Aug. 2, 1966 F. J. MARSEE 3,263,661
AUTOMATIC CHOKE
Filed Oct. 7, 1964 2 Sheets-Sheet 1

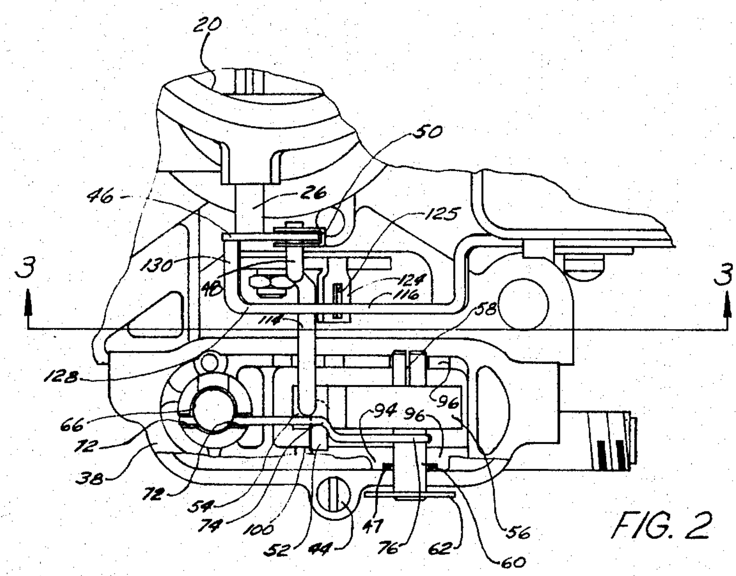

FIG. 2

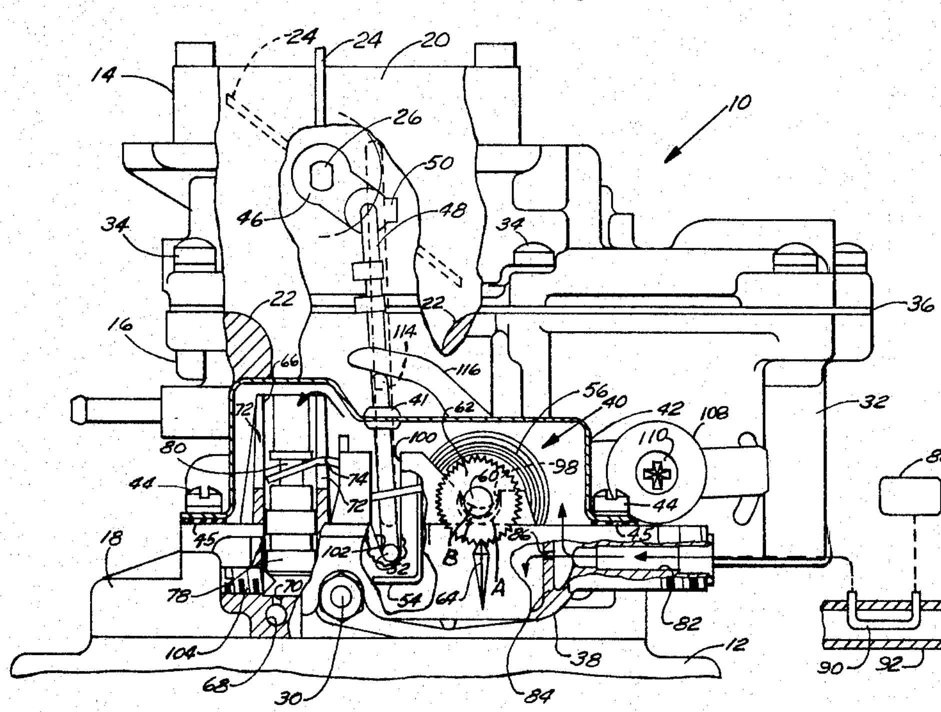

FIG. 1

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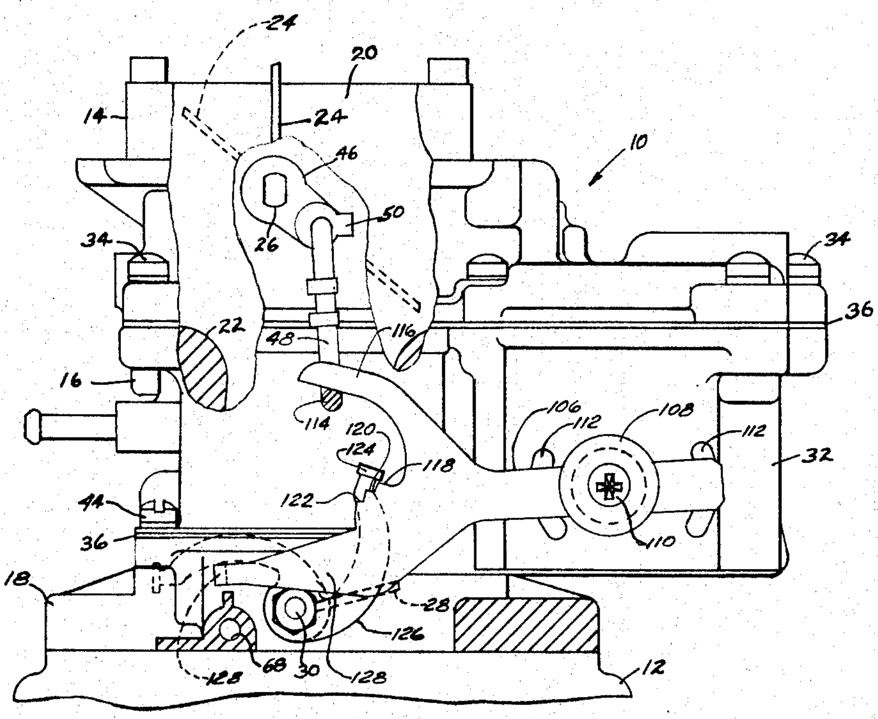

FIG. 3

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1

3,263,661
AUTOMATIC CHOKE

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13 Claims. (Cl. 123—119)

This invention relates generally to carburetors for internal combustion engines, and more particularly to a novel automatic choke control mechanism therefor.

Carburetor automatic choke control mechanisms in which the choke position is influenced by engine temperature and vacuum have been known and used for many years. Such a mechanism is shown by Smitley, U.S. Patent No. 2,988,344.

While these prior art systems have been commercially successful, they involve a substantial number of individual parts, the result being that the assembly is expensive to manufacture.

Many prior art carburetors include a lower throttle body casting and an upper main body casting to which the fuel bowl and the automatic choke mechanism are connected. The two castings are separated by a gasket which tends to prevent the conduction of engine heat to the upper casting. While it is desirable to keep heat away from the fuel bowl, this reduction in radiated and conducted engine heat to the automatic choke mechanism makes the thermostatic element of the choke mechanism less responsive to engine heat. For example, it will cool off faster than the engine when the engine is shut down; thus, the choke will prematurely return to a closed position, as in the case of a relatively short engine shut down, and make restarting difficult.

