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INTERNAL COMBUSTION ENGINE FUEL SYSTEM

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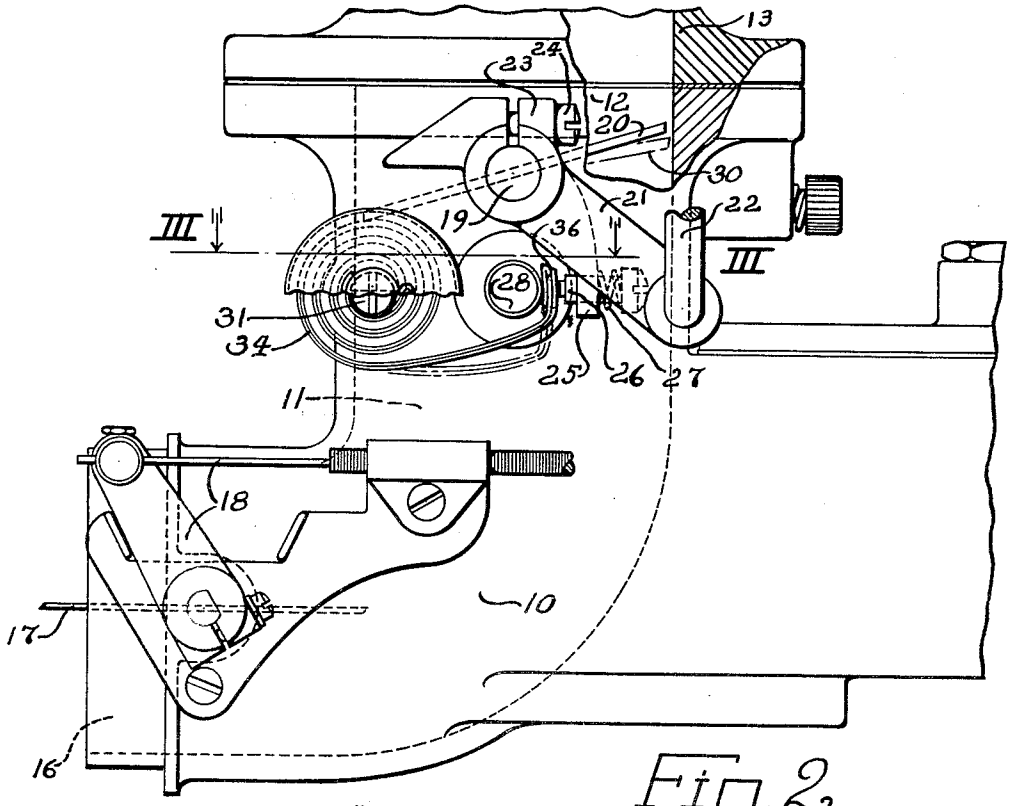


Fig. 2.

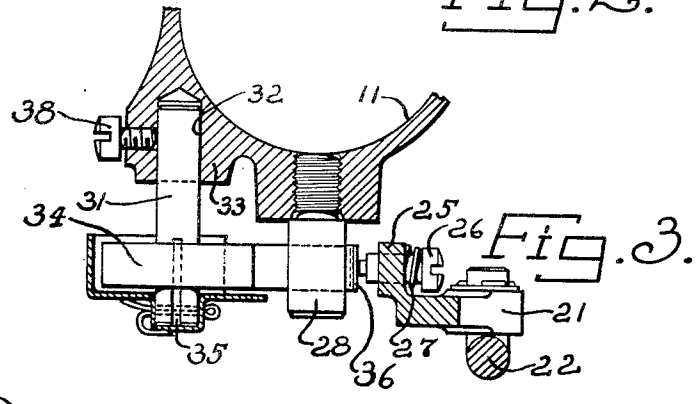


Fig. 3.

