

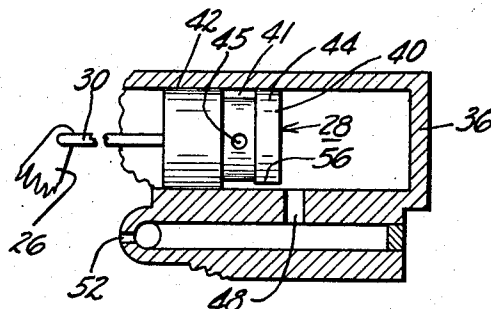
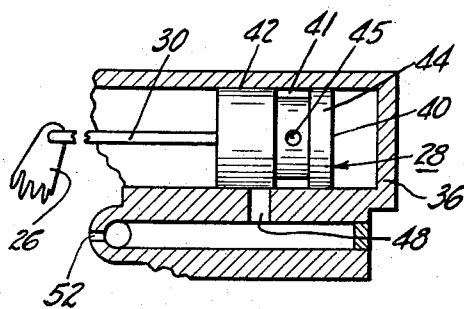
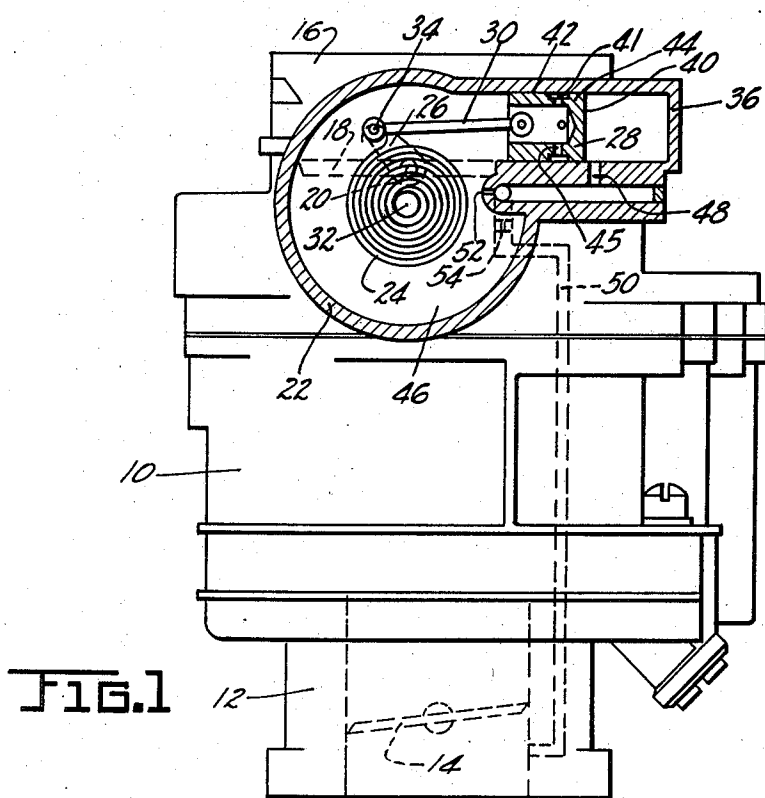
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AUTOMATIC CHOKE CONTROL

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AUTOMATIC CHOKE CONTROL

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The present invention relates to carburetors for internal combustion engines and more particularly to a choke control device for said carburetors.

One of the types of automatic choke devices widely used on automotive carburetors consists of a housing containing a thermostatic element responsive to engine temperature for closing the choke valve when the engine is cold and a piston, disposed in a cylinder formed in the housing, responsive to manifold vacuum for moving the choke valve to a partially open position when the engine begins to fire. Manifold vacuum is transmitted to the interior of the housing through a conduit connected directly to the housing interior and to a port in the side wall of the cylinder adapted to register with a passageway in the piston through which heated air may be drawn from a stove or the like through the housing in proximity to the thermostatic element so that said element may readily respond to changes in engine temperature.

