April 20, 1965 W. E. HIGHLEY ETAL 3,179,098

CARBURETOR

Filed Sept. 11, 1963 2 Sheets-Sheet 1

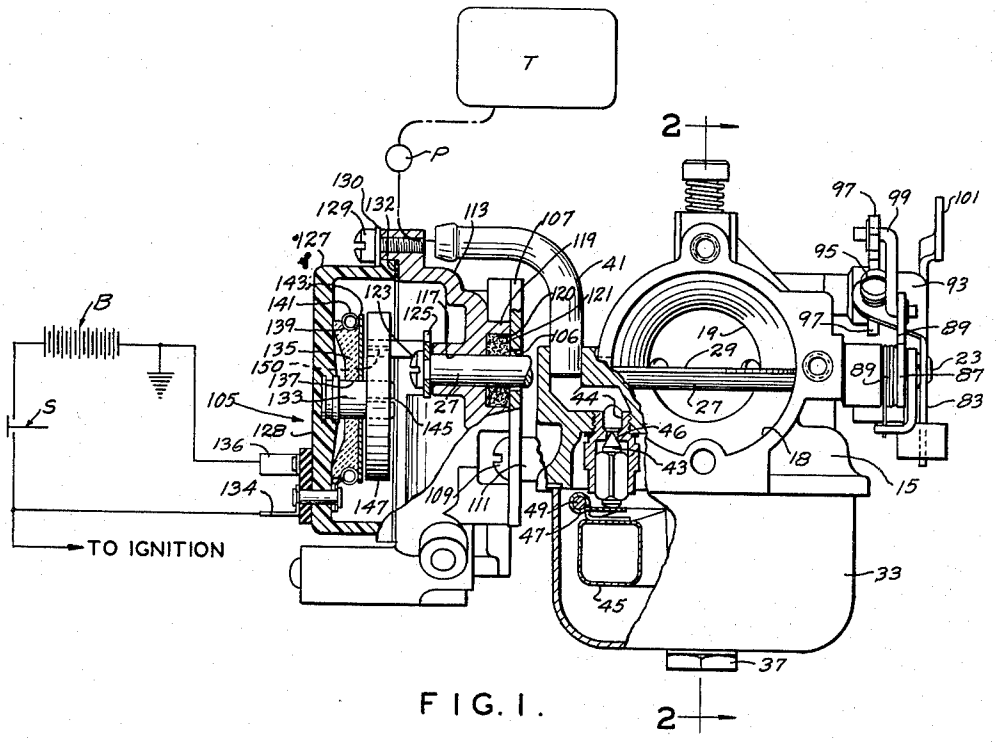


FIG. 1.

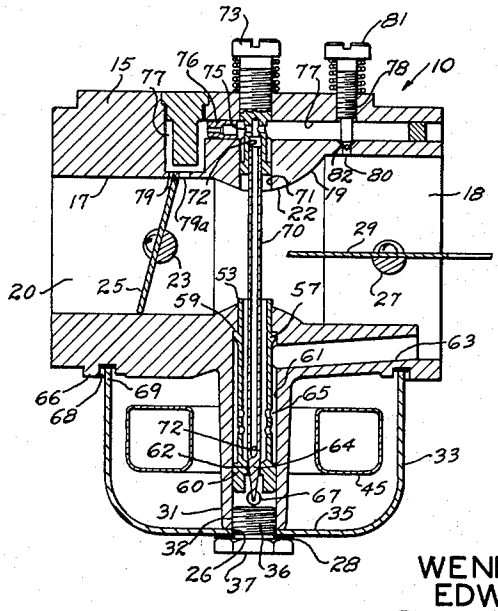


FIG. 2.

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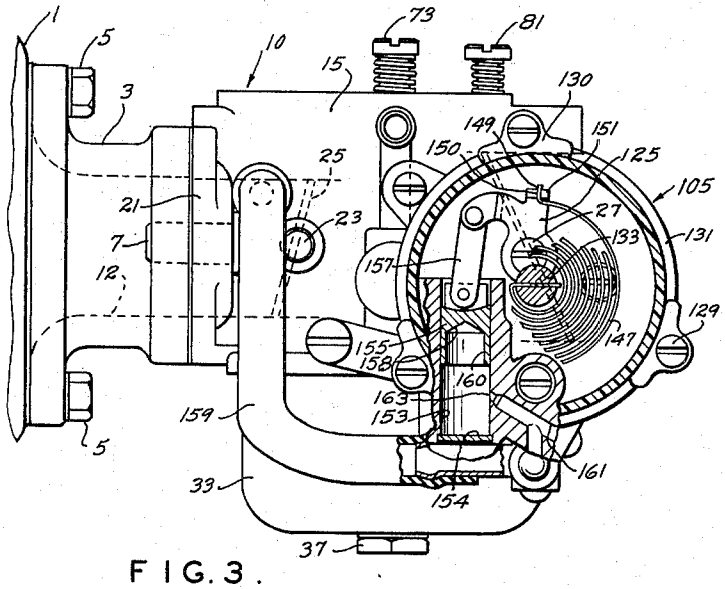


FIG. 3.

