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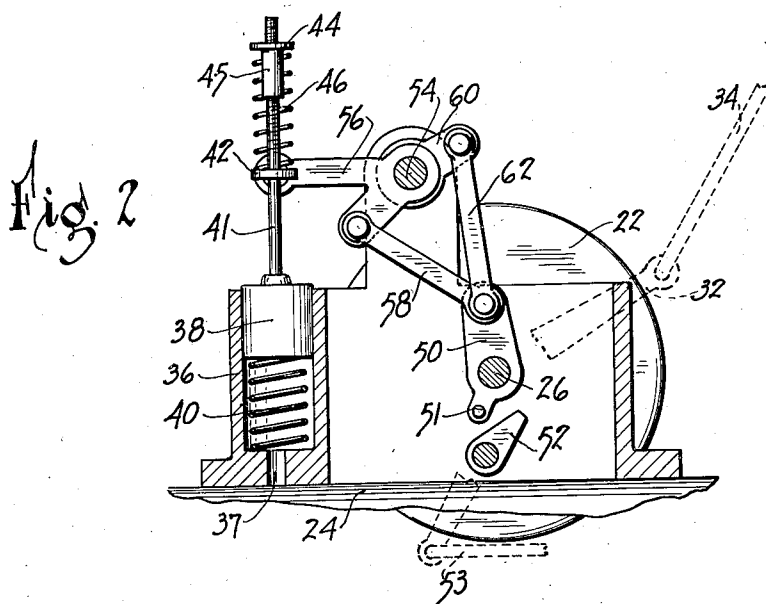
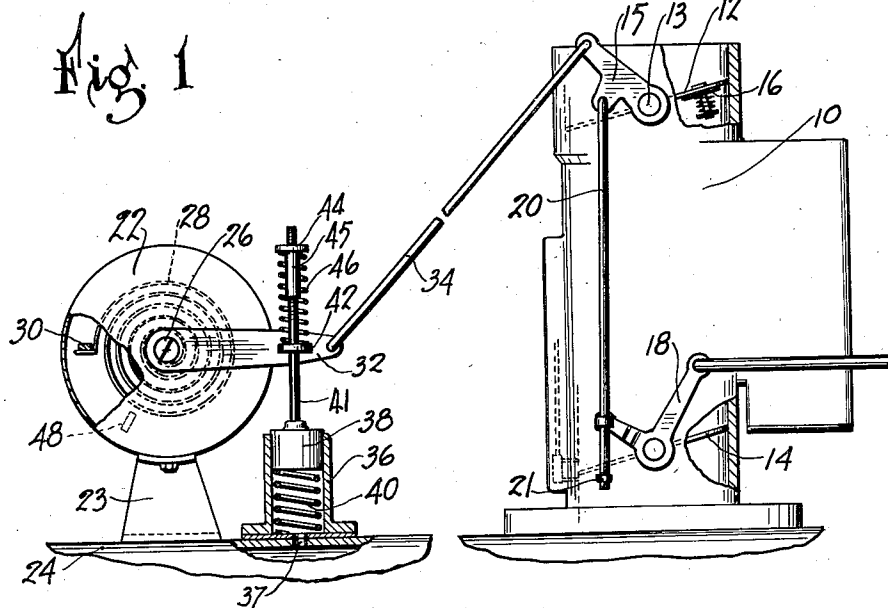
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2,030,331

