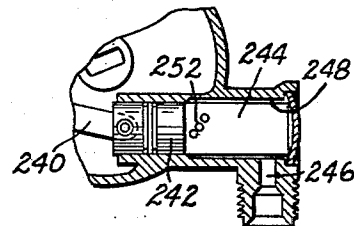


Fig. 3.

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CARBURETOR

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6 Claims. (Cl. 261—39)

This invention relates to carburetors for internal combustion engines, particularly for automotive use, and is an improvement on and quite similar to the carburetor disclosed and claimed in applicant's copending application, Serial No. 109,347, filed August 9, 1949.

The carburetor disclosed in the above application was provided with a manually operated choke valve for controlling the fuel-air ratio of the mixture in order to facilitate starting and operation of the engine during the warm-up period before the engine reaches normal operating temperature. One of the objects of the present invention is to provide novel means for controlling the position of the choke valve automatically in response to variations in temperature and engine suction, in which the effect of the suction on the suction operated means is varied upon movement of the valve itself to different positions.

According to the present invention, this object is accomplished by the provision of certain openings extending throughout the wall of a cylinder in which a suction operated piston connected to the choke valve slides. These openings which admit air to the cylinder and control the suction effective on the piston are closed by movement of the piston.

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 vertical section through the carburetor.

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

Fig. 3 is a modified form of the suction operated choke control device shown in Fig. 2.

Referring to Fig. 1, the carburetor includes three main castings 2, 4 and 6 which are, respectively, the outlet member which is attachable to the intake, the constant level fuel chamber which is positioned immediately above the outlet member and the air intake member which has formed integrally therewith a cover for the fuel chamber. The outlet member has a projecting flange having holes for receiving the attaching bolts which secure the carburetor to the manifold in the usual way. The outlet member and the fuel chamber, the fuel chamber and the air inlet, respectively, are secured together in any suitable way, gaskets 16 being provided between the several parts to prevent leakage, as shown in Fig. 1.

Depending from the casting 6 is a small casting 18, separated from the casting 6 by a gasket 20 and in which is provided the main fuel supply passage 22, through which fuel passes from the fuel chamber to the mixture passage 24. The latter extends centrally through all of the castings 2, 4 and 6 and supplies combustible mixture to the manifold, the flow of such mixture being controlled by a throttle valve 26 of conventional form, secured to a shaft 28, journaled for rotation in the wall of the outlet member 2; and manually operated by mechanism which will be later described.

As shown best in Fig. 1, fuel is supplied from a main source of supply to the fuel chamber through a bore 36 in casting 6 to which the fuel is delivered by any suitable conduit. The bore 36, at its inner end, communicates with a bushing 40, screwed into casting 6 and having a passage 42 formed therein. This passage extends from the bore 36 to a space within the bushing in which a conventional float valve 44 is positioned and which seats against the lower end of passage 42, so as to cut off the

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flow of fuel into such chamber when fuel within the fuel chamber 46 reaches a predetermined level.

The float valve is operated by a finger 48 integral with and projecting from a lever 50 pivoted on rod 52 supported by lugs 54 depending from the cover casting 6. The lever 50 is operated by a float or floats (not shown) for the purpose of maintaining a substantially constant fuel level in the chamber 46. A finger 58 integral with lever 50 will engage the bushing 40, if for any reason there is any extreme drop in fuel level and will prevent the float from striking the bottom of chamber 46 and will also prevent the valve 44 from falling out of the bushing under such conditions.

As already stated, the passage 22 in the small casting 18 constitutes the main fuel supply passage through which fuel flows from chamber 46 to the mixture passage. Admission of fuel to the passage 22 is primarily controlled by the metering plug 60. Under certain operating conditions, fuel is also admitted to the passage 22 through an auxiliary inlet which is effective only at high speed operations. Since this inlet forms no part of the present invention, it is not shown.

The casting 18 in which the vertical fuel passage 22 is formed is secured to the casting 6 in any suitable way and the two castings are separated by a gasket to limit as far as possible the transfer of heat by conductivity to the fuel passage casting 18, and the latter is also so positioned that it is completely surrounded by the fuel in chamber 46 to keep the temperature of such casting as low as possible. This, of course, aids in reducing the vaporization of fuel in the passage.

