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AUTOMATIC CHOKE VALVE FOR CARBURETORS

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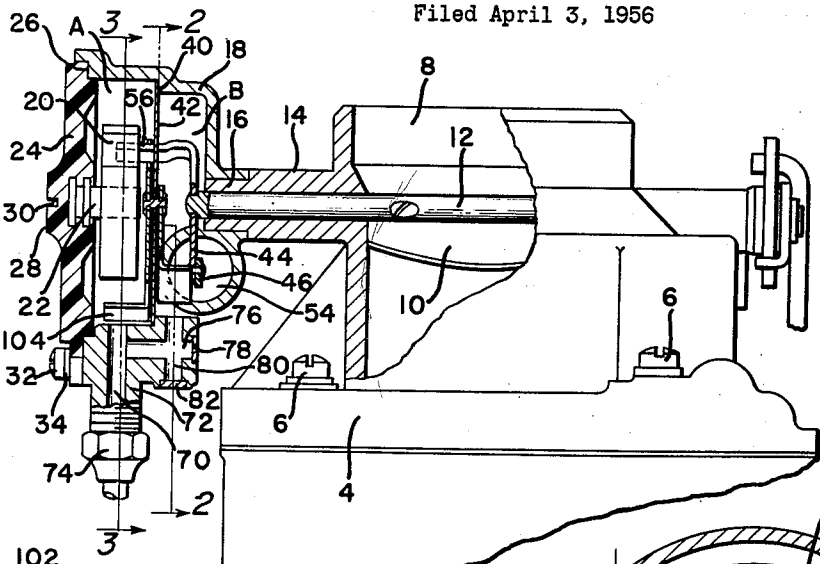


Fig. 1

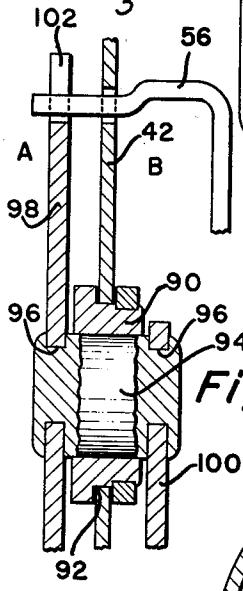


Fig. 4

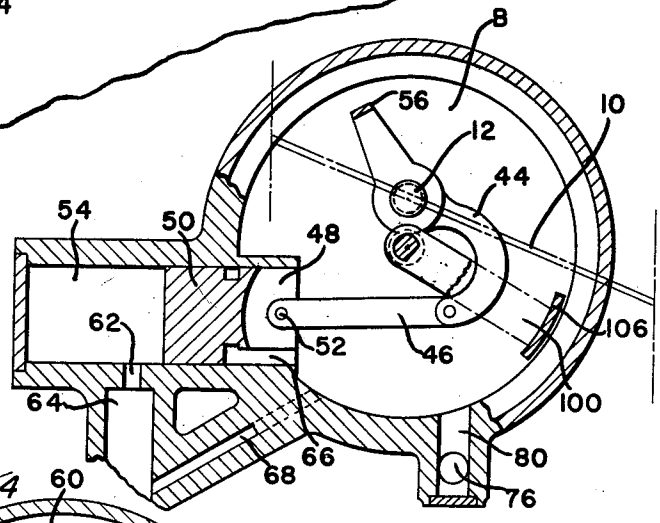


Fig. 2

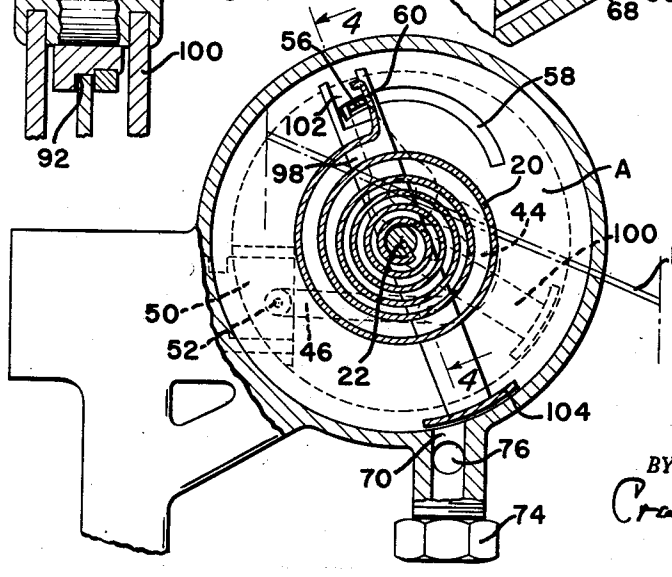


Fig. 3

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AUTOMATIC CHOKE VALVE FOR CARBURETORS

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2 Claims. (Cl. 261—39)

This invention relates to carburetors for internal combustion engines, and, most particularly, to mechanism for automatically controlling the operations of the choke valve thereof which regulates the admission of air to the mixture passages of a carburetor.

