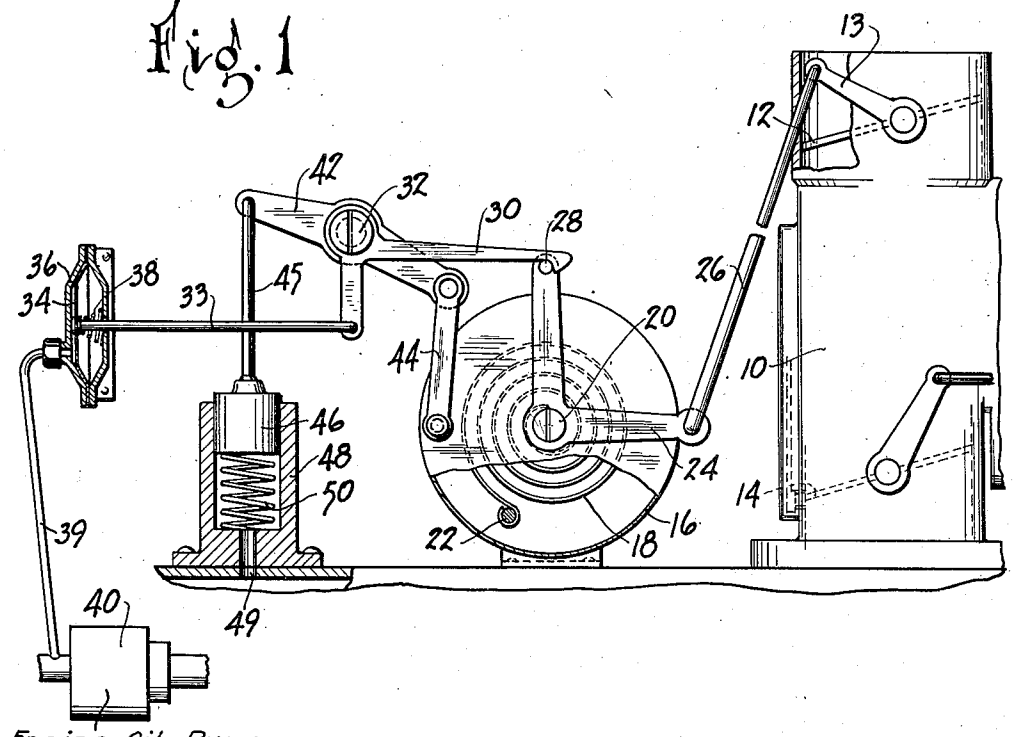
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CARBURETOR