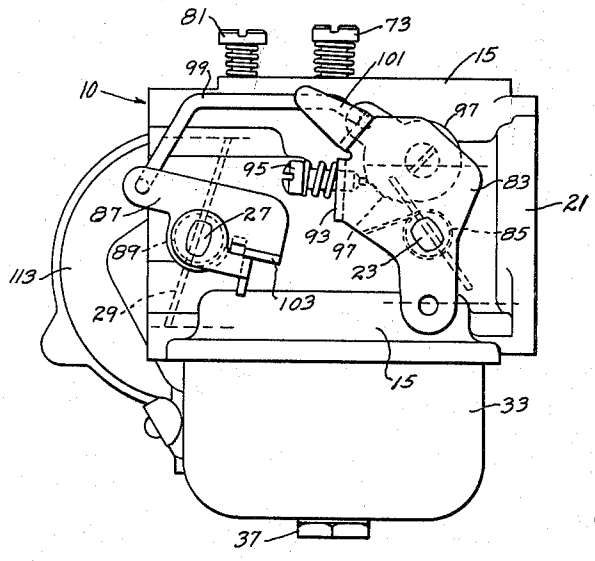


FIG. 4.

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United States Patent Office 3,179,098 Patented Apr. 20, 1965

3,179,098

CARBURETOR

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Filed Sept. 11, 1963, Ser. No. 308,154
11 Claims. (Cl. 123—119)

This invention relates to carburetors for internal combustion engines, and particularly to novel structures incorporating an automatic choke system for a carburetor.

The employment of an automatic choke on the carburetor of a small internal combustion engine, such as those of the type used on two wheeled motorized vehicles, motorized golf carts and the like, as well as small stationary engines for industrial use, has been handicapped in the past by characteristics which are inherent in most small engines. Small internal combustion engines are generally very sensitive to mixture control and require strict maintenance of the mixture at all phases of engine operation for optimum performance. Carburetors which employ automatic chokes with an air heated thermostat and a vacuum actuated choke piston present a problem because the air which bleeds into the intake manifold generally exceeds the limits of mixture control and makes the performance of the engine poor and may also result in hard starting.

Because the engine on which the carburetor is used is small, the carburetor itself must be small and light of weight, but it must also be durable because a small engine of this nature is frequently subjected to severe jarring.

Automatic choke systems on small engines of the type described must be capable of preventing overchoking of the engine prior to reaching optimum operating temperature.

Since the mixture control of an engine of the type described is highly critical, it is imperative that air entering the intake manifold of the engine from sources other than the mixture conduits of the carburetor be severely limited. For this reason automatic chokes, which are heated by hot air from a manifold stove, when used in carburetors of small engines, do not generally achieve optimum performance. Air from the manifold stove flows through the choke housing and into the mixture conduit below the throttle valve due to influence of manifold vacuum. While this type of air flow is not excessive in large engines, it seriously aggravates the excess air problem common to small internal combustion engines.

The use of vacuum actuated pistons in small engines, to establish an initial partially open choke position upon starting of the engines, has also been limited because the excess air problem is even further aggravated. The piston and cylinder type choke operator employs an air bypass which is established upon movement of the piston to a predetermined position within the cylinder. The air bypass breaks the vacuum acting on the pistons and induces air to flow through the cylinder and into the mixture conduit below the throttle. While excess air flow is not particularly disadvantageous in large internal combustion engines, in small engines it presents a serious problem because the mixture balance is easily disturbed.

Another disadvantage involving employment of automatic chokes on small internal combustion engines is that the choke housing is generally supplied with heated air from an exhaust manifold stove, and this air heats a thermostatic coil which in turn coils upon itself and drives the choke toward its open position. The heated air carries to the choke housing a certain amount of dust, since the manifold stove is open to the atmosphere. This dust in time will impair the movement of the automatic choke requiring servicing. Also, since the choke

shaft must turn freely, the fit between the choke shaft and the choke shaft bore is loose, allowing air to move through the space between the shaft and bore to the housing. Dust carried by this air is sometimes deposited in the choke shaft bore causing binding or otherwise impairing rotation of the choke shaft and again resulting in a condition where maintenance is required.

A carburetor of the type described, contrary to the idiosyncrasies of carburetors on larger internal combustion engines, such as an automobile engine, must be capable of choke movement from the closed position to a partially open position instantly, when the engine starts under cold conditions to prevent flooding and hard starting. It has been difficult to provide an automatic choke, on small engines of the type described, which will maintain the choke closed until the engine starts and allow the choke to move quickly and automatically to a predetermined partially open position.

Accordingly, it is an object of this invention to provide a carburetor for use with small internal combustion engines which employs an automatic choke capable of maintaining the choke valve closed when the engine is cold and not operating, partially open when the engine is cold and operating, and fully open at optimum operating temperature.