CARBURETOR

Filed Jan. 25, 1933

3 Sheets-Sheet 1



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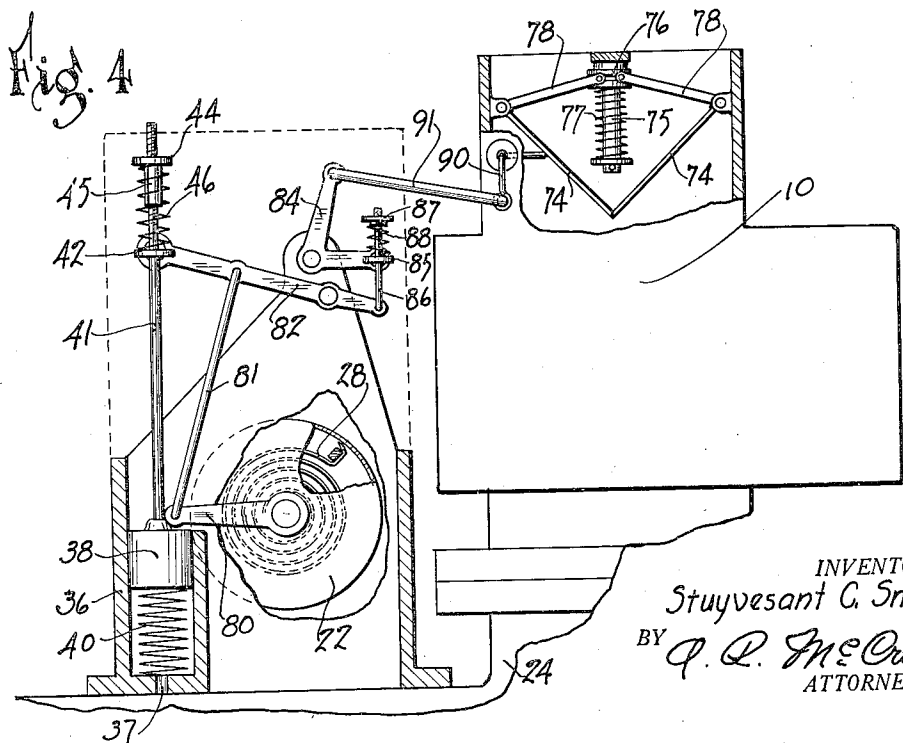
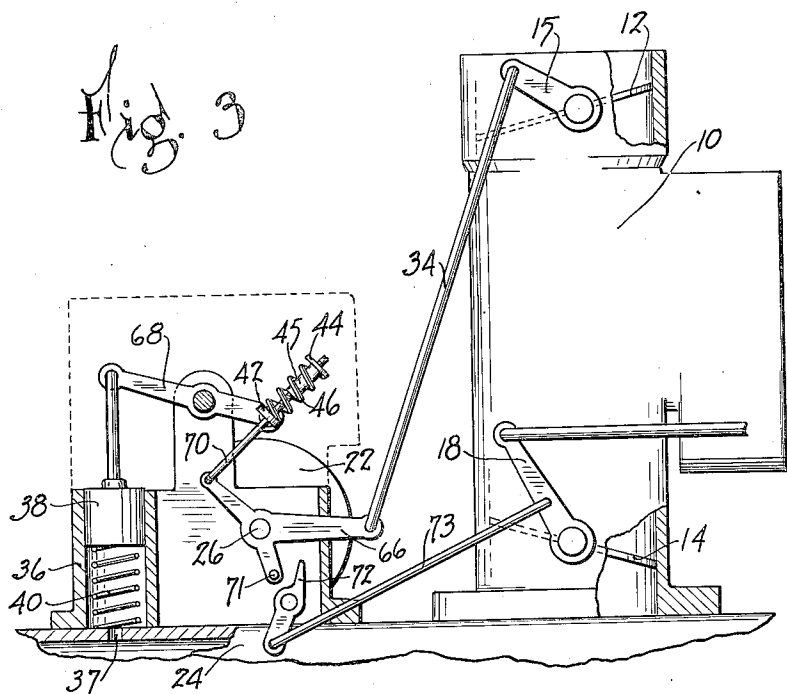
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CARBURETOR