Another inherent disadvantage of the choke mechanism shown by Smitley is that the linkage between the thermostatic coil and the choke plate is such that the torque output of the thermostatic coil is substantially constant. This makes it more difficult or impossible to make small choke adjustments for different engine applications.

The tendency today is toward reduction in cost of manufacture and standardization. Accordingly, a primary object of this invention is to provide an automatic choke control mechanism of the type shown by Smitley, but wherein the number and complexity of the individual parts is substantially reduced as to reduce the over-all cost of the mechanism.

Another object of the invention is to provide a choke control mechanism that forms a part of the throttle body casting so as to be more effectively subjected to conducted and radiated engine heat, which is the desired parameter.

Still another object of the invention is to provide such a mechanism wherein the torque output characteristics of the thermostatic coil can be changed, within limits, so as to enable minor adjustments and thus permit a single thermostatic coil to serve more engine applications, or special applications.

These and other objects and advantages of the invention will become more apparent upon reference to the following specification and the accompanying drawings wherein:

FIGURE 1 is a side elevational view, with portions thereof cut away and in cross section, illustrating a carburetor having an automatic choke control mechanism embodying the invention.

FIGURE 2 is a fragmentary top plan view of the carburetor shown by FIGURE 1, with the cover of the choke control mechanism cut away to better illustrate the internal structure.

FIGURE 3 is a view similar to FIGURE 1, but taken substantially on the plane of line 3—3 of FIGURE 2 to illustrate additional details of construction.