It is among the objects of this invention to provide a carburetor including an automatic choke wherein contamination by dust or foreign matter is eliminated.

An object of this invention is to provide a carburetor including an automatic choke and a piston for establishing an initial choke position upon starting of the engine, wherein air entering the engine through the automatic choke system is severely limited and strictly controlled.

A further object of this invention is to provide a vacuum actuated choke control piston which cuts off communication to the vacuum source upon reaching a predetermined initial position and prevents air from by-passing the throttle and entering the intake manifold of the engine.

An object of this invention is to provide a carburetor having an automatic choke system wherein the thermostatic coil is heated electrically.

A further object of the invention is to provide a carburetor having an automatic choke system wherein the thermostatic spring positively urges the choke valve to its full open position upon reaching a predetermined temperature and to its full closed position when the engine temperature is below a predetermined level.

Another object of the invention is to provide a carburetor which is inexpensive in manufacture and reliable in use.

The invention embodies other novel features, details of construction and arrangement of parts which are hereinafter set forth in the specification and claims and illustrated in the accompanying drawings, forming a part thereof, wherein:

FIGURE 1 is an elevation showing the inlet end of the mixture conduit and with parts broken away showing a portion of the fuel system and automatic choke in section and showing the electrical heating circuit schematically.

FIGURE 2 is a sectional view taken along line 2—2 in FIGURE 1.

FIGURE 3 is an elevation showing the left side of the carburetor with parts of the automatic choke broken away and shown in section.

FIGURE 4 is an elevation showing the right side of the carburetor of this invention.

Referring now to the drawings for a better understanding of the invention, the carburetor is shown as comprising a body 15 having a horizontal mixture conduit 17 (FIGURE 2) provided with an air inlet 18, an outlet

20 and a venturi 19 having a throat 22. A flange 21 is provided at the outlet end of the body 15 (FIGURE 3), for attachment of the carburetor to the intake manifold 3 of an engine 1. The intake manifold is mounted on the engine 1 by means of bolts 5 and the carburetor is mounted on the intake manifold 3 by bolts 7.

A throttle shaft 23 is journaled horizontally in appropriately aligned bearing apertures formed in body 15 to support a throttle valve 25 for pivotal movement within the outlet 20.

A choke shaft 27 is journaled horizontally in aligned bearing apertures formed in the body 15 to support a choke valve 29 for pivotal movement within the air inlet 18. The choke valve 29 is adapted for pivotal movement from a full open position as shown in FIGURE 2 to a closed position where the choke 29 completely blocks the air inlet 18. The choke 29 is also adapted for movement either automatically or manually as will be discussed in detail hereinafter.

The body 15, as illustrated in FIGURE 2, is provided with a downwardly projecting tubular stem 31 having its lower end internally threaded at 32 for engagement with the externally threaded end 36 of a bolt 37 and having an internal shoulder 59 at the upper end thereof. A main fuel nozzle 53 is press-fitted within tubular stem 31 and is formed with an upper annular flange 57 abutting the shoulder 59 and a lower enlarged annular portion 60 tightly fitting the internal wall of stem 31 and establishing a fluid-tight seal therebetween. The upper end of the main fuel nozzle 53 projects into the mixture conduit in the region of venturi 19. The main fuel nozzle, except for the enlarged portion 60 and the flange 57, has a smaller external diameter than the internal diameter of the stem and defines a fuel well 61 with the stem 31. A plurality of ports 65 are formed in the nozzle 53 for passage of fuel into and out of the lower end of the well 61. An air bleed passage 63 is formed in the body 15 leading from the carburetor inlet 18 to the upper end of well 61.

A fuel metering orifice 62 is formed in the lower end of the main fuel nozzle 53 to receive the lower end 64 of a metering tube 70. The upper end of the metering tube 70 is press-fitted within a central longitudinal bore 71 in a high speed adjustment screw 73. Upon turning of the high speed adjustment screw 73 the lower end 64 of the metering tube 70 will move relative to orifice 62 to effectively vary the flow of fuel through the orifice.

The under portion of the body 15 is formed with a downwardly projecting annular flange 66 having an annular recess 68 therein to receive the rim 69 of a cup shaped fuel bowl 33. The bottom of the fuel bowl 33 has an aperture 26 adapted to receive a screw 37. During the assembly of the carburetor, the screw 37 is inserted through the aperture 26 in the fuel bowl and screwed into the internally threaded stem 31. By screwing the threaded end 36 of the screw 37 into the stem 31 the screw head first forces the bowl rim 69 against a gasket in the recess 68, and then forces the bowl bottom against the stem 31 with a gasket 28 making a fluid seal between the head of the screw and the bowl 33.

A hollow ring shaped float 45 is mounted on a float arm 47 which is pivoted to the body at 49 to actuate a needle valve 43 to control the flow of fuel through an inlet 44 and valve port 46 into the bowl 33. The float and valve are adapted to coact to maintain a substantially constant fuel level within the bowl. Fuel is supplied from a tank T (FIGURE 1) through a conduit 41 and a fuel pump P to the fuel inlet 44. Fuel passes from the bowl 33 through ports 67 of the stem 31 into a chamber which is located within the stem 31 and below the nozzle 53. Fuel flows through metering orifice 62 and orifices 65 to a level in well 61 and nozzle 53 equal to that maintained by float 45 in fuel bowl 33.