Filed Jan. 25, 1933

3 Sheets-Sheet 2



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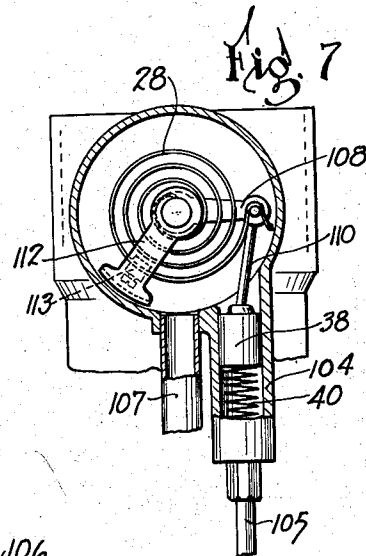
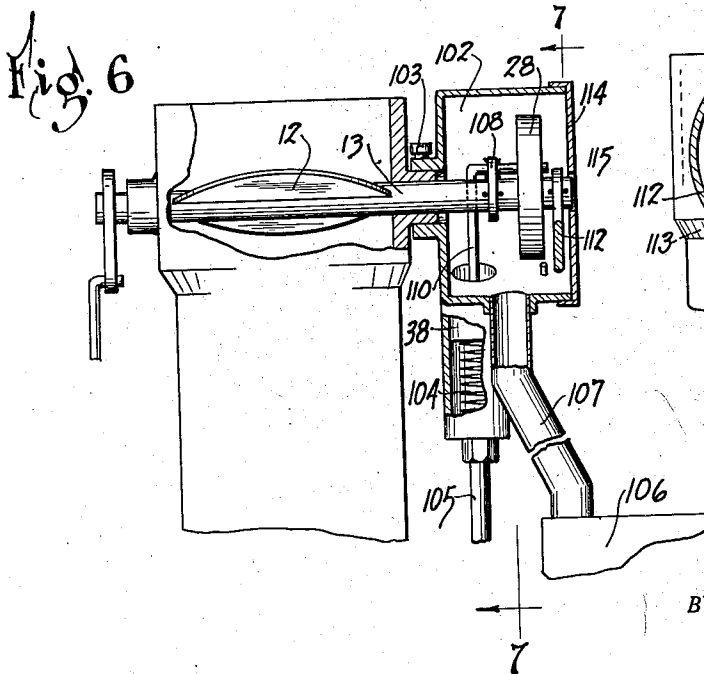
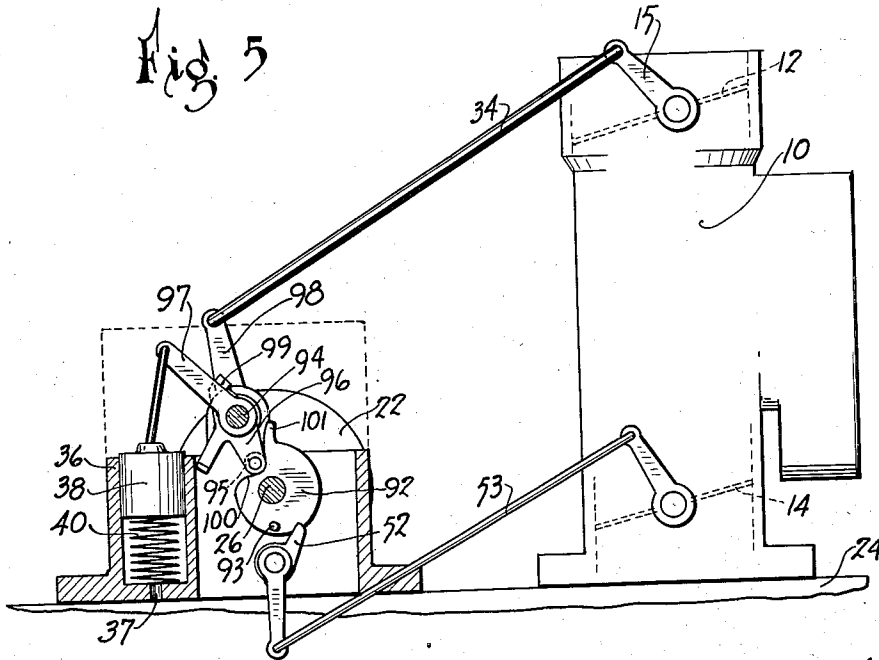
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CARBURETOR

Filed Jan. 25, 1933

3 Sheets-Sheet 3



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2,030,331

CARBURETOR

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Application January 25, 1933, Serial No. 653,500

9 Claims. (Cl. 123—119)

This invention relates to carburetors for internal combustion engines, more particularly it relates to control mechanism for the carburetor, and has for its principal object the provision of a mechanism actuated jointly by a thermostat and vacuum in the engine for controlling the richness of the fuel mixture as a function of temperature.