2

Referring now to the drawings in greater detail, FIGURE 1 illustrates a carburetor **10** embodying the invention, mounted on an intake manifold **12** of an internal combustion engine. In this particular instance, the carburetor **10** generally comprises three cast sections, including an upper so-called air horn casting **14**, an intermediate main body casting **16** and a lower throttle body casting **18**. As usual, the assembled carburetor includes an induction passage **20** having a venturi **22**. The usual offset choke plate **24** is secured on a shaft **26** pivotally mounted in the induction passage **20** upstream of the venturi **22**, and the usual throttle plate **28** is likewise secured to a shaft **30** pivotally mounted across the induction passage downstream of the venturi **22**. The carburetor also includes a fuel reservoir **32** formed with the intermediate main body section **16**, and the carburetor sections are secured together in any suitable manner such as by means of the screws **34**, with gaskets **36** positioned between the sections to prevent leakage.

The operation of the throttle plate **28**, which is spring loaded to close, through the foot throttle valve is well known in the art. Since it forms no part of this invention, this structure is not shown.

A preferably elongated, generally hollow housing **38** containing the improved choke control mechanism, designated generally as **40**, may be formed integral with the throttle body casting **18**, or it may be attached thereto. In the carburetor shown, the housing **38** is cast integrally with the throttle body, and a stamped cover member **42** is provided to enclose the mechanism, the cover being secured by any suitable means such as the screws **44** and sealed by gaskets **45** and **47**.

The shaft **26** to which the choke plate **24** is fixed extends through the wall of the carburetor and has secured thereto a lever **46**. A link **48** is pivotally secured at the upper end thereof to the lever **46** by means of a clip **50**, the other end of the link **48** extending downwardly into the housing **38**, through an eyelet **41** in the cover **42**, so as to have the lower transverse end **52** thereof in a position to be engaged by the outer radially extending free end **54** of a thermostatic bimetal coil element **56**. The inner end of the coil **56** is fixedly secured in the usual manner through the slot **58** in the shaft **60**, the rotational position of which may be set to determine the preload of coil **56** by engagement of the toothed wheel **62** secured to the shaft with a pointed lug **64** formed on the housing **38**. Alternatively, the wheel **62** may be replaced by a slotted plate adapted to receive a screw to hold the plate in any desired position. Bearing openings in the cover **42** locate the shaft **60**.

As is well known in the art, the thermostatic coil **56** is formed so as to expand with decreasing temperature and to contract with increasing temperature. Thus, at lower temperatures, the coil tends to unwind so that the free end **54** thereof tends to close the choke valve **24** through its engagement with the link **48**. As alreadly stated, the choke closing force of the thermostatic coil **56** can be varied by adjusting the initial rotational position of the shaft **60**.

The housing **38** is preferably formed at the other end thereof with a vertically positioned cylinder **66**, the closed end of which is in communication with engine manifold vacuum by means of the passage **68** extending from the induction passage **20** at a point downstream of the throttle plate **28** and communicating with the bottom of the cylinder through the opening **70**. The cylinder walls are formed at the upper end thereof with a pair of aligned slots **72** adapted to receive the free end of a wire or other suitably formed beam member **74**, the other end **76** of which is rotatably anchored, as by a loop, to the shaft **60** on which the inner end of the thermostatic coil is fixedly mounted. As will be explained, the beam **74** may be rigid, or it may flex at a predetermined rate.

A piston **78** is positioned in the cylinder **66**, the piston preferably having only sufficient clearance to allow engine vacuum to cause air to flow by the piston and yet to cause the piston **78** to move downwardly in the cylinder in response to the same engine vacuum. The upper portion of the piston is formed to provide an annular groove **80** aligned with the grooves **72** formed in the cylinder wall so that beam **74** member may be received both in the annular groove **80** in the piston and the vertical grooves **72** in the cylinder wall. It will also be noted that the beam **74** passes above the transverse end **52** of the link **48** that engages the free end **54** of the thermostatic coil **56**.

Other details of construction of the housing **38** to be noted are the air inlet **82** and the baffle **84** having an opening **86**, the baffle causing air, preferably coming from the air cleaner **88** and heated stove **90** positioned in or near the exhaust manifold **92** in the usual manner well known in the art, to pass both over and under the thermostatic coil **56** to heat the same more uniformly. The heated air eventually passes into the open top of the cylinder **66**, around the piston **78** and thence into the intake manifold by way of a passage **68**, as indicated by the arrows.