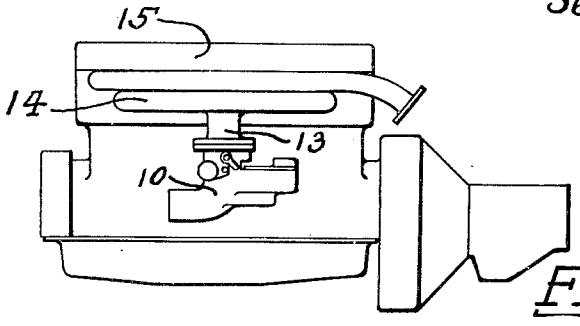


Fig. 1.

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INTERNAL COMBUSTION ENGINE FUEL SYSTEM

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6 Claims. (Cl. 123—119)

This invention relates to improvements in internal combustion engine fuel system and particularly to the provision therein of means for automatically causing an internal combustion engine to idle at different speeds under diverse temperature conditions respectively.

Internal combustion engine fuel mixture supply systems of the type used in vehicles are generally conditioned to establish a predetermined idling engine operating speed under no-load conditions by preventing full closure of the throttle valve of the engine. The idling speed is preferably reduced to the lowest possible rate at which smooth and continuous performance of the engine is maintained so as to economize on fuel consumption and avoid the creation of noise and vibrations. Such performance can be maintained at a much lower idling rate when the engine is either heated or started under warm atmospheric conditions than when the engine is started while cold in cold atmosphere. It is common practice to reduce the idling speed of an engine to that value which is best suited by warm operating conditions, and as a result continuous and smooth idling operation of the engine is not procurred during the period of time following starting which is required to raise the engine temperature.

With an engine having a fuel system calibrated in this manner, it is necessary to temporarily increase the idling speed during cold weather immediately after starting by manipulation of the throttle. Frequently an operator forgets to reduce the idling speed after the engine has become heated, thereby causing a loss in economy. The failure of the engine to continue to run at an idling speed is particularly objectionable in vehicles equipped for free wheeling, for the engine ceases to operate during cold weather when the vehicle is coasting and it becomes necessary for the operator to restart the engine by employment of the starting motor.

The main objects of the invention are to provide means in an internal combustion engine fuel system for maintaining a low and a high idling speed under warm and cold operating conditions respectively; to provide means of this character which holds the throttle of a fuel mixture system against closing beyond a predetermined partially open position during idling while the engine is heated or in a warm atmosphere and against closing beyond a further open position when the engine is idling while cold and in a cold atmosphere; to provide manually adjustable means for establishing the low idling speed of the engine; to provide a thermostatic element for establishing a fast idling speed which becomes operative only after the temperature to which it is subjected has fallen below a predetermined temperature; to provide a thermostatic element of this character which coacts with the means for holding the throttle against closing beyond a low idling speed position which is also so constructed and arranged that the force of thermal expansion or contraction of its temperature responsive element is not relied upon to oppose the tendency of the throttle valve to close; and to provide means of this character which is of simple and inexpensive construction and adapted to be employed on carburetors or fuel mixture systems of conventional design without necessitating revision thereof.

An illustrative embodiment of the invention is shown in the accompanying drawing, in which:

Fig. 1 is a side elevational view of an internal combustion engine having a fuel system which embodies the invention.

Fig. 2 is a side elevational view, partly in section, of a carburetor showing our improved idle control apparatus somewhat in detail.

Fig. 3 is a fragmentary horizontal sectional view taken on the line III—III of Fig. 2.

In the form shown, our improved idle control apparatus is illustrated in conjunction with that portion of a fuel mixture system which the fuel mixture passage of a carburetor constitutes. The idle control apparatus may, however, be incorporated with any portion of the fuel mixture passage of an internal combustion engine fuel system at which a throttle valve or other means of controlling the flow of fuel mixture is provided.

The carburetor 10, somewhat diagrammatically illustrated in Fig. 2, includes a body portion having a fuel mixture passage 11 which is provided at its upper end with an outlet 12 that communicates with the lower end of a riser 13 or other conduit leading to the manifold 14 of an internal combustion engine 15. The carburetor 10 has an air inlet 16 communicating with the fuel mixture passage 11 provided with a choke valve 17 and operating mechanism therefor generally designated by the numeral 18.

