

[54] **FAST IDLE ASSEMBLY FOR
CARBURETORS HAVING AUTOMATIC
CHOKE**[75] Inventors: **Masahiko Nakada; Hirofumi
Matsumoto**, both of Toyota, Japan[73] Assignee: **Toyota Jidosha Kogyo Kabushiki
Kaisha**, Japan[22] Filed: **July 23, 1973**[21] Appl. No.: **381,423**

2,348,544	5/1944	Jorgensen.....	123/119 F
2,410,758	11/1946	Thompson.....	261/39 B
2,415,529	2/1947	Perrine.....	123/119 F
2,957,465	10/1960	Wagner.....	123/119 F
3,109,874	11/1963	Mennesson.....	261/39 R
3,185,453	5/1965	Mennesson.....	261/39 B

Primary Examiner—Wendell E. Burns

Attorney, Agent, or Firm—Toren, McGeady and
Stanger[30] **Foreign Application Priority Data**

Aug. 10, 1972 Japan..... 47-79462

[52] U.S. Cl..... 123/119 F; 261/39 R; 261/64 E

[51] Int. Cl.²..... F02M 1/10[58] Field of Search..... 261/39 R, 39 B, 64 E;
123/119 F[56] **References Cited****UNITED STATES PATENTS**

2,189,219 2/1940 Olsen..... 123/119 F

[57]

ABSTRACT

Choke valve opening and timing of the fast idle cam of a carburetor are set so that a certain angular difference is provided therebetween with the fast idle means kept operative for some time after the choke valve has fully opened. Engine idling during warmup is sufficiently stabilized for emission control, thus contributing to prevention of atmospheric pollution.