It has been the general practice for a number of years to provide a choke valve for controlling the admission of air to the carburetor which could be moved to closed or partially closed position to variably restrict the admission of air to the carburetor in order to provide a richer than normal mixture of fuel and air for starting purposes. When the engine has started and is operating under its own power, it is necessary to progressively open the choke valve as the engine temperature increases to gradually decrease the fuel content of the mixture until, when normal temperature is reached, the choke valve is wide open and imposes no restriction on the air inlet.

These choke valves were originally manually operated and were positioned wholly by the operator of the vehicle. For a good many years, however, it has been customary to provide in most carburetors in commercial use choke valves which are automatically controlled in response to variations in engine temperature and engine suction, such valves being held closed when the temperature is low, to facilitate starting and being gradually opened by the effect of suction as the temperature increases after the engine becomes self-operative, until the valves are fully open when normal operating temperature is reached. Generally, the choke valve is held closed by a bimetallic thermostat one end of which is fixed while the other end engages an arm on the choke valve shaft. Opening of the valve is generally effected by a suction operated piston subject to variations in suction posterior to the throttle and connected to the valve shaft so as to exert a force in opposition to that of the thermostat, and the valves are also generally unbalanced so as to be responsive to variations in suction effective directly on the valves themselves.

Obviously, an increase in temperature will decrease the force holding the valve closed, while an increase in suction will increase the force tending to open the valve so that, after the engine is self-operative, the valve will be moved toward open position by the effect of suction as the engine temperature increases and also if the suction is increased without change in temperature. For example, when the engine starts to run under its own power, there is no immediate increase in temperature, but there is a great increase in suction, due to increase in engine speed, and this effects an appreciable opening of the valve immediately when the engine starts to run. After the engine is running and during the warm-up period, the opening of the valve is a gradual movement and primarily due to the reduction in the closing force exerted by the thermostat as the engine temperature increases.

To effect heating of the thermostat, hot air is generally drawn from a stove adjacent the exhaust manifold of the engine through a housing in which the thermostat is positioned or the thermostat is placed in such a position that it is subject to direct radiation from the exhaust manifold

so that the temperature variation of the thermostat follows closely the temperature variation of the exhaust manifold. The intake passage of the intake manifold through which mixture is conveyed to the engine also generally receives heat from the exhaust manifold and in some engine installations the intake passage receives so little heat from the exhaust manifold that the increase in temperature of the intake passage is far less rapid than the increase in temperature of the air adjacent the thermostat. In such installations, the choke valve will open too rapidly when the engine first starts to run and the mixture supplied to the engine will be too lean. After the valve is moved to a predetermined open position and the engine temperature has considerably increased, the suction effective on the piston is reduced so that after the valve reaches such position the difficulty referred to is not encountered.

It is the primary purpose of the present invention to eliminate the difficulty above referred to and to provide an automatic choke mechanism having a choke valve controlled in accordance with variations in engine temperature and suction which is provided with means for restricting the application of heat to the thermally responsive means during a part of the movement of the choke valve toward open position, but which is rendered ineffective after the choke valve makes a predetermined movement toward open position.

It is also an object of the invention to provide in an automatic choke mechanism for a carburetor, having a choke valve movable in response to variations in engine temperature and suction which is effective to move the valve more slowly, for a given increase in engine temperature, during the first part of the warm-up period following starting of the engine than during the latter part of such period, as the engine temperature approaches the normal operating temperature.

According to the present invention, these objects are attained by the provision of a passage for hot air from the exhaust stove directly past the thermostat and an additional passage in the form of a by-pass through which the hot air may flow and not directly pass the thermostat, with a valve operable by the thermostat which is effective to close the direct passage and open the by-pass at relatively low temperatures, but will close the by-pass and open the direct passage after a predetermined termperature is reached.

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 form of the present invention is clearly shown.