Internal combustion engines using a mixture of liquid fuel and air require a very rich mixture to start and require that the richness of the mixture be graded down as the engine warms up to prevent stalling when the engine is idling. In the prior art of which I am aware, the copending application of Hunt and Olson, Serial No. 575,025, filed November 14, 1932, being an example, there is provided a control of the choke valve of the carburetor by thermostatically actuated means to grade down the richness of the fuel mixture as a function of engine temperature.

The present invention, which is, broadly speaking, an improvement upon said copending application, provides a thermostat which is connected to the choke valve of the carburetor to control the richness of the mixture produced thereby, and provides a vacuum actuated piston coupled to the valve and thermostat by a spring which is tensioned to oppose the tension of the thermostat, this spring being adjustable so that the setting of the valve can be accurately controlled.

The invention will be best understood from the detailed description and claims which follow, reference being had to the accompanying drawings in which a preferred embodiment of the invention is shown by way of example and in which:

Figure 1 is a diagrammatic view, partly in section, showing the apparatus of the invention;

Figure 2 is a fragmentary view, partly in section, of a modification of the apparatus;

Figure 3 is a view similar to Figure 1 showing another modification;

Figure 4 shows the invention adapted to a particular carburetor;

Figure 5 is a view similar to Figure 1 showing another modification of the invention;

Figure 6 is a view of the control mechanism of the invention applied to a carburetor that is located at a point remote from the exhaust manifold; and

Figure 7 is a cross sectional view taken along the line 7—7 of Figure 6 looking in the direction of the arrows.

Referring now to the drawings in more detail, the apparatus shown in Figure 1 includes a car-

buretor 10 having a balanced choke valve 12 and a throttle 14. The carburetor is shown as a plain tube down draft carburetor, this type being illustrated by way of example only as the invention may be applied to other types of carburetors within the teachings of the invention. The shaft 13 of the choke valve carries a lever 15 fixed thereto and a lever 18 is fixed on the shaft of the throttle. These levers are connected by a rod 20 connected to lever 15 and coupled to lever 18 by a lost motion connection. As the throttle approaches its wide open position, lever 18 operates rod 20 to crack the choke valve so that a flooded condition of the engine can be corrected. The amount that the choke valve is opened is governed by an adjusting nut 21. The choke valve 12 is provided with a small poppet valve 16 of known construction to admit air for starting.

A thermostat casing 22 is mounted upon a suitable bracket 23 fixed upon the intake manifold of the engine adjacent to the carburetor, and a shaft 26 is journaled in the casing. A thermo-responsive element 28 is fixed to the shaft and wound therearound and is disposed so as to be heated by heat radiated from the exhaust manifold of the engine. The free end of the element bears against a stud 30 projecting from the casing. An arm 32 is fixed upon the shaft and its free end is connected to the choke lever 15 by a rod 34. When the engine is cold thermostat 28 is tensioned to rotate lever 32 and close the choke valve and to maintain it closed during starting.

A cylinder 36 is mounted upon the intake manifold 24 and communicates therewith through a suitable port 37. A piston 38 is fitted in the cylinder and urged upwardly therein by a spring 40. A rod 41 is fixed to the piston and extends through an ear 42 on lever 32 and therebeyond, the end of the rod being threaded to receive an adjusting nut 44. A sleeve 45 formed on nut 44 surrounds the rod, and a spring 46 surrounds the sleeve and bears against ear 42 and nut 44.