The idle fuel system of the carburetor is an interconnected system with the primary fuel system through the

main fuel nozzle 53 as illustrated in FIGURE 2. The metering tube 70 is formed with a hollow central channel with its lower end closed and its upper end open. The upper end of the metering tube 70 is fitted into a bore 71 in adjustment screw 73 as described herein above. A small calibrated orifice 72 is formed in the lower end of the metering tube 70 and which is adapted to be located below the fuel level within the well 61. The body 15 is formed with an idle passage 77 for providing a flow of mixture into the engine while the throttle 25 is in its closed position, as shown in FIGURE 2. Adjustment screw 73 is threaded into a bore formed in body 15 normal to and intersecting idle passage 77 and is formed with perforations 75 which allow fuel to flow from metering tube 70 into the idle passage 77. The idle passage 77 is provided with an economizer 76 having a calibrated orifice for controlling the amount of mixture flow through the idle passage and for further mixing the fuel and air flowing therethrough. The idle passage 77 is provided with an idle adjustment screw 81 which is threaded into a bore 78 formed in body 15 which is normal to and intersecting idle passage 77. A bore 80 of smaller diameter than the bore 78 is formed in body 15 in continuation of bore 78 and includes a tapered portion adapted to coact with the tapered end 82 of idle adjustment screw 81 to control the amount of air flowing from the inlet 18 into the idle passage 77. An idle port 79 is formed in body 15 and communicates the idle passage 77 with the mixture conduit downstream of the throttle 25. A second elongated rectangular idle port 79*a* also communicates the idle passage 77 with the mixture conduit 17 and is operative to allow air to bypass the throttle 25 and to create turbulence in the region of port 79 which further vaporizes the rich mixture flowing from the idle system. The amount of air bypassing the throttle is dependent upon the position of the throttle and an optimum throttle position at idle is generally known as the "curb idle position."

Operation of the idle system is as follows: Air flows into the idle pasage 77 through bore 80 as a result of manifold pressure drop. Fuel flows through orifice 72 in the idle tube 70 and upward to the idle passage 77 as a result of pressure drop. Mixing of the fuel and air is accomplished as they flow through the perforations 75 in adjustment screw 73 and through the economizer 76. Further mixing to achieve the correct mixture is accomplished by turbulence created by air bypassing the throttle 25 as discussed hereinabove.

A manually operable control arm 83 is secured to the throttle shaft 23 at one end thereof to control the proportion and quantity of fuel and air supplied to the engine. A helical compression spring 89 mounted around the choke shaft 27 is tensioned between the carburetor body 15 and control arm 83 for biasing the throttle 25 to its closed or "curb idle" position. A lateral finger 93 of the control arm 83 is bent normal to the control arm and is formed with a threaded aperture for receiving a throttle adjustment screw 95. A fast idle eccentric cam 97 is pivotally mounted on the body 15 in a position to be engaged by adjustment screw 95 for controlling engine speed during the various operating conditions of the engine. The fast idle cam 97 is connected by a connecting link 99 to a choke control arm 87 which is fixed to one end of the choke shaft 27 for pivoting the fast idle cam 97 relative to pivotal movement of the choke shaft 27.

Control arm 83 is provided with an offset unloading finger 101 which, upon full opening of the throttle 25 when the choke is closed, will contact a transverse finger 103 of choke control arm 87 and effect opening of the choke. This feature is generally known as "unloading." Opening both the throttle and the choke when the engine is flooded allows air to sweep the carburetor and engine with air to remove excess fuel.

As illustrated in FIGURES 1 and 4, an automatic

choke mechanism indicated generally at 105 is attached to the body 15 of the carburetor 10 by means of a mounting plate 107. The mounting plate 107 is supported on the body 15 by screws 109 which are threaded into bosses 111 projecting from the body 15. The automatic choke mechanism comprises a housing 113 fixed to the mounting plate 107 and having a choke shaft bore 117 in a wall thereof providing a bearing aperture for the choke shaft 27. The choke shaft 27 extends from the body 15 through an opening 106 in the plate 107 and through bore 117 into the choke housing 113, as illustrated in FIGURE 1.

A cylindrical piston bore 153 is formed in the choke housing 113 and receives a cylindrical choke piston 155 for reciprocation therein. An upper portion 156 of piston 155 is connected to the choke arm 125 by a link 157 pivotally attached to both the arm 125 and the upper portion 156 of the piston 155. It will be understood that the thermostatic coil 147 upon heating drives arm 125 in a counterclockwise direction as seen in FIGURE 3 and transmits energy through arm 125 and link 157 to drive the piston 155 downwardly within the cylinder 153.