The passage 22 connects, as indicated in dotted lines, with a horizontal passage 94 formed in a horizontal tubular member 102 which is part of the casting 6 which extends across the mixture passage and is separated by a vertical partition 100 into two passages, for a purpose which need not be discussed herein as the structure is not material to the structure claimed in this application. That part of the passage 94 in which the partition is positioned terminates in a slightly enlarged part of passage 94 designated 94a, which communicates with the main supply nozzle 104. The latter is integral with and extends downwardly from the tubular member 102 and has a flow controlling member 106 positioned therein with a restricted opening and tapered walls flaring from the opening in both directions. The nozzle 104 terminates at the throat of a small primary venturi tube 108 which discharges into the throat of a secondary venturi tube 110 formed by the wall of the mixing chamber.

Positioned in the passage 94a is a tubular member 112 having a passage 114 therethrough for the passage of idling fuel mixture. This member is reduced in size at its right end providing a small annular space 116 between it and the wall of passage 94a. The latter is closed at its left end, as seen in Fig. 1, by a plug 118 and communicates with a vertical passage 120 formed in the wall of casting 4, the lower end of which connects with a horizontal passage 122 which leads eventually to the idling fuel inlet which supplies idling fuel to the mixture passage but is not shown. Two orifices 132 and 134 admit air to the passage 94a above the main fuel inlet 104.

During idling of the engine when the throttle is substantially or nearly closed, the high suction of the intake passage posterior to the throttle is communicated to the fuel in the passage 22 through the arrangement of passages described above. This will cause fuel to flow from the passage 22 through the several passages above described and finally into the mixture passage to supply combustible mixture for idling purposes. A stream of solid fuel flows through the passages 22 and 94 but is mixed with air which enters the orifices 132 and 134 and from that point to the idling fuel inlet a rich mixture of fuel and air is conveyed through the idling fuel passage and is discharged into the intake passage.

During idling there is practically no flow of air through the primary venturi tube and no introduction of fuel into such tube from the main fuel inlet. However, as the throttle is moved toward its open position from the idling position, the flow of air through the primary venturi will be progressively increased and the suction will ultimately become great enough in the main fuel inlet to effect a

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flow of fuel therefrom. The flow of fuel from the main inlet begins before the flow of idling mixture ceases, but as the throttle is progressively opened, the suction in the primary venturi will become so great by comparison with the suction at the idling fuel inlet that flow from such inlet will cease and instead there will be a flow from the intake passage back into the idling fuel supply passage and a reverse flow from that point back through such passage to the main fuel inlet. Thus, after the throttle has been opened sufficiently for the suction to the main fuel inlet to become high enough there will be a flow of mixture from the mixture passage along the path above described back to the main fuel inlet and this mixture will pass out into the mixing chamber through the main fuel inlet along with the fuel which is supplied to such inlet from the passage 94.

It will be understood that this arrangement of fuel supply passages forms no part of the invention which is now claimed in this application. The claims being directed only to the automatic choke mechanism which is described later.

The bleed holes 132 and 134 which admit air to the fuel passage 94a immediately above the main fuel inlet not only supply air to mix with the fuel in formation of the idle mixture, but also to reduce the surface tension of the solid fuel at this point and to cause the transfer of fuel from the idle range to the main range to be made smoother. The admission of air at relatively high velocity through the orifices 132 and 134 aids in effecting thorough atomization of the fuel which is discharged from the passage 94 to form a homogeneous mixture which is supplied to both the idling fuel passage and the main fuel discharge inlet 104.

Although not a part of this particular invention the carburetor includes an accelerator pump which is manually operable upon opening of the throttle and which comprises a cylinder 140 formed in the fuel chamber casting 4 and a piston 142 slidable therein as shown in Fig. 1. The piston carries a flexible cup 144 retained by a washer 146 against which a portion of the piston rod 148 is deformed as indicated at 150. A coil spring 152, positioned between the cup and the piston, urges the cup into engagement with the cylinder wall. Secured to the piston rod 148 is a bar 154 having a slot 156 which receives a horizontal portion 158 of a vertically movable bar which slides in a slot formed in the wall of the fuel chamber casting 4. The lower end of the operating bar is connected to the throttle operating arm 166 by means, not shown. The bar 154 extends through a spring 168 confined between the washer 146 and an upper washer through which the bar extends, the upper washer being engaged by the horizontal part of the bar. The spring 168 being under compression, holds the parts in the position shown in Fig. 1 when the device is not in operation.

Downward movement of the pump piston is opposed by a spring 174 located in the space between the piston and the bottom of its associated cylinder. Fuel from the fuel chamber 46 is supplied to this space during upward movement of the pump piston, and is forced out of this space and into the mixture passage upon the downward or running stroke of the piston.