The piston arrangement in devices of this character however is unsatisfactory in that they must be very sensitive, and even very fine particles of foreign matter, such as sand or dust, carried by the heated air and deposited on the side walls of the cylinder may impair the free movements of said piston or might even cause the piston to stick which, if the choke valve is only partially open, will result in an excessive quantity of fuel in the mixture which in turn will result in excessive fuel consumption and improper operation of the engine, overloading and the like. If the piston sticks in a manner to prevent closing of the choke valve it will be impossible to start the engine when cold.

It is therefore one of the principal objects of the present invention to provide an automatic choke control device in which the build up of sand, dirt or other foreign material in the cylinder thereof is substantially eliminated whereby the piston remains sensitive to manifold vacuum and thermostatic action.

Another object of the invention is to provide a choke control device in which the flow of heated air through the cylinder of said device may be cut off or sharply reduced after the choke valve has substantially reached its fully open position.

A further object of the invention is to provide an automatic choke control device which is readily responsive to engine operating conditions.

Additional objects and advantages of the invention will become apparent from the following description and drawings wherein:

Figure 1 is a side elevation of the carburetor in which the choke control device is shown in cross section;

Figure 2 is an enlarged fragmentary cross-sectional view of the piston and cylinder of the choke control device shown in Figure 1; and

Figure 3 is a fragmentary cross-sectional view of the piston and cylinder construction showing a modified form of my invention.

Referring more specifically to the drawing, numeral 10 designates the main body of a downdraft carburetor, 12

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a throttle body, 14 a throttle valve, 16 an air horn in which is mounted a choke valve 18 on a shaft 20. The shaft is off-set from the center of the induction passage to unbalance the choke valve so that air flow through the induction passage will tend to open the valve. The carburetor contains, in addition to those elements mentioned, a main fuel system, idle system, accelerating pump, fuel bowl and power enrichment jet, usually found in conventional float type automotive carburetors. A description of these elements here is not necessary since their construction is well known.

The choke valve 18 is controlled by an automatic choke unit mounted on the air horn at one end of a shaft 20 and consisting principally of a housing 22, a thermostat 24 of a coiled bi-metallic material connected to the choke shaft through a lever 26, and a vacuum actuated piston 28 connected to lever 26 by a rod 30. The housing is in communication, through a tube, with a stove (not shown) mounted on the exhaust manifold of the engine. The thermostat is anchored at its center to a fixed pin 32 and is hooked at its outer end over a pin 34 on the free end of lever 26. As the engine cools, the thermostat uncoils and urges the lever 26 in a counterclockwise direction, i.e. in the direction to close the valve. After the engine has started to run under its own power and commences to warm, the thermostat gradually coils upon itself and backs the free end thereof away from the pin 34 thus permitting the choke valve to open under the influence of air flow in the induction passage. Since the larger portion of the unbalanced valve is on the side moving downwardly as the valve opens, the valve tends to move to and stay in open position and must be positively moved to and held in closed or partially closed position. In the unit shown in the drawing, the thermostat is capable of positively moving the choke valve only toward closed position although in some installations it may be desirable to secure the free end of the thermostat to pin 34 so that the choke valve will also be positively opened.

Piston 28 is disposed in a cylinder 36 and consists of a hollow cylindrical member 40 formed with a recess or groove 41 in the periphery thereof which defines an elongated land 42 on the rear or rod end of the piston and a relatively narrow land 44 at the head end of the piston. A drilled passageway 45 extends through the piston and opens at each end into the recess 41.