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Fig. 1



Engine Oil Pump

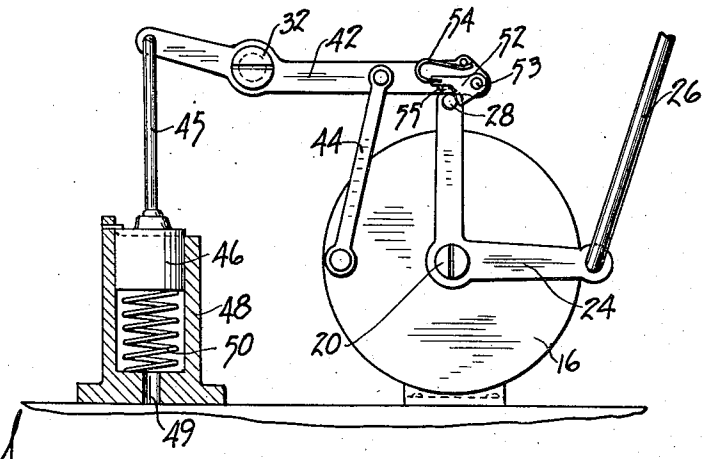


Fig. 2

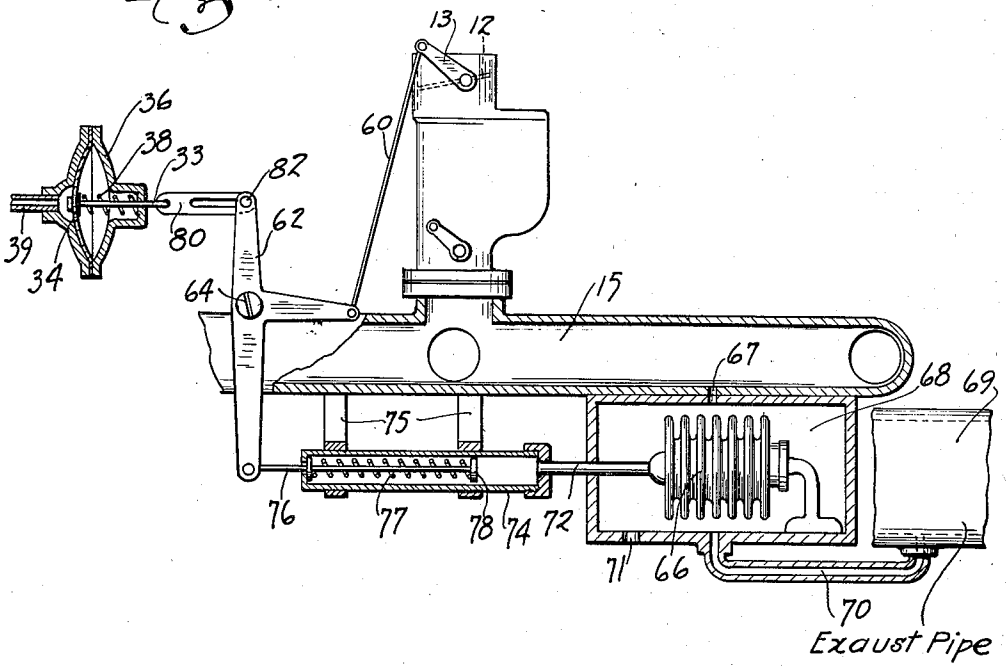
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CARBURETOR

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Fig. 3



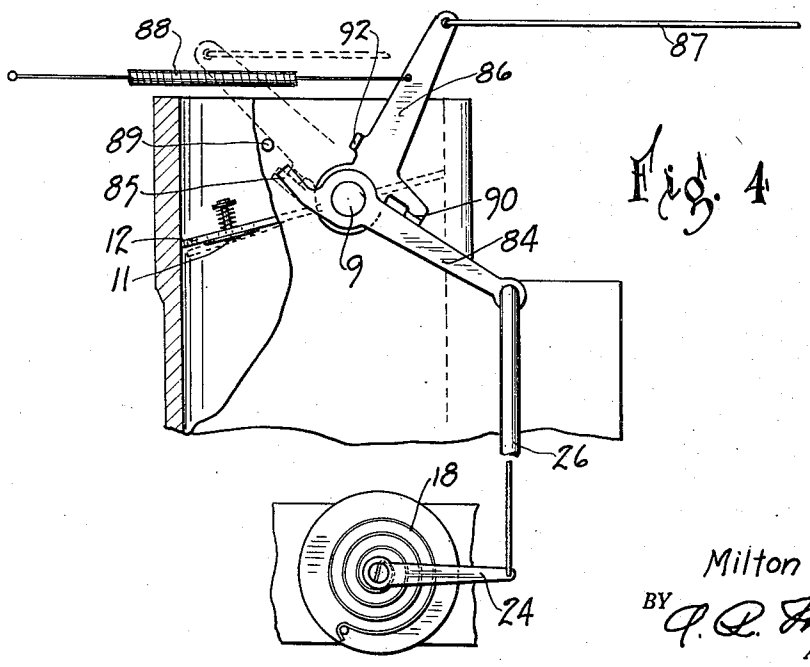


Fig. 4

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Patented Nov. 26, 1940 2,222,865

UNITED STATES PATENT OFFICE

2,222,865

CARBURETOR

Milton E. Chandler, South Bend, Ind., assignor to Bendix Aviation Corporation, South Bend, Ind., a corporation of Delaware

Application January 20, 1933, Serial No. 652,722

2 Claims. (Cl. 123—119)

This invention relates to carburetors for internal combustion engines, more particularly to means for automatically controlling the richness of the mixture produced by the carburetor as a function of temperature, and has for its principal object the provision of a vacuum actuated piston for adjusting the tension of the thermostat when the engine begins to fire.

Internal combustion engines using a mixture of liquid fuel and air require a rich mixture to start, and the mixture must be graded down in richness immediately the engine begins firing to prevent stalling. Such engines also require a richer mixture when cold than when operating at normal temperature. In the prior art, of which the copending application of Hunt and Olson, Serial No. 575,025, filed November 14, 1931, and now abandoned is an example, these requirements of an engine are met by apparatus for automatically controlling the richness of the mixture as a function of temperature.

The present invention provides a thermostat arranged to lock the choke valve closed under considerable tension for starting, and provides a piston, actuated by vacuum in the engine when it begins firing, for relieving the tension of the thermostat to permit the choke valve to open and grade down the richness of the mixture. I may also provide a lock, for holding the choke valve closed, actuated by oil pressure in the engine to release the valve and permit grading down the richness of the mixture under the control of the thermostat. This arrangement prevents operating the engine with a faulty oil system.