When it is desired to start the engine the throttle is set to starting position, that is, about one fourth open, and the choke valve is closed by the automatic mechanism just described. The engine is cranked and as soon as it begins firing piston 38 is drawn downwardly against the tension of spring 40. Sleeve 45 engages ear 42 and moves lever 32 to crack the choke valve so that the engine will not stall. Spring 46 is tensioned in opposition to the tension of the thermostat. As the engine warms up, the thermostat tension decreases and spring 46 moves lever 32 to open

the choke valve more and thereby reduce the richness of the fuel mixture. As the choke valve opens the tension of spring 46 decreases as lever 32 moves away from nut 44. When the normal operating temperature of the engine is reached, thermostat 28 will have zero tension and the choke valve will be fully opened. As the thermostat is heated further, as it will be by heat radiated from the exhaust manifold of the engine, the end of the element moves away from bracket 30 and engages a second bracket 48. The thermostat is then tensioned in the opposite direction to aid spring 46 in holding the choke valve open. The particular type of thermostat shown is not new, being shown and more fully described in the copending application of S. F. Hunt, Serial No. 647,641, filed December 16, 1932. When the engine is stopped, spring 40 raises the piston and the tension of spring 46 is reduced. As the engine cools down, the thermostat is retensioned and lever 32 operated thereby to close the choke valve.

The modification shown in Figure 2 is adapted for use with a carburetor having an unbalanced choke valve. In this modification the thermostat, which is housed in a casing 22, is provided with a shaft 26 upon which arm 32 is fixed as before. Rod 34 connects the arm to the choke valve. A lever 50 is fixed upon shaft 26 and carries a pin 51. A second lever 52 is pivotally mounted upon the frame work of the mechanism and connected to the throttle by suitable means 53. When the throttle is moved to wide open position, lever 52 engages pin 51 and arm 32 is moved to open the choke valve so that a flooded condition of the engine may be corrected. A shaft 54 is journaled in the mechanism frame-work above and parallel to shaft 26. A lever 56 floats on this shaft and carries an ear 42 through which rod 41 extends. Cylinder 36 is mounted upon the intake manifold and communicates therewith through a port as before. The cylinder carries a piston 38 which is urged upwardly by spring 40 and to which rod 41 is connected. A sleeve 45 surrounds the rod and a spring 46 surrounds the sleeve and bears against a nut 44 and the ear 42 as before. Lever 56 is connected to lever 50 by a link 58 to apply the tension of spring 46 to the thermostat, as will presently appear. A second lever 60 floats upon shaft 54 and is connected to lever 50 by a link 62. When the choke valve is closed the pivotal connection between link 62 and lever 50 is aligned with the median line of the link and the axis of shaft 26, to form a toggle lock for holding the valve closed. When the valve is fully opened the pivotal connection of link 62 to lever 60 aligns with the median line of the link and the axis of shaft 54 to form a toggle lock for holding the valve open.

In the operation of the device, the thermostat when cold is tensioned with more tension than is required for the proper operation of the carburetor, that tension decreasing as the engine warms up. The engine is cranked with the choke valve closed and as soon as the engine fires, piston 38 is drawn down against the tension of spring 40. Spring 46 is tensioned to move lever 56 counterclockwise on shaft 54 and through link 58 to break the toggle holding the valve closed. The tension of spring 46 subtracts from the tension of the thermostat and the choke valve is opened by the pressure difference upon its posterior and anterior faces under the control of the thermostat. The degree of opening of the valve at any particular temperature can be regulated by adjust-

ing nut 44 to add to or subtract from the tension of spring 46. When the choke valve is wide open it is locked by the toggle lock. When the engine stops and cools down tension is built up in the thermostat and the toggle is broken and the valve closed.

In the modification shown in Figure 3 thermostat shaft 26 carries a multiarm lever 66 and choke valve control rod 34 is connected to the free end of one of the arms. A pivoted lever 68 is connected to piston 38 and provided with an ear 42 through which a rod 70 extends. The rod 70 is connected to one of the arms of lever 66. A sleeve surrounds the rod, and a spring 46 surrounds the sleeve and bears against the ear and a nut 44 as before. A third arm of lever 66 carries a pin 71 against which a lever 72 is adapted to bear. Lever 72 is connected by rod 73 to the throttle lever and the lever 72 thus moves the pin and lever 66 to crack the choke valve when the throttle is wide open.

In the operation of the device, the thermostat is tensioned to hold the choke valve closed when the engine is cold. When the engine fires, piston 38 is drawn into the cylinder and spring 46 tensioned to oppose the tension of the thermostat to permit the choke valve 12 to open under the pressure difference on its faces. The tension of spring 46 is adjusted by nut 44 as before.