The sides of the housing **38** are formed with suitable projections **94** and **96** providing oppositely disposed aligned slots **98** to receive the shaft **60** and a second pair of slots **100**, the outermost of which is adapted to guide the lower transverse end **52** of the link **48**. It is understood that the slots **98** may be initially formed to provide either a deeper or a shallower seat for the shaft **60**, as indicated by the dotted lines A and B in FIGURE 1. Since the link **48** must move through the fixed opening **41** in the cover member **42**, the outer slot is formed with an angular cam portion **102** to guide the lower end of the link in a manner to permit the upper end of the link to move outwardly, as it must due to the arcuate movement thereof resulting from its pivotal connection to the choke lever **46**, as shown in dotted lines in FIGURE 1. It will thus be noted that while the upper end of the link moves at a fixed radius, the lower end of the link does not move at a fixed radius.

The extent to which the piston **78** can move downwardly in response to engine vacuum may be manually adjusted by means of the screw **104** having a cone end. Alternatively, the piston itself can be formed so as to enable variation in its travel.

As best seen in FIGURES 2 and 3, a fast idle and dechoke lever **106** is pivotally secured at one end thereof to the fuel bowl portion of the carburetor **10** by means of a washer **108** and screw **110**. Lateral movement of the lever is prevented by means of the bosses **112** extending from the fuel bowl, movement of the lever being thus limited to pivotal movement about the screw **110** in the plane of the lever.

It will be noted that the link **48** has a transverse portion **114** intermediate the ends thereof at a point above the cover **42**. An upper arm **116** of the lever **106** extends over this transverse portion **114** and is positioned thereby. In other words, the lever **106** is free to pivot and will always fall in a counterclockwise direction about the screw until it engages the transverse portion **114**. It is apparent that movement of the choke plate **24** to the closed position, as shown in dotted lines, will raise the link **48**, and at the same time pivot the lever **106** clockwise.

The intermediate left-hand portion of the lever **106** is formed with a series of steps **118**, **120** and **122** which comprise a fast idle mechanism co-operating with the free, laterally extending end **124** of the lever **126** secured to pivot with the end of the throttle shaft **30** protruding through the wall of the carburetor. Since the throttle **28** is spring loaded to close, the tap **124** on the lever **126** will either be free of or engage one of the steps **118**, **120** and **122**, depending upon the choke position when the throttle is released. The tap **124** may be formed with an opening **125** adapted to receive a tool, such as a screwdriver, with which the tab may be suitably bent to provide fast idle settings intermediate that provided by the steps, correct for misalignment, etc.

The lower left-hand arm **128** of the lever **106** is formed with a portion **130** turned into the carburetor so as to be engaged by the intermediate contoured portion of the lever **126** so as to cam the lever **106** counterclockwise and open the choke when the throttle is opened fully.

Operation

When an engine is shut down after a run, the engine is at normal operating temperature and the choke **24** is open, as shown in solid lies in FIGURE 1. The fast idle lever **106** would thus be in its most counterclockwise position, and the lever **126** would have been positioned above the first step **118**. The thermostatic coil **56** would be wound up so as to be positioned below and away from the bottom transverse end **52** of the link **48**.

As the engine cools, the thermostatic coil **56** cools so as to unwind until it engages the bottom transverse end **52** of the link **48**, thereafter urging the link upwardly and the choke closed. However, the first step **118** coming into engagement with the tap **124** on the lever **126** prevents the lever **106** from pivoting clockwise and the choke from closing. Since there is no engine vacuum, the piston **78** is free, and it falls to the bottom of the cylinder, the beam **74** being pivotally connected to the shaft **60**.

The first step in starting a cold engine is to depress the foot throttle. This opens the throttle **28** and causes the lever **126** to move counterclockwise in FIGURE 3, disengaging the tap **124** from the first step **118** and allowing the stressed coil **56** to unwind and raise the link **48**, thereby closing the choke valve **24**. The lower transverse end **52** of the link will also raise the beam **74**, and thus the piston **78**, to its uppermost position. At the same time, link **48** will rotate lever **106** clockwise so that the tab **124** will engage the fast idle step **122** when the throttle is released.

The ignition key is then turned on and the engine is cranked. As soon as the engine starts and becomes self-sustaining, and while the coil is still in the cold condition and tending to close the choke **24**, the piston **78** will be drawn downwardly by engine vacuum to the stop **104**, causing the beam **74** to move the link **48** downwardly and partially opening the choke plate, against the closing force of the still cold unwound thermostatic coil.