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 elevational view of the invention;

Figure 2 is a fragmentary view of a modification of the invention;

Figure 3 is a diagrammatic view of another modification of the invention;

Figure 4 is a fragmentary view showing still another modification of the invention.

Referring now to Figure 1 in more detail, I have shown a plain tube down draft carburetor 10 to which the control mechanism of the invention is applied. This particular type of carburetor is shown by way of example, as the invention may equally well be applied to other known types of carburetors. The carburetor is provided with a choke valve 12 which is unbalanced to cause pressure differences on its faces to unbalance it and admit air to the mixing chamber. A throttle 14 controls the passage of fuel mixture from the carburetor to the engine.

The control mechanism of the invention comprises a casing 16, mounted on or adjacent to the carburetor and in juxtaposition to a source of heat, such as the exhaust manifold of the engine. A temperature responsive element 18 is fixed to and wound around a shaft 20 which is journalled for rotation in the casing. The free end of the element is fixed to the casing at 22. Shaft 20 carries an arm or lever 24 fixed thereto, and a rod 26 is pivotally connected to one end of this arm and to the lever 13 by which the choke valve is actuated. The other end of lever 24 carries a locking pin 28 which is engaged by the hooked end of a lever 30. Lever 30 is pivoted upon a suitable screw or pin 32 mounted adjacent to the casing, and is connected by a rod 33 to a diaphragm 34. The diaphragm is mounted in a pressure tight casing 36 and is pressed towards one side of that casing by a spring 38. With the diaphragm in this position lever 30 is positioned to engage the locking pin on arm 24. Casing 36 communicates with a source of pressure in the engine, such as the oil pump 40, through pipe 39, for a purpose which will presently appear.

A second lever 42 floats upon pivot 32 and is connected at one end to casing 16 by link 44. The other end of the lever is connected by rod 45 to a piston 46 that fits in cylinder 48 and is urged upwardly therein by a spring 50. Cylinder 48 is mounted upon the intake manifold of the engine and communicates therewith through port 49. Casing 16 is mounted so that it may be rotated, and when the engine is not running and there is no vacuum acting on piston 46, spring 50, acting through the linkage that connects it to the casing, rotates the casing in the counterclockwise direction to tension the thermostat.

When it is desired to start the engine, throttle 14 is opened approximately one fourth open, and the engine is cranked. A very rich mixture is drawn into the engine by the suction developed by cranking since the choke valve is closed and locked closed. As soon as the engine begins to fire vacuum is built up in the intake manifold and piston 46 is drawn down in the cylinder against the tension of spring 50 to rotate the casing in the clockwise direction and relieve the tension on the thermostat. As soon as the oil pump 40 begins to build up pressure, diaphragm 34 is moved against the tension of spring 38 to disengage lever 30 from pin 28 and the choke valve is unlocked and free to open under the control of the thermostat which prevents the valve from opening fully until the engine reaches normal operating temperature. Preferably the thermostat element is of the type

fully disclosed in the copending application of S. F. Hunt, Serial No. 647,641, filed December 16, 1932, and is arranged to decrease its tension as it is heated. When the engine is stopped the springs restore the various levers to their normal positions and the choke valve is closed as soon as the thermostat cools down sufficiently to have tension to close it. Movement of the casing 16 by spring 50 causes the thermostat tension to increase to hasten the closing of the choke valve.

In the modification shown in Figure 2 the thermostat casing 16 is mounted as before and connected to lever 42 by link 44. Lever 42 is connected to piston 46 which is moved by spring 50 to rotate the lever on pivot 32 and move casing 16 to tension the thermostat. Shaft 20 carries arm 24 which is connected to the choke valve by rod 26 and which carries pin 28 as in the embodiment shown in Figure 1. Lever 42 also carries a latch 52 which is mounted on a pivot 53 and rotated thereon by a spring 54 against a stop 55. When in this position the latch engages pin 28 to lock the choke in closed position. From the foregoing it is apparent that when the engine begins to fire and piston 46 is drawn into the cylinder, lever 42 is rotated to unlock the choke valve and to rotate the casing to relieve the tension of the thermostat, and the valve opens under the control of the thermostat.