In Figure 4 I have shown the invention adapted to a carburetor having a choke valve which comprises two leaves 74 which are hinged to the side-walls of the structure. A stud 75 is fixed in the carburetor midway between the leaves of the valve. A collar 76 is mounted on the stud for sliding, and is urged upwardly thereon by a spring 77. Collar 76 is grooved to receive the ends of arms 78 which are fixed on the leaves adjacent to the hinges. Air pressure on the upper face of the leaves and vacuum on the lower faces causes the leaves to swing on their hinges and the collar to move downwardly against the tension of spring 77. In the control mechanism, thermostat arm 80 is fixed on the thermostat shaft and connected by a rod 81 to a pivoted lever 82 which carries an ear 42. Piston 38 is urged upwardly in cylinder 36 by spring 40 and carries rod 41 which extends through the ear and is threaded to receive nut 44 by which spring 46 and sleeve 45 are held on the rod. A bell crank lever 84 is pivoted adjacent to lever 82 and carries an ear 85 through which rod 86 slidably projects. One end of this rod is pivotally connected to lever 82 and the other end is threaded to receive a nut 87. A spring 88 surrounds the rod and bears against ear 85 and nut 87. A crank arm 90 is journaled in the carburetor casing and connected to lever 84 by a rod 91. The free end of arm 90 bears against one of the leaves of the choke valve.

When the engine is cold and not running, thermostat 28, which is of the type shown in copending application of S. F. Hunt, Serial No. 647,641, above referred to, is tensioned to raise arm 80 and thereby rotate lever 82 clockwise on its pivot. Spring 88 is tensioned to rotate arm 84 and with it arm 90 to close the choke valve. The thermostat is tensioned sufficiently to keep the valve closed during starting of the engine. When the engine fires, piston 38 is drawn downwardly in the cylinder against the tension of spring 40 and spring 46 is tensioned to oppose the thermostat and sleeve 45 engages and moves lever 82 counterclockwise. The tension of spring 88 is relieved and the choke valve opened slightly. Since the tension of spring 46 opposes the thermostat ten-

sion the effective force holding the valve closed is insufficient to resist the air pressure on it. The thermostat is arranged to decrease its tension as the engine warms up and the valve opens wider, being fully opened when the engine reaches normal operating temperature. As the valve opens, tension is built up in spring 75. When the engine is stopped spring 40 raises piston 38 to decrease the tension in spring 46 and as the engine cools tension is built up in the thermostat and functions to rotate arm 90 to close the valve with the aid of spring 75. Adjustments of the choke setting are made by adjusting nuts 44 and 87.

In the embodiment of the invention shown in Figure 5, the shaft of thermostat 28 carries a cam 92 upon which is mounted a pin 93. A lever 52 is pivotally mounted adjacent to the cam and connected to the throttle of the carburetor by suitable means 53. When the throttle is moved to wide open position, lever 52 engages and moves cam 92 to partially open the choke valve. A shaft 94 is journaled in the casing of the mechanism and carries a lever 96 which is fixed thereto and carries a roller 95 that engages the cam. A second lever 98 is fixed upon shaft 94 and connected by rod 34 to the choke valve 12. A lever 97 floats upon shaft 94 and is connected to piston 38. Spring 40 urges piston 38 upwardly to move lever 97 counterclockwise on shaft 94. Lever 96 carries an ear 99 which overhangs lever 97 so that the tension of spring 40 is applied to lever 98 to hold the choke valve closed.

When the engine is cold, shaft 26 is urged counterclockwise by the tension in the thermostat. A shoulder 101 on the cam strikes roller 95 to apply the thermostat tension to lever 98 to aid in keeping the choke valve closed while the engine is being cranked. Immediately the engine fires piston 38 is drawn downwardly against spring 40 and lever 97 is moved away from ear 99 so that the tension of spring 40 is removed from the valve and it is partially opened against the tension of the thermostat by the difference of air pressure on its faces. As the thermostat is heated cam 92 is rotated clockwise. Roller 95 rides over cam surface 100 to move lever 96 counterclockwise and thereby open the choke valve. When the engine reaches normal operating temperature, roller 95 engages a concentric portion of the cam to lock the choke valve open, and further rotation of the cam is without effect. Movement of lever 96 reengages ear 99 with lever 97 to lock the piston in its operated position so that it will not be vibrated by variations in pressure in the intake manifold during operation. This feature is more fully explained in the copending application of S. F. Hunt, Serial No. 653,518, filed January 25, 1933. When the engine is shut down, spring 40 raises piston 38 and closes the choke valve as soon as the tension in thermostat 28 rotates cam 92 back so that roller 95 engages surface 100.