Journaled in the wall structure of the fuel mixture passage 11 adjacent the outlet 12 thereof is a throttle shaft 19 having a throttle valve 20 for controlling the flow of fuel mixture to the internal combustion engine. The throttle valve shaft 19 has an external end portion on which is mounted an operating lever 21 which may be connected by a rod 22 with an accelerator pedal (not shown) or other suitable operating means.

The lever 21 has an enlarged, split end portion or yoke 23 which is provided with a screw 24 for adjustably clamping the lever in a selected position on the shaft 19 of the throttle valve.

An arm 25, which may be either integral with the lever 21 or fixed to the shaft 19 independently of the lever 21 in any suitable manner, is provided for limiting movement of the choke valve toward a fully closed position. The arm 25 has an aperture in its lower end portion in which a set screw 26 is adjustably threaded. A spring 27 bearing between a head on one end of the screw 26 and the adjacent side of the arm 25 yieldably holds the set screw against displacement from an adjusted position. The other end of the set screw protrudes beyond the arm 25 and is engageable with a stop or lug 28 rigidly mounted on the wall structure of the fuel mixture passage 11. The screw 26 is preferably so adjusted as to engage the stop 28 when the throttle valve is in the dotted line position shown at 30 in Fig. 2 so as to hold the throttle valve against closing beyond a partially open position. In practice, this set screw is generally adjusted while the engine is heated to establish the idling speed of the engine at the lowest possible rate which will maintain continuous and smooth operation of the engine during idling operation thereof.

Mounted on the wall structure of the fuel mixture passage 11 is a thermostatic device having a cylindrical stud 31 adjustably mounted in an aperture 32 of a boss 33 formed integral with the wall of the passage 11. A temperature responsive element, preferably comprising a bi-metallic ribbon 34, is spirally coiled about the outer end of the stud 31, as illustrated in Fig. 2. The inner end portion of the bi-metallic ribbon 34 is non-rotatably fixed to the outer end of the stud 31 by engagement in a slot 35 extending diametrically through the latter. The other end portion of the bi-metallic ribbon 34 extends to the right of the stud 28, as viewed in Fig. 2, and is provided with a thickened extremity 36 which is so located as to register with that portion of the periphery of the stop 28 with which the set screw 26 engages. The thermostatic device may be adjustably positioned by bodily rotating it about the axis of the stud 31 and it may be releasably held in an adjusted position by tightening a set screw 38 threaded in the boss 33. The bi-metallic element 34 of the thermostatic device is constructed so as to expand sufficiently to withdraw the thickened end portion 36 from its full line position shown in Fig. 2 to the dotted line position shown therein when the temperature to which it is exposed increases above a predetermined temperature.

In operation, the bi-metallic ribbon 34 is preferably calibrated so as to normally hold the thickened end portion 36 of the ribbon in the dotted line position shown in Fig. 2 as long as the temperature to which the bi-metallic ribbon is subjected does not fall below a temperature at which smooth and continuous operation of the engine can be maintained with the low idling speed at which the engine is operated when the set screw 26 is permitted to engage the stop 28. As the temperature at which the bi-metallic element is subjected falls below the above mentioned temperature the thickened end portion of the ribbon is moved to a position between the stop 28 and the end of the set screw 26 so as to hold the throttle valve 20 at a further open position, thereby causing the engine to operate at a fast idling rate. In practice, it is found that satisfactory results are obtained if the apparatus is constructed so as to assure the placement of the thickened portion of the ribbon in an operative position at a temperature of substantially 50° F. and to assure the removal of the thickened end portion of the ribbon to an inoperative position by the time a temperature of substantially 70° F. is reached.