Once the piston **78** reaches the stop **104**, further choke opening due to air flow on the unbalanced choke plate **24** is resisted only by the force of the coil **56**. As warm air is drawn through the housing and around the thermostatic coil, the coil is progressively heated, causing it to wind up and offer less and less resistance to choke opening. When the coil reaches normal temperature, it no longer offers resistance, and the system returns to the solid line choke fully open condition shown by FIGURE 1.

As stated in the objects of the invention, various internal combustion engines require more or less choking during certain periods of engine operation. It is thus desirable to provide a choke control mechanism in which the characteristics of the bimetal movement may be readily changed.

Since the lower end of the link **48** does not traverse a fixed radius, as opposed to the typical prior art structure of Smitley, a maximum mechanical advantage occurs at some given point, which can be adjusted by simply repositioning the bimetal post or shaft **60** vertically, either up or down from the position shown in FIGURE 1. Such a shift in shaft position will also adjust the torque characteristics, within a limited range of choke plate travel, and can be accomplished by changing the depth of the slots **98**, as already stated above.

With the proposed choke mechanism, the above changes or adjustments in choking characteristics can be easily made, without resorting to complicated lever modifications, as would be required in the case of the Smitley structure wherein the choke link does traverse a constant radius.

It will also be noted that the beam **74**, which is pulled downwardly by the piston so as to move the link **48** downwardly and open the choke plate against the force of the thermostatic element, may be of a wire spring construction. It is apparent, if the bending movement of the beam is lower than the force of the thermostatic element, that under certain predetermined temperature conditions the beam will be forced to bend a predetermined amount. This bend of the beam will prevent the choke plate from being opened to the same angle, for a constant piston travel, as it would be if the beam were rigid. Thus, the fuel-air mixture can be modulated in accordance with temperature changes.

By actual count, the number of separate pieces required for a complete Smitley type choke system is approximately 39; with the proposed structure, the number of pieces required for a complete choke system is reduced to approximately 28.

Furthermore, since the housing containing the thermostatic element is located at the lower portion of the carburetor near the engine, it is more responsive to conducted and radiated engine heat, which is the desired parameter. Also, such a location reduces the length and exposure of the passage required to connect the vacuum cylinder with manifold vacuum and the housing with the stove.

It should be apparent that various modifications may be possible within the scope of the appended claims.

What I claim as my invention is:

1. In an internal combustion engine carburetor automatic choke mechanism of the type wherein a thermostatic force opposes a choke plate unbalance force substantially at all times during engine operation and an engine vacuum force overcomes the thermostatic force when the engine first starts, a member pivotally connected at one end thereof to said choke plate and means whereby said thermostatic and engine vacuum forces are applied to said member from opposite sides thereof, said structure being free of any pivotal connections at the point of application of said forces.

2. In an internal combustion engine carburetor automatic choke mechanism of the type wherein a thermostatic force opposes a choke plate unbalance force substantially at all times during engine operation and an engine vacuum force overcomes the thermostatic force when the engine first starts, a link pivotally connected at one end thereof to said choke plate and means whereby said thermostatic and engine vacuum forces are applied in opposite directions directly to the other end of said link.

3. In a carburetor automatic choke mechanism of the type wherein the opening of a choke plate offset to open in response to flow of air to the engine is opposed by a thermostatic coil element anchored at its inner end and responsive to engine heat so that opposition to choke opening decreases with increasing engine temperature and assisted by a pressure responsive member actuated fully by any engine vacuum exceeding engine cranking vacuum, means for connecting said choke plate, said thermostat and said vacuum responsive member, said means comprising a link pivotally connected to an arm extending from said choke plate, the free end of said link having a lateral extension passing between elements extending from said coil and said pressure responsive member so as to be acted upon by said elements from opposite sides thereof and so that the torque output characteristics of said coil may be varied by varying the location of said coil anchor.