A relatively slow opening movement of the throttle causes the bar to be moved downwardly gradually and the spring 168 to transmit a downward movement to the piston 142, but if the throttle is opened suddenly, the horizontal part of the bar will strike the bottom of the slot 156 and will cause a positive and rapid downward movement of the piston to produce a relatively rapid discharge of fuel from the pump delivery nozzle which is followed by a slower discharge as the spring 168 gradually expands to effect a further downward movement of the piston. Therefore, on any slow opening of the throttle there will be a gradual and slow discharge of fuel from the pump but upon a fast opening of the throttle there will be a sudden and rapid discharge of fuel followed by a slower discharge as the spring 160 expands.

The pump piston is provided with four spaced ribs (not shown) which support a tube 202 on top of which a ball check valve 204 is normally seated. In such position, the ball is spaced from valve seat 206 surrounding a by-pass duct 208 which extends through the pump piston. When the pump piston moves down, the check valve will engage this seat and close the by-pass duct, but at all times except during downward movement of

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the piston any bubbles of fuel vapor which may be formed within the pump cylinder may pass upwardly through the by-pass duct and into a recess 209 in the casting 6 above the pump cylinder and out through a vent pipe 210 and the formation of such bubbles will not cause any discharge of fuel from the pump delivery nozzle. As already pointed out, upon downward movement of the pump piston the by-pass passage is closed, but during upward movement of the piston and at all times when the latter is stationary, the ball is seated on top of tube 202 and the by-pass passage is open.

The structure of the accelerator pump above described is substantially the same as that shown in the copending application Serial No. 109,347, and does not constitute a specific part of the present invention.

The admission of air to the carburetor is automatically controlled by a choke valve 220, secured to a shaft 222 journaled for rotation in the air intake casting 6, as shown in Fig. 1, the movements of this shaft being automatically controlled in response to variations in temperature and engine suction. For this purpose the right end of the shaft 222, as seen in Fig. 1, has connected thereto in any suitable way, a lever 224, which is operated by a thermostat and a suction operated piston, the lever and associated elements being positioned in the housing 226 closed by an adjustable plate 228 held in position by screws 230.

In the main the mechanism for controlling the position of the choke valve is the same as the conventional automatic choke controls now in use, but differs therefrom in certain particulars which will be explained hereinafter. The lever 224 has a projecting arm 231 which may be engaged by the hooked end 232 of a coiled bimetallic thermostat 234 the inner end of which is secured to a stub shaft 236 which is fixedly mounted on the plate 228, but which may be adjusted by adjustment of the plate, to vary the force initially exerted by the thermostat on the choke valve to hold it closed. At low temperatures the end 232 of the thermostat engages the arm 231 to hold the choke valve closed with a force which is dependent upon the temperature. As the temperature increases, this force is reduced and ultimately the end of the thermostat will move away from the arm 231 so as to exert no force thereon tending to close the valve, but the thermostat is never effective to pull the choke valve toward open position.

As best shown in Fig. 2, the lever 224 has an arm 238 projecting therefrom which is pivotally connected to a link 240 in turn pivotally connected to a suction operated piston 242, slidable in cylinder 244 with which a suction connection 246 connects. Suction of the intake manifold is communicated to the connection 246 by a means not shown, but of conventional construction. If the choke valve is being held closed by the thermostat with any appreciable force, the suction which is communicated to the cylinder 244 during cranking is insufficient to have any material effect or to open the choke valve. However, when the engine begins to run under its own power, the suction effective in cylinder 244 greatly increases and the choke valve is pulled toward open position against the force of the thermostat until it reaches a position where the force of the thermostat and the forces exerted by suction on the piston 242 and directly on the unbalanced valve are balanced.

Grooves 248 are formed in the wall of cylinder 244 and when the piston 242 moves a predetermined distance, the piston passes the left end of such grooves so that air can enter the cylinder from the thermostat housing through such grooves. This reduces the suction effective on the piston so that any further movement of the piston and resulting opening of the choke valve will be slower than before the ends of the by-pass grooves are uncovered. The grooves may be of any desired length.

As so far described, the automatic choke controlling mechanism is substantially the same as that in general use at this time. According to the present invention, however, additional means have been provided to variably control the suction effective on the piston during the movement thereof, as the choke valve moves toward open position so as to variably control the effective force operating against the force of the thermostat on the choke valve during the movement of the latter. The purpose of this device is to secure a mixture having the proper proportions of fuel and air during the entire range of movement of the choke. To this end there is provided in

the wall of cylinder 244 a T-slot 250 which connects the cylinder with the interior of the thermostat housing 226 which is in communication with the atmosphere. Since air is admitted through such slot to the cylinder 242, the suction maintained in such cylinder, when the slot is not blocked by the piston is much less than it would be if the slot was omitted. As the piston moves, it covers the slot and the part 250a of such slot is covered by a relatively small movement of said piston after which the remainder of the slot is progressively covered during a considerably greater movement of the piston until the piston has moved enough to cover the entire slot.