The piston 155 is hollowed out by a longitudinal bore 158 formed therein for reducing the piston weight and for forming a thin walled vacuum cut-off flange 160. A vacuum passage 161 is formed in the choke housing 113 and is communicated with the cylinder 153 by a calibrated orifice 163. The vacuum passage 161 is connected with the mixture conduit 17 of the carburetor 10 by a conduit 159. Conduit 159 is connected to the mixture conduit 17 downstream of the throttle 25 so that manifold vacuum may act through the conduit 159, passage 161 and the orifice 163 to reduce the pressure in the cylinder and cause the piston 155 to be forced downwardly by atmospheric pressure. A plug 154 seals the bottom of the cylinder 153 and forms a stop engageable by the piston 155 to limit movement of the choke valve. When the piston engages the plug 154 the choke valve will be in its wide open position. As the piston 155 moves downwardly a sufficient amount for the flange 160 to close the orifice 163 it will be understood that the orifice 163 allowing communication between the source of vacuum and the cylinder is closed and that subatmospheric pressure no longer is applied to the piston. The piston will move down no further than the intermediate position illustrated by broken lines in FIGURE 3.

In accordance with a feature of this invention, an annular flange 119 is formed on a wall of the choke housing 113 concentric with the choke shaft bore 117 and defining a circular recess 120 around the choke shaft 27. A filter ring 121 formed of permeable material, such as felt, plastic foam, sintered metal or the like, is retained within the recess 120 by the mounting plate 107. A substantial clearance is allowed between the choke shaft and the bearing aperture to allow air to flow from the atmosphere into the housing to prevent a vacuum from forming above the piston as the piston moves downwardly under influence of manifold vacuum. This allows the piston to be freely movable by manifold vacuum. The filter member 121 is provided to restrict the flow of air through the clearance and to prevent dust from entering the choke housing and being deposited along the choke shaft. The filter may also be saturated with lubricant to provide for lubrication of the choke shaft.

In carburetors of the type described which employ an automatic choke system, a means of employing heat from the exhaust manifold to heat the thermally responsive bimetallic coil was popularly employed. A heat riser extended from the exhaust manifold to the interior of thermostat housing and a bore was formed in the housing and carburetor body to communicate with the intake manifold downstream of the throttle valve. The subatmospheric pressure present in the intake manifold induced the atmospheric or superatmospheric pressures within the exhaust manifold to induce a flow of hot exhaust gasses through the heat riser, through the thermostat housing and down the aforesaid bore to the intake manifold. The hot gasses heated the thermally responsive coil upon passing through the thermostat housing. While the method of heating the thermostat coil is acceptable in larger engines, it becomes a serious disadvantage in smaller engines by aggravating the excess air problem described hereinabove and thus reducing the engine to inefficient operation. Therefore, in accordance with this invention, other heating means is provided for heating the thermostatic coil and for preventing excessive flow of air to the intake manifold.

A choke housing cover 127 is retained on the choke housing 113 by screws 129 and spring clips 130, which engage a flange 131 on the cover 127. A gasket 132 is positioned between the choke housing and cover 127 to establish an airtight seal therebetween. When assembled, the interior of the automatic choke housing is sealed from the atmosphere except for a small amount of filtered air flowing along the choke shaft 27 as indicated above.

The choke housing cover is dish-shaped and is formed of a material which is nonconductive and heat resistant, such as bakelite, for example, and has a shaft 133 located centrally thereof and which may either be integral therewith or moulded therein. A circular heat-retaining, nonconductive insulator member 135 is mounted on the shaft 133 by means of a central opening 137. The insulator 135 may be formed of ceramic material or any other material having properties similar to ceramic material. A groove 139 is formed in the periphery of the insulator 135 for receiving a spirally wound heater coil 141. A flat circular plate 143 having a centrally located opening is mounted on the shaft 133 to retain the insulator 135 in position and to retain the heater coil 141 in the groove 139. The heater plate 143 is formed of metal and coated with a nonconductive material such as porcelain so that it will conduct heat but will not conduct an electric current. A spirally wound thermostatic coil 147 is mounted on the free end of shaft 133, with the interior end of the coil 147 retained in a slot 145 longitudinally formed in the shaft 133.

A choke piston arm 125 having an offset coil engaging member 151 thereon is fixed to one end of the choke shaft 27 by a screw 123 and adapted for imparting rotary movement to the choke shaft. The thermostatic coil 147 has its outer end extending through a longitudinal slot 150 in member 151. Rotational movement of the thermostatic coil, during the heating thereof, is transmitted to the choke shaft 27 by arm 125. When the temperature of the thermostatic coil is below a predetermined temperature the choke will be closed and upon reaching a higher predetermined temperature the choke will be at its full open position.