The cylinder 36, which is closed at one end and connected directly at the other end with chamber 46 of the housing, is connected at port 48 in the side wall of the cylinder to the induction passage on the engine side of the throttle valve by conduit 50. A bleed 52 connects conduit 50, which contains a restriction 54, directly to chamber 46 of the housing. The port 48 is located in the side wall of the cylinder between the closed end thereof and the head end of the piston when the choke valve is in closed position, as shown in Figure 1. After the engine begins to fire the manifold vacuum is transmitted through conduit 50 and port 48 causing the piston to move rapidly in a direction to open the choke valve. At a predetermined degree of choke opening land 44 passes over the port 48 establishing communication with passage 45 and substantially cutting off the vacuum at the head end of the piston. Thereafter, during the initial operation of the engine, the choke valve is held in the partially opened position by air flow acting on the unbalanced portion of the valve, and heated air is drawn from the chamber 46 both through drilled passage 45 and bleed 52 so that the thermostat may be quickly heated as engine temperature increases. Heated air continues to flow through drilled passage 45 until the thermostat backs away from pin 34 sufficiently to permit the piston under the influence of the unbalanced choke

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to move toward wide open position thus bringing rear land 42 in position to close off port 48 as shown in Figure 2.

With this arrangement the chamber 46 is subjected to the full flow of heated air while the thermostat is warming; but, when a predetermined condition of manifold vacuum and thermostat heating has been reached, the flow of heated air is reduced to that amount necessary to maintain the thermostat in its warmed up position. When the land 42 closes port 48 the air flow through the drilled passage 45 and the cylinder 36 is interrupted thereby removing the source of sand, dirt and other foreign material and eliminating the cause of piston sticking.

By varying the sizes of drilled passage 45, port 48, bleed 52 and restriction 54 and the axial location of the port 48 in the side wall of the cylinder any desired operating characteristic of the choke control device may be obtained.

A modification of my invention is shown in Figure 3 wherein a flat or groove 56 is milled in the land 44 at head end of the piston. In this embodiment the piston is subjected to two stages of torque, the first stage when the choke is closed and the piston is subjected to the force of vacuum through port 48 modified by the bleed through groove 56, and the second stage when the land 44 has passed over the port 48 and the piston is subjected to the force of vacuum as reduced by the bleed through passage 45. The amount of torque produced in the second stage may be readily varied by varying the size of the flat or grooves 56 and the passage 45. Movement of the piston to a predetermined position corresponding to a predetermined condition of manifold vacuum and thermostat heating, positions rear land 42 over the port 48 cutting off or substantially reducing further flow of air through the cylinder 36 as in the previous embodiment.

Other modifications and arrangements may be made without departing from the scope of the invention.

I claim:

1. In a carburetor for an internal combustion engine, an induction passage, a choke valve and a throttle in said passage, a shaft for said choke valve, a lever secured to said shaft, thermostatic means operatively connected to said lever, a housing for said means, a cylinder opening at one end into said housing and being closed at the other end, a hollow piston in said cylinder connected at one end to said lever, a land on each end of said piston with a groove therebetween, a passageway extending through said piston and opening into said groove, a port in the side wall of the cylinder adjacent the head end of said piston when said choke valve is in closed position, said port being adapted to register with said passageway when said choke valve is in a predetermined partially opened position and to be closed by the land on the lever end of said piston when said choke valve is opened beyond said partially open position, means for communicating manifold vacuum to said port, and a conduit connecting said housing with said last mentioned means.

2. A control device for a choke valve having a source of vacuum, comprising a thermostatic means, a housing for said means, a cylinder opening at one end into said housing and being closed at the other end, a piston in said cylinder operatively connected to said choke valve, a port in the side wall of said piston, means for connecting said port with said housing, a port in the side wall of said cylinder located between said closed end and said piston when said choke valve is in substantially closed position, said second mentioned port being adapted to register with said first mentioned port when said choke valve is in a predetermined partially open position and to be closed by said piston when said choke valve is opened beyond said partially open position, and means connecting said second mentioned port with said source of vacuum.

3. A control device for a choke valve having a source of vacuum comprising, a thermostatic means operatively

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connected to said choke valve, a housing for said means, a cylinder opening at one end into said housing and being closed at the other end, a piston in said cylinder operatively connected to said valve, a land on each end of said piston with a groove therebetween, a passageway in said piston opening into said groove and communicating with said housing, a port in the side wall of the cylinder located between the head end of said piston and the closed end of said cylinder when the choke valve is in closed position, means on the land formed adjacent the head end of said piston for providing restricted communication between said port and said passageway when said choke valve is in closed position, said port being adapted to register with said passageway when the choke valve is in a predetermined partially opened position and to be closed by a land on said piston when said choke valve is opened beyond said partially opened position, and means for connecting said port with said source of vacuum.