The slot is effective to prevent sufficient opening of the choke valve immediately after the engine becomes self operative to form too lean a mixture for proper operation, because the admission of air through the slot reduces the suction which is effective on the choke valve to open it against the force of the thermostat which tends to hold the valve closed. This being true, the valve is not opened as far when the engine becomes self operative as would be the case if the slot to admit air to the cylinder 244 was not provided.

As the valve starts to open upon increase of temperature, the movement of the piston decreases the effective area of the slot 250 so that the suction effective on the piston 242 is increased and the movement of the piston resulting from any given increase in temperature would be greater than at the beginning of its movement due to the increase in suction. It will be noted that the area of slot 250 is reduced by approximately half during the slight movement of the piston necessary for it to obstruct the part 250a of such slot. About twice that amount of movement is necessary for the piston to cover the other half of the slot 250, and after the slot is covered there is no further increase in the suction effective on the piston for any given throttle position and when the choke valve reaches a predetermined position the effective suction is actually decreased because the movement of the piston uncovers the grooves 248. In view of the fact that the rate at which the effective suction is increased during opening movement of the choke valve is progressively decreased as the valve moves toward open position it is obvious that the movement of the valve toward open position for any given change of temperature is progressively decreased as the valve moves toward open position. In other words, a five degree increase in temperature, for example, would bring about a greater opening movement of the valve when the valve is nearly closed than when the valve is in a wider open position.

In Fig. 3 is shown a modification of the means for varying the suction effective on the piston 242 which moves the choke valve in response to engine suction. In this modified form of the device instead of using a slot such as shown in Fig. 7 to admit air to the cylinder 244, there are a series of holes 252 which accomplish this function. In this device the suction effective on the piston when the choke valve is closed is reduced by admission of air through holes 252 to prevent leaning of the mixture too much when the engine first becomes self operative, just as the effective suction is reduced by the slot 250, in the form of the device shown in Fig. 2. Likewise the suction effective on piston 242 is progressively increased during the opening movement of the choke valve which is necessary to move the piston sufficiently to block all the holes 252, but thereafter there is no increase in the effective suction produced by movement of the valve. Also, the rate at which the effective suction is increased during the movement of the piston which accompanies the opening of the choke valve is substantially uniform until the holes 252 are blocked by the piston, since the holes are substantially the same distance apart.

If the movement of the choke valve toward open position is effected by an increase in manifold suction, due either to a change in throttle position or an increase in engine speed with a fixed throttle, the suction which is effective on the piston will vary as previously described due to the movement of the piston and the variation in area of the means for admitting air to the cylinder 244.

The arrangement described will prevent too much leaning of the mixture occasioned by opening movement of the choke valve in response to the very greatly increased suction which occurs when the engine first begins to operate under its own power, and brings about the desired opening movement of the choke valve to give

the proper fuel mixture ratio during the warm-up period. The idle position of the throttle is variably determined by a stop screw 262 adjustably supported in an offset part 260 of the throttle operating arm which engages a stop member (not shown) as the throttle is moved toward fully closed position.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A charge forming device for an internal combustion engine having, in combination, a constant level fuel supply chamber, an intake passage having an air inlet and a mixture outlet for supplying combustible mixture to the engine, a throttle valve for controlling the flow of mixture through said outlet, means for supplying fuel to said intake passage and a choke valve automatically operable in response to variations in temperature and engine suction for controlling the admission of air through said air inlet, a thermostat operable to move the choke valve toward closed position at low temperatures, means operable by engine suction posterior to the throttle to move said choke valve toward open position in response to an increase in suction, a suction conduit for communicating the engine suction to the suction operated means, means admitting air to said conduit in order to control the suction which is effective on said suction operated means, said means being so constructed as to admit a maximum amount of air to said conduit when the choke valve is closed and a less amount of air as the choke valve is moved toward open position.