In many V-type engines the intake manifolds and carburetor are located on top of the engine and the exhaust manifolds are outside and under the cylinders. In an arrangement of this kind the thermostat of the control mechanism cannot be located sufficiently close to the exhaust manifold to permit it to be operated by heat radiated therefrom. In Figures 6 and 7 I have shown a modification of the invention adapting it to an engine of this type. In this arrangement a casing 102 is mounted upon the boss 103 on the air horn of the carburetor in which choke valve shaft 13 is journaled. A cylinder 104 projects from the

bottom of this casing and is connected by a pipe 105 to the intake manifold of the engine. A stove 106 is placed over the exhaust manifold of the engine and connected to the casing by a pipe 107 so that hot air will be conducted to the casing.

Shaft 13 projects through the casing, and thermostat element 28 is fixed to and wound around the shaft. A piston 38 fits in the cylinder and carries a rod 110 having a bent end over which the free end of the thermostat is hooked. A lever 108 floats on shaft 13 and the bent end of rod 110 extends through and is guided by the lever. A spring 40 fits in cylinder 104 and urges piston 38 upwardly to tension the thermostat so as to hold the choke valve closed when the engine is cold. A valve 112 floats upon shaft 13 and is connected to thermostat element 28 by a suitable clamp 113.

When the engine is not running and is cold, piston 38 is at the top of the cylinder and the thermostat is tensioned to hold the choke valve closed. Immediately the engine fires, piston 38 is drawn into the cylinder against the tension of spring 40 and the effective tension holding the valve closed is reduced to permit the valve to partially open. As the engine warms up, heat from the exhaust manifold heats stove 106 and hot air passes through pipe 107 into casing 102 to heat the thermostat. The casing is closed by a cover 114 which has a central opening into which the end of shaft 13 projects and through which air escapes from the casing. Thermostat 28 loses tension as it is heated and with this loss of tension, valve 12 is permitted to open more nearly wide open. Preferably the thermostat will be adjusted so that the valve will be wide open when the engine reaches its normal operating temperature. Further heating of the thermostat raises the hooked end of the element off of rod 110 and the element can move without damage to itself or to the casing. This movement of the element carries valve 112 across the opening of pipe 107 into the casing to block off the heat therefrom. When the engine is stopped spring 40 raises piston 38. As the thermostat cools, its hooked end is reengaged with rod 110 and the element is tensioned to close the valve. Valve 112 is moved to unblock pipe 107 and the apparatus is in readiness for another operation.

In Figures 1 to 5 inclusive I have shown the control mechanism as a separate unit mounted adjacent to the carburetor to simplify the figures, but it should be understood that the control mechanism may be included as an integral part of the carburetor within the teachings of the invention. Throughout the figures parts which are not materially different in construction and function bear the same reference numerals.

Subject matter disclosed but not claimed herein is being claimed in my copending application Serial No. 41,439, filed September 20, 1935.

While I have illustrated and described a preferred embodiment of the invention, I have done so by way of example only as there are many modifications and adaptations that can be made by one skilled in the art within the teachings of the invention.

What is claimed is:

1. A control mechanism for an internal combustion engine carburetor having a choke valve fixed on a shaft that is journaled in and projects from the carburetor, comprising a casing fixed upon the carburetor, a cylinder projecting from the casing, a piston in the cylinder, a rod on the

piston, a thermostat connected between the shaft and rod and tensioned to rotate the shaft to close the valve when the engine is cold, said cylinder being connected to the engine and the piston actuated thereby to move the rod and reduce the tension of the thermostat when the engine fires, a stove on a heated portion of the engine, a duct connecting the stove to the casing to conduct heat thereto, and a valve floating on said shaft and connected to the thermostat and moved thereby to block said duct and regulate the amount of heat admitted to the casing.