4. In a charge forming device for an internal combustion engine having a constant level fuel supply chamber, an intake passage having fuel and air inlets and a mixture outlet for supplying a combustible mixture to said engine, a throttle valve for controlling the flow of said mixture, an unbalanced choke valve operable in response to variations in the intake passage for controlling the admission of air through said inlet; mechanism for automatically controlling the operation of said choke valve comprising a thermostat operable to exert a force tending to hold said valve closed upon a reduction in temperature, a suction operated member connected to said valve and operable to move said valve toward open position upon an increase in suction, a conduit to communicate the engine suction to said member, means on said member for blocking the suction conduit to render the suction operated means ineffective when the choke valve moves to the position it normally occupies when the engine becomes self-operative, and a second means on said member operable to substantially block said conduit when the choke valve is moved a predetermined distance beyond said first mentioned position.

5. In a charge forming device for an internal combustion engine having a constant level fuel supply chamber, an intake passage having fuel and air inlets and a mixture outlet for supplying a combustible mixture to said engine, a throttle valve for controlling the flow of said mixture, an unbalanced choke valve operable in response to variations in the intake passage for controlling the admission of air through said inlet; mechanism for automatically controlling the operation of said choke valve comprising a thermostat operable to exert a force tending to hold said valve closed upon a reduction in temperature, a suction operated member connected to said valve and operable to move said valve toward open position upon an increase in suction, a conduit to communicate the engine suction to said member, means on said member for blocking the suction conduit to render the suction operated means ineffective when the choke valve moves to the position it normally occupies when the engine becomes self-operative, a second means on said member operable to substantially block said conduit when the choke valve is moved a predetermined distance beyond said first-mentioned position, and means to progressively heat the thermostat after the engine becomes self-operative so that the valve closing force of the thermostat is progressively reduced whereby the valve can be moved further toward open position by suction effective on the valve when both means for blocking the suction conduit are effective.

6. In a charge forming device for an internal combustion engine having a constant level fuel supply chamber, an intake passage having fuel and air inlets and a mixture outlet for supplying a combustible mixture to said engine, a throttle valve for controlling the flow of said mixture, an unbalanced choke valve operable in response to variations in the intake passage for control-

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ling the admission of air through said inlet; mechanism for automatically controlling the operation of said choke valve comprising a thermostat operable to exert a force tending to hold said valve closed upon a reduction in temperature, a suction operated piston connected to said valve and slidable in a cylinder to move the valve toward open position or an increase in the suction effective on said piston, a suction conduit connected with the side of said cylinder, and a plurality of lands on said piston movable successively to a position to substantially block said suction conduit as the choke valve moves toward open position and prevent movement of the valve by said suction operated piston when the valve is opened to two different open positions.

7. In a charge forming device for an internal combustion engine having a constant level fuel supply chamber, an intake passage having fuel and air inlets and a mixture outlet for supplying a combustible mixture to said engine, a throttle valve for controlling the flow of said mixture, an unbalanced choke valve operable in response to variations in the intake passage for controlling the admission of air through said inlet; mechanism for automatically controlling the operation of said choke valve comprising a thermostat operable to exert a force tending to hold said valve closed upon a reduction in temperature, a suction operated piston connected to said valve and slidable in a cylinder to move the valve toward open position on an increase in the suction effective on said piston, a suction conduit connected with the side of said cylinder, a plurality of lands on said piston movable successively to a position to substantially block said suction conduit as the choke valve moves toward open position and prevent movement of the valve by said suction operated piston when the valve is opened to two different open positions, and a groove between said lands for communicating with the suction conduit when the choke valve is in an intermediate position between the positions occupied when the lands are effective, and a passage connecting said groove with the cylinder in which the piston slides.