When an engine equipped with this apparatus is started under cold conditions a fast idling speed is maintained until after the engine has warmed sufficiently to perform properly at a low idling speed. All this is accomplished automatically without the assistance of the operator. The thickened end portion 36 merely coacts between the stop 28 and the set screw 26 to serve as a wedge for limiting clockwise rotation of the throttle to its normal slow idling position and neither thermal contractive or expansive forces of the temperature responsive portion of the ribbon are relied upon to oppose movement of the throttle valve.

Although but one specific embodiment of the invention is herein shown and described, it will be understood that various changes in the size, shape, and arrangement of parts may be made without departing from the spirit of our invention, and it is not our intention to limit its scope other than by the terms of the appended claims.

What we claim is:

1. In a carburetor including a fuel mixture passage having a variable choke valve, means for controlling only the quantity of fuel mixture passing through the latter including a variable throttle valve, a stop engageable by said means for holding said throttle valve against closing beyond one predetermined partially open position, and means including a temperature responsive element operable irrespective of the position of said variable choke valve only when subjected to temperatures below a predetermined temperature for holding said throttle valve against closing to said predetermined partially open position and beyond another predetermined partially open position.

2. In a fuel system for an internal combustion engine having a fuel mixture passage, means for obstructing the inlet of air thereto, variable means for controlling only the quantity of fuel mixture flowing through said passage, a stop for holding said means against movement beyond one predetermined partial flow obstructing position toward a complete flow obstructing position, and a temperature responsive device operable independently of said air inlet obstructing means and only when subjected to temperatures below a predetermined temperature for holding said means against movement to said predetermined partial flow obstructing position and beyond a less obstructing position.

3. In a carburetor including a fuel mixture passage and having a choke valve, means for controlling the quantity of fuel mixture flowing through said passage including a variable throttle valve, a stop on said carburetor engageable by said means for holding said throttle valve against closing beyond a partially open low speed idling position, and a temperature responsive device mounted on said carburetor externally of said passage and exposed to the heat generated during operation of said engine and having an element adapted to coact with said stop in holding

said throttle against closing beyond a high speed idling position when said temperature responsive device is subjected to temperatures below a predetermined temperature, said element being movable to an operative position irrespective of the position of said choke valve and to an inoperative position by said temperature responsive device when the latter is heated by said engine to a temperature above said predetermined temperature.

4. In a carburetor including a fuel mixture passage and having a variable choke valve, a throttle valve including a shaft journaled in the wall structure of said passage having an externally protruding end portion, means on the external end portion of said shaft for rotating the latter to vary the position of said throttle, engageable members on said shaft and the wall structure of said carburetor respectively for holding said throttle against closing beyond a predetermined low speed idling position, and a thermostatic device mounted on said carburetor externally of said passage having an element movable to a position between said engageable members irrespective of the position of said choke valve when the temperature to which said device is subjected falls below a predetermined temperature for holding said throttle against closing beyond a predetermined high speed idling position.

5. In an internal combustion engine carburetor having a fuel mixture passage and including a choke valve at the inlet of said passage, apparatus for controlling the quantity of fuel mixture passing through said passage including a throttle valve and operating mechanism therefor, a stop engageable by said mechanism for holding said throttle valve against closing beyond a low speed idling position, and means independent of said choke valve for holding said throttle valve against closing beyond a further open position to maintain operation of said engine at a higher idling speed, said means including a thermostatic element mounted externally of said carburetor and having a portion engageable between said stop and said mixture flow controlling apparatus only when the temperature to which said thermostatic element is subjected is below a predetermined value.

6. In an internal combustion engine carburetor including a fuel mixture passage, a throttle valve in said passage for controlling the quantity of fuel mixture passing therethrough, mechanism for moving said throttle valve to open and closed positions respectively, a stop engageable by said mechanism for holding said throttle valve against closing beyond a low speed idling position, and means for releasably holding said throttle valve against closing beyond a further open position to maintain operation of said engine at a higher idling speed, said means including a thermostatic element comprising a coiled bimetallic member mounted externally of said carburetor and having an end portion engageable between said stop and a portion of said mechanism registering with said stop only when the temperature to which said thermostatic element is subjected is below a predetermined value.

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