In the drawings:

Figure 1 is a fragmentary elevation, partly in section, showing a part of a carburetor equipped with an automatic choke mechanism in which the present invention is incorporated;

Figures 2 and 3 are vertical sections on the lines 2—2 and 3—3 of Figure 1, respectively, while Fig. 4 is an enlarged detail of a part of Fig. 1.

Since the invention to which this application relates is concerned solely with the automatic choke mechanism and the specific construction of the carburetor is in no sense material, the entire carburetor is not shown, Fig. 1 showing only the upper, or air intake end of a down-draft carburetor and the automatic choke mechanism which constitutes the present invention. The carburetor may be of any suitable construction such as that shown in the patent to Olson, 2,339,907, May 26, 1953, for example, and its structure need not be described herein.

As shown in Fig. 1, the reference numeral 2 indicates a casting in which is formed a constant level fuel chamber of conventional form which supplies fuel to a mixture

passage which extends through the control part of the fuel chamber, as shown in the above patent. A casting 4 which forms the cover for the fuel chamber and is secured to casting 2 by screws 6 also has an air intake passage 8 formed therein. The latter constitutes a part of the mixture passage, is in line with the passage extending through the fuel chamber, and supplies air to be mixed with fuel in the mixture passage to form a combustible mixture which is conveyed to the engine through the usual intake manifold and the flow of which is controlled by a conventional throttle valve, which is not shown but may be such as shown in the above-mentioned patent.

The flow of air through the passage 8 is controlled by an unbalanced choke valve 10 suitably secured to a shaft 12 which is journalled for rotation in the casting 4. As indicated in Figs. 2 and 3, the choke valve is very considerably unbalanced, the shaft 12 being off-center with respect to the valve, so that the effect of engine suction directly on the valve itself tends to open it, and this effect is increased as the throttle is opened and the engine speed is increased. One end of the shaft 12 is journalled in an extension 14 of the casting 4 and secured in any suitably way on the reduced end 16 of such extension is a metal housing 18 which surrounds a bimetallic coiled thermostat 20. This thermostat is fixedly connected in any suitable way to a pin 22 which is secured to a cover plate 24 for the housing 18 at the center thereof, as shown in Fig. 1.

The open end of the housing 18 is cut away to form a shoulder 26 against which the cover plate, which may be either metal or some suitable plastic, seats and the cover plate is rotatable to change the position of the fixed end of the thermostat in order to vary the pressure which is exerted by the thermostat at any given temperature to hold the choke valve closed. At the center of the cover plate 24 is a raised boss 28 in which is provided a slot 30 which is adapted to be engaged by a suitable tool for rotating the cover plate, while the plate is held in any adjusted position by screws 32 which have threaded engagement with ears (not shown), integral with and extending from the housing 18. The screws engage clips 34 which overlie the edge of the cover plate 24 and a clamp it against the shoulder 26 when the screws are tightened.

Within the housing 18 a second shoulder 40 is formed and a partition plate 42 is seated on said shoulder. This plate may be secured in position in any desirable way and divides the housing 18 into two chambers, A and B, in the first of which the thermostat is positioned while the choke valve shaft 12 extends into the chamber B and the suction operated arm which moves the valve toward open position in response to increase in suction, is positioned in the chamber B. This arm is indicated by the numeral 44 on the drawings and is secured in any desirable way to the left end of the shaft 12. As best shown in Fig. 2, one part of the arm 44 extends below the shaft 12, its lower end being pivotally connected to a link 46, the other end of which extends into a slot 48 formed in the right end of a piston 50 and is pivotally connected to a pin 52 which extends across the slot 48. The piston slides in a cylinder 54 and when the engine suction, when the engine starts to run, is communicated to the cylinder at the left of the piston, by means which will be later described, the piston will be pulled to the left and through the connections above-described will move the valve 10 toward open position.

This movement of the valve is opposed at low temperatures by the thermostat which exerts a force on the valve tending to hold it closed. The arm 44 extends above the valve shaft 12 and at its upper end has a lateral extension 56 which extends through a slot 58 in the partition plate 42 into the chamber A in which the thermostat is positioned. The free end of the thermostat 20 has a hook 60 formed thereon, as best shown in Fig. 3, and this hook engages the extension 56 of arm 44, tending to move such extension to the left, as seen in Fig. 3, to hold the choke valve closed. As the temperature increases, the hook 60 moves to the right, reducing the pressure effective to hold the choke valve closed and finally, when normal operating temperature is reached, the hook is moved far enough to the right to eliminate any controlling effect on the choke valve, so that the latter is free to move to fully open position without any opposition by the thermostat.