8. In a charge forming device for an internal combustion engine having a constant level fuel supply chamber, an intake passage having fuel and air inlets and a mixture outlet for supplying a combustible mixture to said engine, a throttle valve for controlling the flow of said mixture, an unbalanced choke valve operable in response to variations in the intake passage for controlling the admission of air through said inlet; mechanism for automatically controlling the operation of said choke valve comprising a thermostat operable to exert a force tending to hold said valve closed upon a reduction in temperature, a suction operated member connected to said valve and operable to move said valve toward open position upon an increase in suction, a conduit to communicate the engine suction to said member, means on said member for blocking the suction conduit to render the suction operated means ineffective when the choke valve moves to the position it normally occupies when the engine becomes self-operative, a second means on said member operable to substantially block said conduit when the choke valve is moved a predetermined distance beyond said first-mentioned position, and means for rendering said conduit effective to communicate the engine suction to said member when the choke valve occupies a position intermediate those occupied by said valve when said conduit is blocked by the first and second blocking means.

9. In a charge forming device for an internal combustion engine having a constant level fuel supply chamber, an intake passage having fuel and air inlets and a mixture outlet for supplying a combustible mixture to said engine, a throttle valve for controlling the flow of said mixture and a choke valve for controlling the admission of air through said inlet; mechanism for automatically

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controlling the operation of said choke valve comprising thermally responsive means operable to hold the valve closed at low temperatures, means operable by engine suction and effective to move the valve toward open position when the engine starts to run under its own power, means for rendering said suction operated means substantially ineffective when the choke valve is opened to the position it normally occupies when the engine first becomes self-operative, and a second means for rendering the suction operated means inoperative when the choke valve is moved to a predetermined distance beyond said first-mentioned position.

10. In a charge forming device for an internal combustion engine having a constant level fuel supply chamber, an intake passage having fuel and air inlets and a mixture outlet for supplying a combustible mixture to said engine, a throttle valve for controlling the flow of said mixture and a choke valve for controlling the admission of air through said inlet; mechanism for automatically controlling the operation of said choke valve comprising thermally responsive means operable to hold the valve closed at low temperatures, means operable by engine suction and effective to move the valve toward open position when the engine starts to run under its own power, means for rendering said suction operated means substantially ineffective when the choke valve is opened to the position it normally occupies when the engine first becomes self-operative, said means becoming ineffective if said choke valve is moved in a direction to open the valve beyond said first-named position, and a second means for rendering the suction operated means substantially ineffective when the choke valve is moved still further toward open position.

11. In a charge forming device for an internal combustion engine having a constant level fuel supply chamber, an intake passage having fuel and air inlets and a mixture outlet for supplying a combustible mixture to said engine, a throttle valve for controlling the flow of said mixture and a choke valve for controlling the admission of air through said inlet; mechanism for automatically controlling the operation of said choke valve comprising thermally responsive means operable to hold the valve closed at low temperatures, means operable by engine suction and effective to move the valve toward open position when the engine starts to run under its own power, means for rendering said suction operated means substantially ineffective when the choke valve is opened to the position it normally occupies when the engine first becomes self-operative, a second means for rendering the suction operated means ineffective when the choke valve is moved a predetermined distance beyond said first position, and means for progressively heating the thermostat after the engine becomes self-operative in order to effect movement of said choke valve toward open position when said suction operated means is ineffective.

12. In a charge forming device for an internal combustion engine having a constant level fuel supply chamber, an intake passage having fuel and air inlets and a mixture outlet for supplying a combustible mixture to said engine, a throttle valve for controlling the flow of said mixture, an unbalanced choke valve operable in response to variations in the intake passage for controlling the admission of air through said inlet; mechanism for automatically controlling the operation of said choke valve comprising a thermostat operable to exert a force tending to hold said valve closed upon a reduction in temperature, means operable by engine suction and effective upon increase in suction to move the valve toward open position, means whereby said suction operated means is rendered ineffective after a predetermined partial opening movement of the choke valve, a second means for rendering the suction operated means ineffective when the choke valve is moved a predetermined position beyond said first-mentioned position, and means for progressively heating the thermostat after the engine becomes self-

operative so that the valve closing force of the thermostat is progressively reduced whereby the valve can be moved further toward open position by the suction effective on the valve itself when said suction operated means is ineffective.