2. In a carburetor having a choke valve and a throttle, a shaft for the choke valve, a thermostatic spring operatively connected to the shaft to rotate the same, a casing enclosing the thermostatic spring, means for conveying heat to said casing, a cylinder having one end communicating with said casing and its other end connected to a source of variable pressure, and a piston in said cylinder applied to the thermostatic spring to vary the tension thereof.

3. In a carburetor, a throttle, an unbalanced choke valve mounted on a shaft, a bimetallic spring connected to said shaft to rotate the same, a casing enclosing said spring, a conduit for conveying heated gases to the casing, and a pressure-responsive member having one surface subject to the pressure in the casing and another surface subject to the suction posterior to the throttle, said pressure-responsive member being so related to the spring that movement of the pressure-responsive member varies the tension of the spring.

4. The invention defined in claim 3, wherein a spring associated with the pressure responsive member opposes the force of said suction.

5. In a carburetor, a throttle, a pressure-responsive choke valve mounted on a shaft, a thermostatic spring of spiral form connected to said shaft to rotate the same, a casing enclosing the thermostatic spring, a conduit for conveying heated air to the casing, a cylinder communicating with the casing, and a piston therein having one face subject to the pressure in the casing and its opposite face subjected to pressures posterior to the throttle, said piston being so related to the spring that movement of the piston will vary the tension of the spring.

6. In a carburetor for an internal combustion engine, a throttle, a pressure-responsive choke valve mounted on a shaft, a thermostatic spring connected to said shaft to yieldingly urge the choke valve toward closed position at low temperatures, a casing fixed to the outer wall of the carburetor and enclosing the thermostatic spring, a conduit for conveying heated gases from a heated portion of the engine to the casing, a conduit leading from the casing to a point posterior to the throttle, and means for varying the force

exerted by the thermostatic spring on the choke valve comprising a pressure-responsive member in said last mentioned conduit subject to the varying pressures therein, and applied to the thermostatic spring by an overrunning connection.

7. In a carburetor for an internal combustion engine, a throttle, a pressure-responsive choke valve mounted on a shaft, a spiral bimetallic spring connected to said shaft to yieldingly urge the choke valve toward closed position at low temperatures, a casing fixed to the outer wall of the carburetor and enclosing the thermostatic spring, a conduit for conveying heat from a heated portion of the engine to the casing, a second conduit leading from the casing to a source of valve suction, and means for varying the force exerted by the thermostatic spring on the choke valve comprising a piston in said second conduit applied to the outer end of the thermostatic spring by an overrunning connection.

8. In a carburetor for an internal combustion engine, an air inlet passage, an induction passage, a throttle valve controlling the induction passage, an unbalanced choke valve controlling the air inlet passage, temperature responsive means controlling the choke valve and adapted to move the choke valve in the closing direction at low temperatures, a casing carried by the walls of the air inlet passage and enclosing said temperature responsive means, means including a conduit to convey heated gases from a heated portion of the engine to the interior of the casing, means including a conduit interconnecting the casing and the induction passage posterior to the throttle valve, and means including a pressure responsive member in said last mentioned conduit subject to varying pressures therein for varying the force exerted by the temperature responsive means on the choke valve.

9. In a carburetor for an internal combustion engine, an induction passage, an air inlet passage communicating with the induction passage, a throttle valve-controlling the induction passage, an unbalanced pressure responsive choke valve controlling the air inlet passage, a casing fixed to the outer walls of the air inlet passage, a choke shaft journaled in the walls of the air inlet passage and projecting into said casing, temperature responsive means in the casing and operably connected to the choke shaft to modify the position of the choke valve in accordance with the temperature of the engine, means including a conduit to convey heated gases from the engine to the casing, means including a conduit interconnecting the casing and the induction passage beyond the throttle valve and a pressure responsive member in the conduit to vary the force exerted on the choke valve by the temperature responsive means.

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