2. A charge forming device for an internal combustion engine having, in combination, a constant level fuel supply chamber, an intake passage having an air inlet and a mixture outlet for supplying combustible mixture to the engine, a throttle valve for controlling the flow of mixture through said outlet, means for supplying fuel to said intake passage and a choke valve automatically operable in response to variations in temperature and engine suction for controlling the admission of air through said air inlet, a thermostat operable to move the choke valve toward closed position at low temperatures, a suction operated piston connected to said choke valve and operable to move the choke valve toward open position, a cylinder in which said piston is slidable having a T-shaped orifice in the wall thereof for admitting air to control the suction which is effective on said piston, said T-shaped orifice being so positioned that its area is progressively decreased by the piston as the latter is moved in response to suction.

3. A charge forming device for an internal combustion engine, having in combination, a constant level fuel supply chamber, an intake passage having an air inlet and a mixture outlet for supplying combustible mixture to the engine, a throttle valve for controlling the flow of mixture through said outlet, means for supplying fuel to said intake passage and a choke valve automatically operable in response to variations in temperature and engine suction for controlling the admission of air through said air inlet, a thermostat operable to move the choke valve toward closed position at low temperatures, a piston connected to the choke valve and slidable in a cylinder in response to variations in suction posterior to the throttle to move the choke valve to different positions, said piston being also movable by the thermostat upon variations in temperature, a suction conduit connected to said cylinder, an opening for admitting air to said cylinder for controlling the suction effective on said piston and operative to admit a maximum amount of air to the cylinder when the choke valve is in closed position, said piston being movable to progressively block the opening and reduce the amount of air admitted to said cylinder when the choke valve is moved toward open position either upon an increase in temperature or upon an increase in suction posterior to the throttle, and air by-pass channels in the wall of said cylinder rendered operative to admit air thereto after a predetermined opening movement of the choke valve.

4. A charge forming device for an internal combustion engine, having in combination, a constant level fuel supply chamber, an intake passage having an air inlet and a mixture outlet for supplying combustible mixture to the engine, a throttle valve for controlling the flow of mixture through said outlet, means for supplying fuel to said intake passage and a choke valve automatically operable in response to variations in temperature and engine suc-

tion for controlling the admission of air through said air inlet, a thermostat operable to move the choke valve toward closed position at low temperatures, a piston connected to the choke valve and slidable in a cylinder in response to variations in suction posterior to the throttle to move the choke valve to different positions, said piston being also movable by the thermostat upon variations in temperature, a suction conduit connected to said cylinder, an opening for admitting air to said cylinder for controlling the suction effective on said piston and operative to admit a maximum amount of air to the cylinder when the choke valve is in closed position, said piston being movable to progressively block the opening and reduce the amount of air admitted to said cylinder when the choke valve is moved toward open position either upon an increase in temperature or upon an increase in suction posterior to the throttle, and air by-pass channels in the wall of said cylinder rendered operative to admit air thereto after the choke valve has been opened far enough to move the piston to a position to completely block said opening.

5. A charge forming device for an internal combustion engine having, in combination, a constant level fuel supply chamber, an intake passage having an air inlet and a mixture outlet for supplying combustible mixture to the engine, a throttle valve for controlling the flow of mixture through said outlet, means for supplying fuel to said intake passage and a choke valve automatically operable in response to variations in temperature and engine suction for controlling the admission of air through said inlet, a thermostat operable to move the choke valve toward closed position at low temperatures, suction operated means effective to move the choke valve toward open position upon an increase in suction, a conduit communicating to said means the suction maintained in the intake passage posterior to the throttle, a bypass extending through the cylinder wall for admitting air to said conduit and effective to admit a maximum quantity of air to said conduit when the choke valve is in closed position, said suction operated means fully opening said bypass to admit said maximum quantity of air when said choke

valve is in its closed position, said bypass being progressively reduced in area as the choke valve is moved toward open position.

6. A charge forming device for an internal combustion engine having, an intake passage having an air inlet and a mixture outlet for supplying combustible mixture to the engine, a throttle valve for controlling the flow of mixture through said outlet, means for supplying fuel to said intake passage, and a choke valve automatically operable in response to variations in temperature and engine suction for controlling the admission of air through said inlet, a thermostat operable to move the choke valve toward closed position at low temperatures, suction operated means effective to move the choke valve toward open position upon an increase in suction, a conduit communicating to said means the suction maintained in the intake passage posterior to the throttle, a bypass extending through the cylinder wall for admitting air to said conduit and effective to admit a maximum quantity of air to said conduit when the choke valve is in closed position, said suction operated means fully opening said bypass to admit said maximum quantity of air when said choke valve is in its closed position, said bypass being so shaped that its rate of decrease per unit of movement of the choke valve is greater during the initial opening movement of the choke valve than during the movement of the valve as it approaches a more fully open position.

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