In the modification shown in Figure 3, choke valve 12 carries a lever 13 by which it is operated. A rod 60 is pivotally connected to arm 13 and to lever 62 which pivots on a suitable shaft or screw 64 mounted adjacent to the carburetor. A sylphon or bellows thermostat 66 is fixed in a chamber 68 which communicates with the intake manifold 15 through a small port 67. The chamber also communicates with exhaust manifold 69 through a suitable pipe 70, and a small port 71 opens from the chamber to atmosphere. The free end of the thermostat carries a rod 72 which is connected to a spring casing 74. The spring casing is mounted in suitable brackets 75 which may project from the intake manifold, and is arranged to move through the brackets longitudinally. A rod 76 is pivoted to lever 62 and projects into the spring casing where it terminates in a head 78. A spring 77 bears against this head and the end of the casing through which the rod projects, and is tensioned to push the rod into the casing, which movement rotates the lever to close the choke valve. A slotted link 80 registers with the other end of lever 62 and the lever carries a pin 82 which projects through the slot in the lever. The lever is connected to rod 33 that projects into the pressure tight casing 36 and connects to the diaphragm 34. A spring 38 pulls the rod and link to the left to aid spring 77 in holding the choke valve closed.

As soon as the engine begins firing, thermostat chamber 68 is subjected to a pressure difference and exhaust gases are drawn into it. The thermostat expands under the influence of the heat of the gases and moves rod 72 and spring casing 74 to the left to lessen the tension of spring 77 on the choke valve. As soon as the oil pump, to which casing 36 is connected by a pipe 39, builds up pressure, that pressure moves diaphragm 34 to the right and with it rod 33 and link 80. The tension of spring 38 is thus removed from the pin 82 and the choke valve opens under the influence of the difference in pressure on its faces. Since the thermostat casing is under a pressure difference and exhaust gases are drawn into it, the thermostat is quickly heated to permit the choke valve to partially open immediately the engine begins firing. As soon as the choke valve is fully opened further expansion of the thermostat moves spring casing with respect to rod 76, that is, moves the rod further into the casing. This lost motion prevents damage to the thermostat from heat in excess of that required to permit the choke valve to be fully opened. As soon as the engine is stopped the thermostat begins to cool down and to contract to re-tension spring 77 and close the choke valve. As soon as the oil pressure dies away spring 38 moves link 80 to reapply the tension of the spring to the pin 82.

In the modification shown in Figure 4 I have provided an auto-manual control for the choke valve. In this arrangement the choke valve 12 is provided with a small poppet valve 11 which is arranged to open and admit a small amount of air to the carburetor when the valve is closed. The shaft 9 of the choke valve carries a lever 84 which is fixed thereto, and rod 26 is pivotally connected to this lever and to the arm 24 of thermostat 18. Shaft 9 also carries a lever 86 which floats thereon and is connected by a suitable wire 87 to a manual choke control lever, not shown. Spring 88 is connected to the lever and tensioned to rotate it counterclockwise on shaft 9 against stop 89. Lever 86 carries ears 90 and 92. When the choke control lever is actuated to close the choke ear 90 engages lever 84 and rotates it and shaft 9 to positively close the choke valve. When the engine starts firing the choke control lever is restored manually, and spring 88 moves lever 86 into engagement with stop 89. Ear 92 engages the projection 85 on lever 84 and rotates that lever and shaft 9 to crack the choke by moving it into the position shown in the dotted lines in the figure, thus admitting more air to the engine. As the engine warms up, thermostat 18 exerts a decreasing force on valve 12 and that valve is opened by the pressure difference on its faces. Lever 84 is moved counterclockwise as the valve opens to bring arm 85 away from ear 92. When the engine is stopped and cools down, tension is built up in thermostat 18 and the choke valve closed thereby.

Certain features disclosed herein are disclosed and claimed in my copending application Serial No. 44,675, filed October 12, 1935.

I claim:

1. A control mechanism for an internal combustion engine carburetor having an unbalanced choke valve comprising, means for locking the valve closed to start the engine, oil pressure means for unlocking the valve when the engine fires, a thermostat tensioned to hold the valve closed, and means actuated by vacuum in the engine when firing for decreasing the tension of the thermostat to permit the valve to open under the control of the thermostat.

2. A control mechanism for an internal combustion engine carburetor having a choke valve comprising, a casing journalled for rotation, a shaft journalled in the casing for rotation with respect thereto, a thermostat element connected between the casing and shaft, means connecting the shaft to the valve, a spring for rotating the casing to tension the thermostat to hold the valve closed when the engine is not running, and vacuum actuated means for rotating the casing to decrease the tension of the thermostat when the engine fires.

MILTON E. CHANDLER.