To communicate engine suction to the cylinder 54 an orifice 62 is formed in the wall of the cylinder and this orifice communicates with a passage or conduit 64 which leads to and connects with the engine intake passage between the carburetor throttle and the engine. This conduit 64 is blocked by the piston after the choke valve has made a predetermined movement toward open position and as the valve approaches fully open position, a groove 66 at the right end of the piston comes into registry with the orifice 62 so that the passage 64 is in communication with the chamber A after the valve reaches a nearly wide open position. A bore 68 connects the passage 64 with the chamber A at all times so that the engine suction is communicated to such chamber and is effective to draw heated air through the housing 18 to effect heating of the thermostat in all positions of the piston 50.

In order to control the heating of the thermostat in accordance with the position of the thermostat, a hot air passage 70 is formed in an integral tubular extension 72 of the housing 18. A suitable hot air conduit (not shown), which may be of copper or other metal, is adapted to be connected to the housing 18 by a coupling nut 74 which engages threads formed on the outer surface of the extension 72, such hot air conduit being adapted to extend to a hot air stove of conventional form adjacent the exhaust manifold. The passage 70 communicates directly with the chamber A and connecting with the passage 70, near the upper end thereof, is a horizontal passage 76 closed at the opposite end by a suitable closure plug 78. Crossing the passage 76 and substantially parallel to the passage 70 is a short passage 80, the upper end of which connects directly with the chamber A and the lower end of which is closed by a closure plug 82. If the upper end of passage 70 is open, heated air is drawn directly into the chamber A, past the thermostat, through the slot 58 into chamber B and through bore 68 into the suction passage 64, but if the passage 70 is closed at the upper end thereof and the upper end of the passage 80 is open, heated air will be drawn through the passages 70, 76 and 80, then directly through chamber B and bore 68 into the suction passage 64, without passing through chamber A. There will, of course, be some slight heating of the thermostat because the partition plate 40 will be heated by the passing hot air, but the heating of the thermostat will be, obviously, very much less than when the hot air passes through the chamber A.

To control the passages 70 and 80 certain valve members are provided in the chambers A and B which are moved into and out of cooperative relation with such passages by the thermostat itself. At the center of the partition plate 42 is mounted a bushing 90 which has a peripheral surface 92 with which the edge of a central opening in the partition plate 42 engages. Rotatable in the bushing is a hub 94, the ends of which are reduced in size, as indicated at 96, in Fig. 4. On these reduced ends are mounted two arms 98 and 100 on opposite sides of the partition plate 42, the arm 98 being located in chamber A and the arm 100, in chamber B. The ends of the reduced portions 96 of the hub 94 are riveted over the arms to secure the arms to the hub, so that the hub and the two arms mounted thereon rotate together. The arm 98 has a slot 102 in its upper end through which

the lateral extension **56** of the arm **44** extends, so that when the thermostat or the suction operated piston moves arm **44**, the two arms **98** and **100** are also moved.

Projecting to the left of the lower end of arm **98** as seen in Fig. 1, is a lateral extension **104** which controls the passage **70** and projecting to the right of the lower end of arm **100** is a lateral extension **106** which controls the passage **80**. Normally, at low temperatures, before the engine is started, the parts are in the position shown in Fig. 3, the extension **104** is in registry with the upper end of passage **70** and substantially blocks the flow of air from said passage into the chamber A, while the extension **106** is in such a position that the upper end of passage **80** is open and air can flow freely from such passage into the chamber B. With the parts in the position described, the choke valve is closed. Air flowing into the chamber B will flow directly into the suction and on into the carburetor without passing through chamber A, but when passage **70** is open and heated air is admitted to chamber A, it flows through such chamber, heating the thermostat directly, passes through the opening in partition plate **42** into chamber B and then into the suction passage.