4. A carburetor for an internal combustion engine, comprising a body formed with

(1) an induction passage having a venturi restriction,
(2) a choke plate mounted on a pivotable shaft and positioned upstream of said venturi,
(3) a throttle plate mounted on a pivotable shaft and positioned downstream of said venturi, and
(4) an automatic choke control mechanism, said mechanism including
  (a) a housing extending from said body adjacent one end of said throttle shaft;
  (b) a cylinder formed at one end of said housing, said cylinder having a slot formed lengthwise through the wall thereof;
  (c) a piston in said cylinder, said piston having an annular groove formed in the outer surface thereof;
  (d) adjustable means for limiting the travel of said piston;
  (e) a passage communicating between the induction passage downstream of said throttle plate and a source of air heated by said engine, said passage including said cylinder and said housing;
  (f) a thermostatic element positioned in said housing, said thermostatic element comprising a bimetallic coil spring having the inner end thereof secured to a rotatably adjustable shaft extending across said housing and the outer free end thereof formed to provide a radially extending abutment;
  (g) a lever secured to said choke shaft;
  (h) a link pivotably mounted at one end thereof to said lever and extending into said housing through the top wall thereof, said link having a transverse portion intermediate the ends thereof, the free end of said link within said housing having a lateral extension engaging said abutment formed on the free end of said thermostatic element so that said element tends to close said choke plate through said link when it is cold; and
  (i) a beam having one end thereof pivotally secured on said shaft to which said inner end of said thermostatic element is secured, said beam extending across said lateral extension of said link toward said cylinder and the free end thereof being positioned both in said slot in said cylinder and in said groove in said piston, said beam being in engagement with said lateral extension when said choke is closed so as to open said choke against the force of said thermostatic element when said piston is moved downwardly to its stop due to engine vacuum when the engine is started.

5. In a carburetor for an internal combustion engine including a body formed with

(1) an induction passage having a venturi restriction,
(2) a choke plate mounted on a pivotable shaft and positioned upstream of said venturi,
(3) a throttle plate mounted on a pivotable shaft and positioned downstream of said venturi, and
(4) an automatic choke control mechanism, said mechanism comprising
  (a) a housing extending from said body adjacent one end of said throttle shaft;
  (b) a cylinder formed at one end of said housing, said cylinder having a slot formed lengthwise through the wall thereof;
  (c) a piston in said cylinder, said piston having an annular groove formed in the outer surface thereof;
  (d) adjustable means for limiting the travel of said piston;

(e) a passage communicating between the induction passage downstream of said throttle plate and a source of air heated by said engine, said passage including said cylinder and said housing;

(f) a thermostatic element positioned in said housing, said thermostatic element comprising a bimetallic coil spring having the inner end thereof secured to a rotatably adjustable shaft extending across said housing and the outer free end thereof formed to provide a radially extending abutment;

(g) a lever secured to said choke shaft;

(h) a link pivotably mounted at one end thereof to said lever and extending into said housing through the top wall thereof, said link having a transverse portion intermediate the ends thereof, the free end of said link within said housing having a lateral extension engaging said abutment formed on the free end of said thermostatic element so that said element tends to close said choke plate through said link when it is cold; and

(i) a beam having one end thereof pivotally secured on said shaft to which said inner end of said thermostatic element is secured, said beam extending across said lateral extension of said link toward said cylinder and the free end thereof being positioned both in said slot in said cylinder and in said groove in said piston, said beam being in engagement with said lateral extension when said choke is closed so as to open said choke against the force of said thermostatic element when said piston is moved downwardly to its stop due to engine vacuum when the engine is started.

6. In a carburetor for an internal combustion engine including a body formed with

(1) an induction passage having a venturi restriction,

(2) a choke plate mounted on a pivotable shaft and positioned upstream of said venturi,

(3) a throttle plate mounted on a pivotable shaft and positioned downstream of said venturi, and

(4) an automatic choke control mechanism, said mechanism comprising

(a) a substantially sealed housing;

(b) a cylinder formed in said housing, said cylinder having a slot formed lengthwise through the wall thereof;

(c) a piston in said cylinder, said piston having an annular abutment formed on the outer surface thereof;

(d) a passage communicating between the induction passage downstream of said throttle plate and a source of air heated by said engine, said passage including said cylinder and said housing;

(e) a thermostatic element positioned in said housing, said thermostatic element having one end thereof adjustably secured to said housing and the other free end thereof extending toward said cylinder;

(f) an arm extending from said choke shaft;

(g) a link pivotably mounted at one end thereof to said arm and extending into said housing through a wall thereof, said link having a transverse portion intermediate the ends thereof and the free end of said link within said housing having a lateral extension engaging said free end of said thermostatic element so that said element tends to close said choke plate through said link when it is cold; and

(h) a beam having one end thereof pivotally secured to said housing, said beam extending across said lateral extension of said link toward said cylinder and the free end thereof being engaged in said slot in said cylinder and adjacent said abutment on said piston, said beam being in engagement with said lateral extension when said choke is closed so as to open said choke against the force of said thermostatic element when said piston is moved downwardly due to engine vacuum when the engine is started.