Two electrical connectors 134 and 136, as illustrated in FIGURE 1, are moulded into or otherwise attached to the circular end wall 128 of cover 127 and one of the connectors is attached to each end of heater coil 141. One of the connectors 134 is grounded to the choke housing and the other connector 136 is connected in parallel to the ignition circuit of the engine as indicated schematically in FIGURE 1. Electrical energy flowing from the storage battery B or other electrical source of the engine flows along line L through the ignition switch S, through the connector 136, through the heater coil 141, through the connector 134, and back. The resistance of the heater coil 141 determines the amount of heat given off thereby. As illustrated in the present embodiment, it is apparent that the heater coil circuit is energized as long as the ignition circuit is energized and that the coil is being heated as long as the ignition circuit is closed. The heating coil 141 may be arranged in a circuit which is energized by a pressure sensitive switch such as an oil pressure actuated switch to provide for heating of the coil only when the engine is operating. An alternative electrical circuit might include an alter-

nator instead of a storage battery to provide for energization of the heating coil 141 only when the engine is operating.

Operation

Before the engine is started when the engine is cold, the throttle 25 will normally be in its partially open or "fast idle position" and the choke 29 will be constrained to its closed position by the thermostatic coil 147. When the ignition circuit is completed or when the heater coil circuit is energized, the heater coil 141 begins to heat, as described hereinabove, and heat begins to be transmitted to the thermostatic coil 147. Immediately upon starting of the engine a high manifold vacuum develops below the throttle 25 and through the conduit 159 and the orifice 163 effects downward actuation of the piston 155 to its intermediate position. As the piston 155 reaches its intermediate position the orifice 163 is closed by skirt flange 160 and the vacuum is cut off causing the piston to remain in the intermediate position. As the piston moves to the intermediate position its downward movement is transmitted to the choke 29, by the link 157, the arm 125 and the choke shaft 27, in the form of rotary movement to a predetermined intermediate partially open choke position. As the thermostatic coil 147 begins to heat, it expands and moves counterclockwise as shown in FIGURE 3 moving the piston 155 downwardly to its lowermost position and fully opening the choke 29. Idle speed of the engine during the warm-up phase will be controlled by the position of the fast idle cam 97 which is indirectly controlled by the thermostatic coil through the choke shaft 27, the choke control arm 87 and the connecting link 99.

If operation of the engine is desired at speeds greater than "fast idle" before the choke coil has heated, the operator merely rotates the throttle control arm 83 counterclockwise as shown in FIGURE 4 and the finger 101 thereon engages the finger 103 on the choke control arm 87 and moves the choke to its open position. Manual actuation of the throttle and choke in this manner is also employed if "unloading" is desired should the engine become flooded. The throttle and choke valve are both opened during "unloading" to allow air to sweep excessive fuel vapors from the engine after flooding occurs.

During operation of the engine the heater coil 141 continues to supply heat to the thermostat housing 113 and the insulator member 135 continues to absorb heat. If the engine is shut off for only a few minutes the insulator member 135 will conduct the heat stored therein to the thermostat and accordingly prevent the thermostat from cooling too rapidly. Transmitting stored heat to the thermostat prevents hard starting when the engine is hot by maintaining the choke in its open position until the engine cools to the point that choking is required.

From the foregoing, it will be seen that this invention is one well adapted to attain all of the objects hereinabove set forth, together with other advantages which are obvious and inherent from the description of the apparatus itself.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the appended claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

We claim:

1. A carburetor for an internal combustion engine comprising a body formed with a mixture conduit, choke means including a choke valve mounted within said mixture conduit and movable from a position closing to a position opening said mixture conduit, thermally responsive means adapted for operative contact with said choke means for biasing said choke valve to said closed position when said engine is cold, means within said chamber for heating said thermally responsive means, a cylinder, a choke piston within said cylinder, said piston being operatively connected to said choke means to impart rotary movement to said choke valve, means communicating said cylinder with a source of subatmospheric pressure for inducing movement of said piston within said cylinder, said piston, upon moving to a predetermined intermeidate position within said cylinder, blocking said communicating means and rendering said subatmospheric pressure ineffective, whereby said choke valve is moved from said closed position to a predetermined intermediate position upon communication of said cylinder with said source of subatmospheric pressure.

2. The carburetor as in claim 1 in which the heating means is an electrically energized coil.

3. An automatic choke system for the carburetor of an internal combustion engine comprising a thermostat housing, a housing cover attached to said housing in sealing relation therewith and defining therewith a thermostat chamber, a cylinder having an open upper end and a closed lower end defined in said housing, a piston positioned within said cylinder for reciprocation therein, means connecting said piston and said choke and adapting said piston to impart rotary movement to the choke of said carburetor, means communicating said cylinder below said piston with a source of subatmospheric pressure for actuation of said piston toward said communicating means, means for closing communication between said cylinder and the source of subatmospheric pressure and for maintaining said piston at a predetermined position within said cylinder, means for preventing a vacuum from forming above said piston as said piston moves downwardly, foraminous means for preventing contamination of said thermostat chamber by dust, thermally responsive means located within said chamber and adapted, in response to heat within said chamber, to impart rotary movement to said choke valve, means within said housing for heating said thermally responsive means in response to completion of the ignition circuit of the engine.