When the engine starts to run under its own power there is, as has already been set forth, a very considerable increase in engine suction effective on the piston and also some increase in that directly effective on the unbalanced choke valve. This increase in suction moves the piston **50** to the left, as seen in Fig. 2 and, depending on operating conditions and temperatures, to a position where the forces exerted by suction are balanced by the opposing force exerted by the thermostat. This movement of the piston, of course, effects a movement of the choke valve toward open position, but at low temperatures this initial movement of the valve is not very great. Then, as the temperature of the engine increases, during the warm-up period, the force exerted by the thermostat progressively decreases and the choke valve progressively opens. As already pointed out, this opening of the choke valve occurs too rapidly in some installations if heated air from an exhaust stove is drawn directly past the thermostat, when the application of heat to the intake manifold is insufficient to effect heating of the mixture supplied to the engine in more or less accord with the heating of the thermostat. This results in too much opening of the choke valve and formation of too lean a mixture to effect satisfactory operation of the engine in such installations as are referred to.

In order to eliminate this difficulty, the member **104** is so arranged that it blocks the passage **70** when the choke valve is closed, as it is at low temperatures, but the member **106** is not in position to block the passage **80** until the choke valve has made a very considerable movement toward open position. When the passage **70** is closed and the passage **80** is open, so that hot air is drawn through chamber B, there is some heating of the thermostat, so that its closing force is slowly reduced, but this is not effected nearly as rapidly as if the hot air was drawn directly past the thermostat through the chamber A. The opening of the choke valve is, therefore, delayed by blocking the passage **70**, in comparison with a choke mechanism of conventional construction.

As the choke valve opens, the passage **70** is ultimately unblocked and as this occurs, the member **106** is moved into position to block the passage **80**. The members **104** and **106** are of such magnitude that the passage **70** is not opened, nor the passage **80** closed until the choke valve is approximately 60° open. By the time the valve reaches this position in this device when the heating of the thermostat is no longer retarded, the manifold is relatively hot and the piston **50** has moved to such a position that there is but little suction effective on the piston. Because of these facts, the heating of the thermostat should be more rapid so that movement of the choke valve during the last part of the opening movement, i. e. from 60° on, will be rapid enough to prevent the formation of a mixture that would be too rich for most satisfactory operation. It is for this reason that the passage **70** is unblocked when the valve gets 60° open and during further opening movement the thermostat is heated much more rapidly and the choke valve is opened more rapidly.

During all operation after the temperature of the engine has risen sufficiently to effect the unblocking of the passage **70**, such passage remains open so that during all normal operation of the engine the thermostat is subject to the full heating effect of the hot air passing directly through the chamber A and the hot air is caused to pass through chamber B only during a part of the warm-up period when the engine is started at relatively low temperatures.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. In a carburetor for use on an internal combustion engine and which is adapted to supply said engine with a combustible mixture of fuel and air, an air inlet passage for admitting air to said carburetor, a choke valve in said passage controlling the passage of air therethrough, means responsive to temperature and suction for variably controlling the position of said choke valve in accordance with variations in engine temperature and suction, said means being effective to progressively move said choke valve toward open position as the engine temperature increases during the warm-up period following starting of the engine at relatively low temperatures, a housing, a partition in said housing dividing such housing into two chambers in one of which said thermally responsive means is positioned, a conduit for conveying heated air to both of said chambers, a passage communicating the engine suction to said chambers so as to cause a flow of heated air therethrough, valve means for controlling admission of air from said conduit to said chambers normally positioned to prevent admission of air to the chamber in which the thermostat is positioned and to admit air to the other chamber when the temperature is low and the choke valve closed, and means for moving the valve means to admit heated air to the first chamber and prevent admission of air to the second chamber as the choke valve is moved toward open position upon increase of temperature.

2. In a carburetor for use on an internal combustion engine and which is adapted to supply said engine with a combustible mixture of fuel and air, an air inlet passage for admitting air to said carburetor, a choke valve in said passage controlling the passage of air therethrough, means responsive to temperature and suction for variably controlling the position of said choke valve in accordance with variations in engine temperature and suction, said means being effective to progressively move said choke valve toward open position as the engine temperature increases during the warm-up period following starting of thte engine at relatively low temperatures, a housing, a partition in said housing dividing such housing into two chambers in one of which said thermally responsive means is positioned, a conduit for conveying heated air to both of said chambers, a passage communicating the engine suction to said chambers so as to cause a flow of heated air therethrough, valve means for controlling admission of air from said conduit to said chambers normally positioned to prevent admission of air to the chamber in which the thermostat is positioned and to admit air to the other chamber when the temperature is low and the choke valve closed, and means operatively

connecting said valve means to the choke valve whereby movement of the choke valve toward open position upon increase of temperature effects movement of said valve to a position to admit heated air to the first chamber and prevent admission of heated air to the second chamber.

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