13. In a charge forming device for an internal combustion engine having a constant level fuel supply chamber, an intake passage having fuel and air inlets and a mixture outlet for supplying a combustible mixture to said engine, a throttle valve for controlling the flow of said mixture, an unbalanced choke valve operable in response to variations in the intake passage for controlling the admission of air through said inlet; mechanism for automatically controlling the operation of said choke valve comprising a thermostat operable to exert a force tending to hold said valve closed upon a reduction in temperature, a suction operated member connected to said valve and operable to move said valve toward open position upon an increase in suction, a conduit to communicate the engine suction to said member, said conduit being so positioned that it is blocked by said member when the valve reaches a partially open position, a housing in which the thermostat is positioned, a source of heated air, a suction passage communicating with said housing and effective to draw heated air from said heat source through said housing to progressively heat the thermostat whereby the valve closing force of the thermostat is progressively reduced and the choke valve is moved further toward open position only by the suction effective on the valve itself after said conduit is blocked by said suction operated member, and a second means for drawing heated air through said housing which is rendered effective when the choke valve reaches a predetermined open position to effect more rapid heating of the thermostat so as to bring about more rapid movement of the valve toward open position after it has been opened to a predetermined extent.

14. In a charge forming device for an internal combustion engine having a constant level fuel supply chamber, an intake passage having fuel and air inlets and a mixture outlet for supplying a combustible mixture to said engine, a throttle valve for controlling the flow of said mixture, an unbalanced choke valve operable in response to variations in the intake passage for controlling the admission of air through said inlet; mechanism for automatically controlling the operation of said choke valve comprising a thermostat operable to exert a force tending to hold said valve closed upon a reduction in temperature, a suction operated piston slidable in a cylinder and operatively connected to the valve so as to move the valve toward open position upon an increase of suction, a suction conduit connected to said cylinder intermediate its ends and adapted to be blocked by said piston

when the valve is moved to partially open position so that the piston is rendered ineffective to move the valve further toward open position, a housing surrounding the thermostat, a source of heated air, a constantly open passage connecting said conduit with the housing and effective to draw heated air from the heat source through the housing to heat the thermostat and reduce its valve closing force so as to permit further opening of the valve by the suction effective on the valve itself, and a second normally closed passage connecting said conduit with the housing, said last named means being rendered effective after the choke valve reaches a predetermined open position.

15. In a charge forming device for an internal combustion engine having a constant level fuel supply chamber, an intake passage having fuel and air inlets and a mixture outlet for supplying a combustible mixture to said engine, a throttle valve for controlling the flow of said mixture, an unbalanced choke valve operable in response to variations in the intake passage for controlling the admission of air through said inlet; mechanism for automatically controlling the operation of said choke valve comprising a thermostat operable to exert a force tending to hold said valve closed upon a reduction in temperature, a suction operated piston slidable in a cylinder and operatively connected to the valve so as to move the valve toward open position upon an increase of suction, a suction conduit connected to said cylinder intermediate its ends and adapted to be blocked by said piston when the valve is moved to partially open position so that the piston is rendered ineffective to move the valve further toward open position, a housing surrounding the thermostat, a source of heated air, a constantly open passage connecting said conduit with the housing and effective to draw heated air from said heat source through the housing to heat the thermostat and reduce its valve closing force so as to permit further opening of the valve by the suction effective on the valve itself, said piston having a passage in the wall thereof adapted to connect said conduit with the thermostat housing after the valve has reached a predetermined open position, so that the thermostat is heated more rapidly and the valve is moved more rapidly toward open position as the valve approaches its fully open position.

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