4. An automatic choke system for the carburetor of an internal combustion engine having an ignition circuit and a source of electrical energy, said choke system comprising means defining a thermostat chamber, thermally responsive means located within said chamber and adapted for imparting rotary movement to the choke of said carburetor, electrically energized heating means located within said chamber for heating said thermally responsive means in response to operation of the engine, means for preventing more rapid cooling of said thermally responsive means than the cooling of said engine after said engine ceases to operate, piston and cylinder means responsive to subatmospheric pressures in the engine for imparting predetermined rotary movement to said choke shaft upon starting of said engine and for maintaining said choke in a partially open condition when said engine is cold, means for maintaining atmospheric pressure within said chamber upon actuation of said piston and cylinder means.

5. An automatic choke system for the carburetor of an internal combustion engine having an ignition circuit and a source of electrical energy, a thermostat housing, a housing cover on said housing in sealing engagement therewith and defining therewith a thermostat chamber, thermally responsive means positioned within said chamber and adapted for imparting rotary movement to the choke of said carburetor, electrically energized means positioned within said chamber for heating said thermally responsive means in response to completion of the ignition circuit of the engine, an insulating and heat absorbing body positioned in said chamber and positioned adjacent said thermally responsive means, means for preventing more rapid cooling of said thermally responsive

means than the cooling of said engine after said ignition circuit is broken, means responsive to manifold vacuum in the engine for imparting rotary movement to said choke shaft and for maintaining said choke in a partially open condition when said engine is cold, means for maintaining atmospheric pressure within said chamber.

6. A fuel system for a vehicle having an internal combustion engine and a source of fuel, a carburetor on said engine, a fuel conduit between said source and said carburetor, a fuel pump in said conduit for delivering fuel from said source to said carburetor under pressure, said carburetor having a body formed with a mixture conduit, a choke valve mounted within said mixture conduit, and movable from a position closing to a position opening said mixture conduit, an automatic choke actuating system on said carburetor comprising a thermostat housing, a housing cover on said housing in sealing engagement therewith and defining therewith a thermostat chamber, thermally responsive means positioned within said chamber and adapted in response to temperature changes within said chamber, to move said choke to its open or closed position, heating means within said chamber for supplying heat to said thermally responsive means in response to operation of said engine, cylinder means defined in said housing and having an open upper end positioned within said chamber and a closed lower end, piston means within said cylinder for reciprocal movement therein, said piston means being adapted to impart rotary movement to said choke valve, a source of subatmospheric pressure, means communicating said cylinder intermediate the ends thereof with said source of subatmospheric pressure for downward actuation of said piston upon starting of said engine, a skirt on said piston means rendering said subatmospheric pressure ineffective after said piston is moved to a predetermined intermediate position within said cylinder, means in said housing above said cylinder for maintaining atmospheric pressure within said chamber and for preventing contamination of said chamber by dust.

7. A fuel system for a vehicle having an internal combustion engine a source of electrical energy and a source of fuel, a carburetor on said engine, a fuel conduit between said source and said carburetor, a fuel pump in said conduit for delivering fuel from said source to said carburetor under pressure, said carburetor having a body formed with a mixture conduit, a choke valve mounted within said mixture conduit and movable from a position closing to a position opening said mixture conduit, an automatic choke actuating system on said carburetor comprising a thermostat housing, a housing cover on said housing in sealing engagement therewith and defining therewith a thermostat chamber, thermally responsive means positioned in said chamber and adapted in response to temperature changes within said chamber, to move said choke to its open or closed position, an electrically energized heating coil positioned within said chamber and adapted, in response to connection thereof to said source of electrical energy, for supplying heat to said thermally responsive means, a cylinder defined in said housing and having an open upper end positioned within said chamber and a closed lower end, piston means positioned within said cylinder for reciprocal movement therein, said piston means being adapted to impart rotary movement to said choke valve, a source of subatmospheric pressure, port means communicating said cylinder intermediate the ends thereof with said source of subatmospheric pressure for downward actuation of said piston upon starting of said engine, a skirt on said piston means for closing said port and rendering said subatmospheric pressure ineffective upon movement of said piston to a predetermined intermediate position within said cylinder, vent means in said housing above said cylinder for maintaining atmospheric pressure within said chamber and a foraminous body positioned in said vent for preventing contamination of said chamber by dust.

8. An automatic choke actuating system for the carburetor of an internal combustion engine, said automatic choke system comprising a thermostat housing, a housing cover attached to said housing in sealing relation therewith and defining therewith a thermostat chamber, a cylinder defined in said housing and having an open upper end opening into the chamber and a closed lower end, a piston positioned within said cylinder and adapted for reciprocation therein, said piston adapted to impart rotary movement to the choke of said carburetor, a port formed in the wall of said cylinder intermediate the ends thereof and communicating said cylinder with a source of vacuum for actuation of said piston in a downward direction upon starting of said engine, a skirt on the lower portion of said piston for closing said port to render said vacuum ineffective and retain said piston at a predetermined position within said cylinder, means for preventing a vacuum from forming within said chamber as said piston moves downwardly, foraminous means for preventing contamination of said thermostat chamber by dust, thermally responsive means positioned within said chamber and adapted, in response to predetermined temperature changes within said chamber, to impart rotary movement to said choke valve, an insulating and heat absorbing body member positioned within said chamber in spaced relation with said thermally responsive means, means positioned about said body member and adapted to heat both said body and said thermally responsive means in response to operation of said engine, said body adapted to conduct heat to said thermally responsive means after said engine has ceased to operate to prevent rapid cooling of said thermally responsive means.