7. In a carburetor automatic choke mechanism of the type wherein the opening of a choke plate offset to open in response to flow of air to the engine is opposed by a thermostatic coil element anchored at its inner end and responsive to engine heat so that opposition to choke opening decreases with increasing engine temperature and assisted by a pressure responsive member actuated fully by any engine vacuum exceeding engine cranking vacuum, means for connecting said choke plate, said thermostat and said vacuum responsive member, said means comprising a link pivotally connected to an arm extending from said choke plate, the free end of said link having a lateral extension passing between elements extending from said coil and said pressure responsive member so as to be acted upon by said elements from opposite sides thereof, said element extending from said pressure responsive member having a predetermined bending moment so as to provide modulation of the effect of said thermostat.

8. In a carburetor automatic choke mechanism of the type wherein the opening of a choke plate offset to open in response to flow of air to the engine is opposed by a thermostatic coil element anchored at its inner end and responsive to engine heat so that opposition to choke opening decreases with increasing engine temperature and assisted by a pressure responsive member actuated fully by any engine vacuum exceeding engine cranking vacuum, means for connecting said choke plate, said thermostat and said vacuum responsive member, said means comprising a link pivotally connected to an arm extending from said choke plate, the free end of said link having a lateral extension passing between elements extending from said coil and said pressure responsive member so as to be acted upon by said elements from opposite sides thereof, and so that the torque output characteristics of said coil may be varied by varying the location of said coil anchor, said element extending from said pressure responsive member having a predetermined bending moment so as to provide modulation of the effect of said thermostat.

9. In a carburetor automatic choke mechanism of the type wherein the opening of a choke plate offset to open in response to flow of air to the engine is opposed by a thermostatic coil element anchored at its inner end and responsive to engine heat so that its opposition to choke opening decreases with increasing engine temperature and assisted by a pressure responsive member actuated fully by any engine vacuum exceeding engine cranking vacuum, means for connecting said choke plate, said thermostat and said vacuum responsive member, said means comprising a link pivotally connected to an arm extending from said choke plate, the free end of said link having a lateral extension merely passing between and being free of positive connections to elements extending from said coil and said pressure responsive member.

10. In a carburetor automatic choke mechanism of the type wherein the opening of the choke plate is opposed by a thermostatic element responsive to engine heat and assisted by a pressure responsive member actuated by engine vacuum, means for connecting said choke plate, said thermostat and said vacuum responsive member, said means comprising a link pivotally connected at one end thereof to an arm extending from said choke plate, said link being arranged so that said pivoted end of said link traverses a constant radius arc, the other free end of said link traversing a different path so as to have a distinct maximum mechanical advantage at some particular point, said point being variable by varying the direction of forces acting thereon.

11. In a carburetor automatic choke mechanism of the type wherein the opening of the choke plate is opposed by a thermostatic element responsive to engine heat and assisted by a pressure responsive member actuated by engine vacuum, means for connecting said choke plate, said thermostat and said vacuum responsive member, said means comprising a link pivotally connected at one end thereof to an arm extending from said choke plate, said link being arranged so that said pivoted end of said link traverses a constant radius arc, the other free end of said link traversing a different path so as to have a distinct maximum mechanical advantage at some particular point.

12. An internal combustion engine carburetor automatic choke mechanism comprising an offset choke plate, a thermostat heated by the engine, and a link extending between said choke plate and said thermostat so that opening of said choke plate is resisted by the force of said thermostat, said link being arranged so that its maximum mechanical advantage occurs at a single fixed point, whereby said point can be varied merely by varying the direction of application of said thermostat force.

13. An internal combustion engine carburetor automatic choke mechanism comprising an offset choke plate, a thermostat heated by the engine, a link extending between said choke plate and said thermostat so that opening of said choke plate is resisted by the force of said thermostat, said link being arranged so that its maximum mechanical advantage occurs at a single fixed point, whereby said point can be varied merely by varying the direction of application of said thermostat force, an engine vacuum responsive device assisting initial opening of said choke plate, and means to modulate the effect of said thermostat.

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