9. An automatic choke actuating system for the carburetor of an internal combustion engine having a source of electrical energy, said automatic choke system comprising a thermostat housing, a housing cover attached to said housing in sealing relation therewith and defining therewith a thermostat chamber, a cylinder defined in said housing and having an open upper end opening into the chamber and a closed lower end, a piston positioned within said cylinder for reciprocation therein, means connecting said piston and said choke shaft and adapting said piston to impart rotary movement to the choke of said carburetor, a port formed in the wall of said cylinder intermediate the ends thereof and communicating said cylinder with a source of vacuum for actuation of said piston in a downward direction upon starting of said engine, a skirt on the lower portion of said piston for closing said port to render said vacuum ineffective and retain said piston at a predetermined position within said cylinder, a vent in said housing above said piston for preventing a vacuum from forming within said chamber as said piston moves downwardly, foraminous means positioned within said vent and preventing contamination of said thermostat chamber by dust, thermally responsive means positioned within said chamber and adapted, in response to heat conditions within said chamber, to impart rotary movement to said choke valve, an insulating and heat absorbing body member positioned within said chamber in spaced relation with said thermally responsive means, an electrically energized heating coil positioned about said body member and adapted to heat said body and said thermally responsive means in response to the flow of electrical energy from said source through said coil, said body adapted to conduct heat to said thermally responsive means after flow of electrical energy has ceased to prevent rapid cooling of said thermally responsive means.

10. A fuel system for a vehicle having an internal combustion engine a source of electrical energy and a source of fuel, a carburetor on said engine, a fuel conduit between said source and said carburetor, a fuel pump in said conduit for delivering fuel from said source to said carburetor under pressure, said carburetor having a body formed with a mixture conduit, a choke shaft jour-

naled in said carburetor body across said mixture conduit, a choke valve mounted on said choke shaft and positioned within said mixture conduit, said choke valve being movable from a position closing to a position opening said mixture conduit, an automatic choke actuating system on said carburetor comprising a thermostat housing, a housing cover on said housing in sealing engagement therewith and defining therewith a thermostat chamber, thermally responsive means positioned in said chamber and adapted in response to temperature changes within said chamber, to move said choke to its open or closed position, an insulating and heat absorbing body member positioned within said chamber in spaced relation with said thermally responsive means, said insulating and heat absorbing body adapted to absorb heat while said engine is operating and to conduct heat to said thermally responsive means after said engine has ceased to operate to prevent rapid cooling of said thermally responsive means, an electrically energized heating coil positioned about said body member and adapted in response to connection thereof to said source of electrical energy for supplying heat to said thermally responsive means, cylinder means defined in said housing and having an open upper end positioned within said chamber and a closed lower end, piston means located within said cylinder for reciprocal movement therein, said piston means being connected to said choke adapted to impart rotary movement to said choke valve, a source of subatmospheric pressure, means communicating said cylinder intermediate the ends thereof with said source of subatmospheric pressure for downward actuation of said piston upon starting of said engine, a skirt on said piston means rendering said subatmospheric pressure ineffective after said piston is moved to a predetermined intermediate position within said cylinder, means in said housing above said cylinder for maintaining atmospheric pressure within said chamber and for preventing contamination of said chamber by dust.

11. An automatic choke for a carburetor comprising a housing, a removable housing cover in sealing engagement with said housing and defining therewith a thermostat chamber, a choke operating shaft journaled in a bearing aperture in said housing and extending into said thermostat chamber, an arm fixed to said choke operating shaft within said chamber, a coiled thermally responsive member located within said thermostat chamber and having one end thereof attached to said cover and the other end thereof attached to said bell crank arm, a heat storing insulator member positioned within said chamber and adjacent said thermostat, electrically energized means mounted around the periphery of said insulator member, electrical circuit means connected to said electrically energized means and adapted to energize the same when the ignition circuit to said engine is complete, said housing having a cylindrical bore therein, one end of said cylindrical bore opening into said thermostat chamber, a piston in said cylindrical bore and adapted for reciprocating movement therein, said piston being connected with said arm, a source of subatmospheric pressure, said housing having a passage therein connected to said source of subatmospheric pressure and communicating with said cylindrical bore below said piston, said piston adapted for movement under influence of said subatmospheric pressure to a predetermined intermediate position within said cylindrical bore upon starting of said engine, said piston upon reaching its predetermined intermediate position, closing said vacuum passage.

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