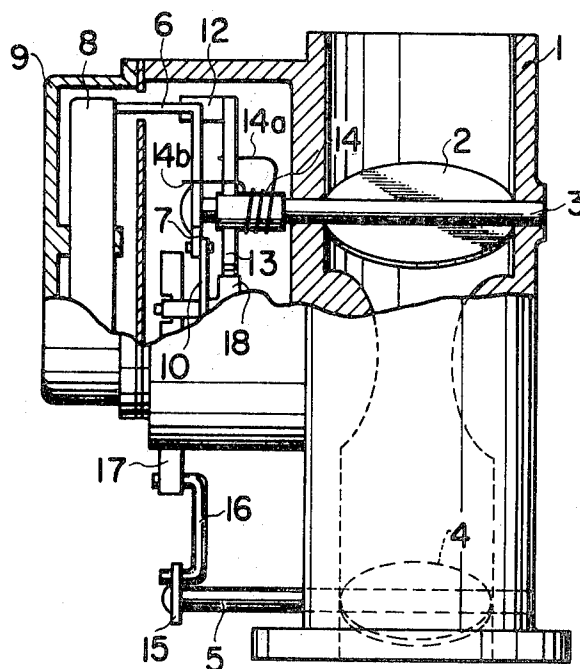
2 Claims, 9 Drawing Figures

FIG. 1

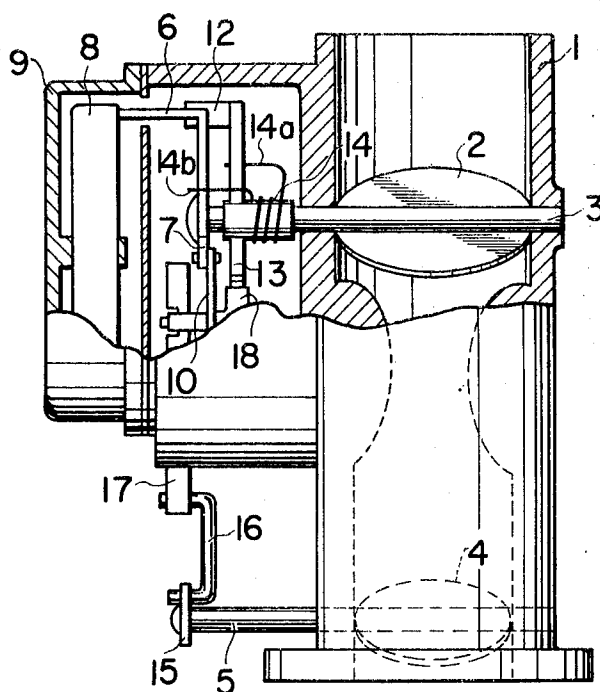


FIG. 2

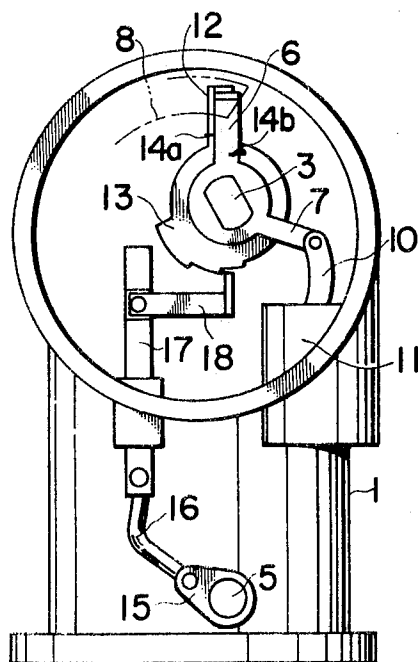


FIG. 3

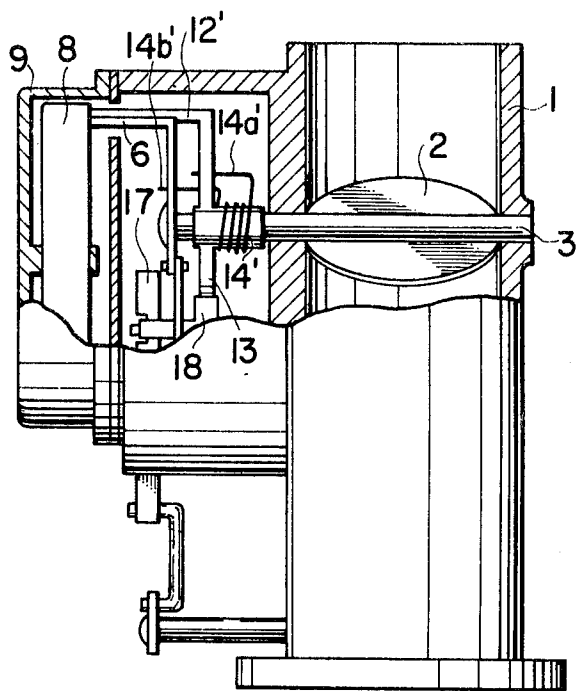


FIG. 4

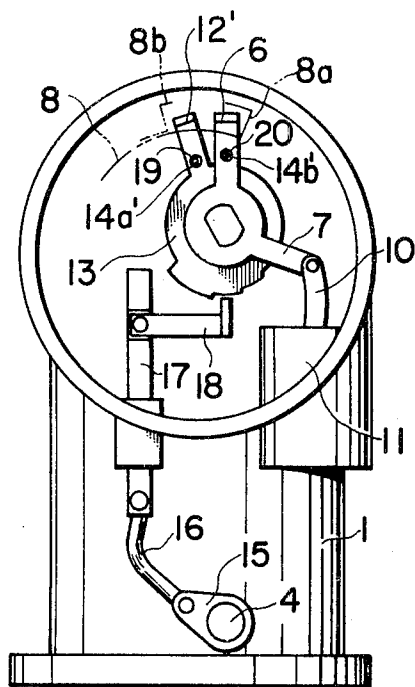


FIG. 5

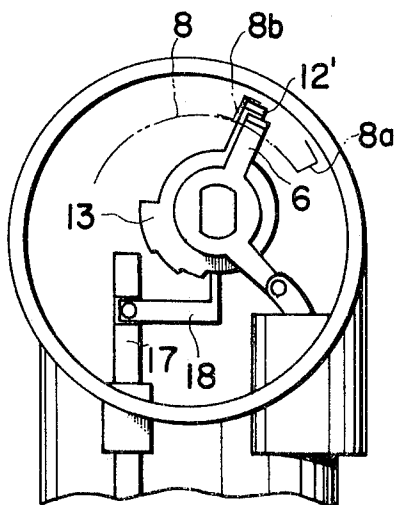


FIG. 6

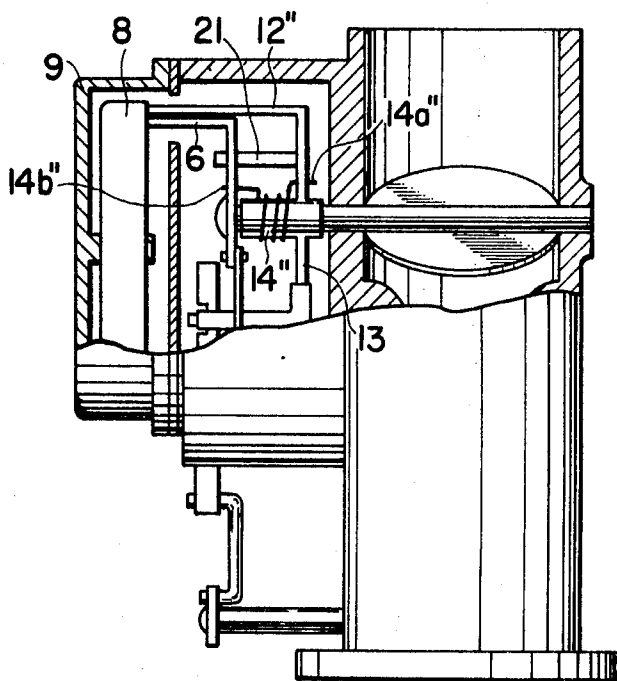


FIG. 7

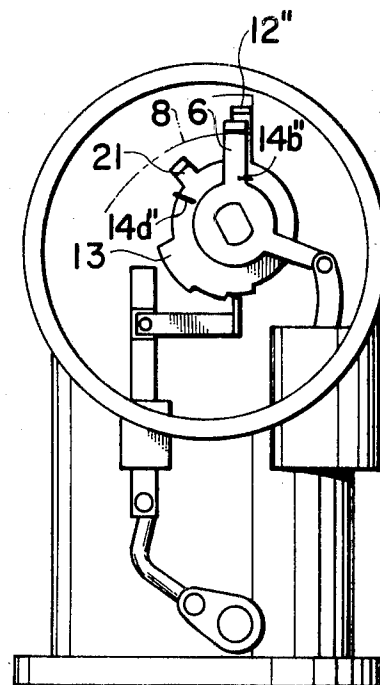


FIG. 8

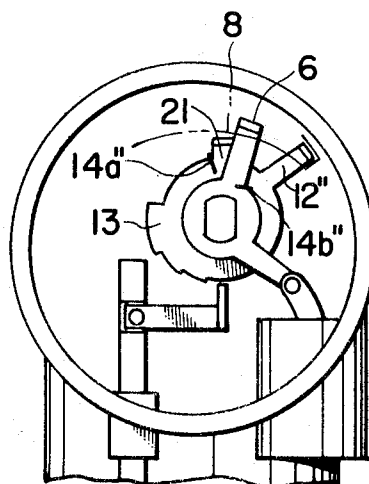
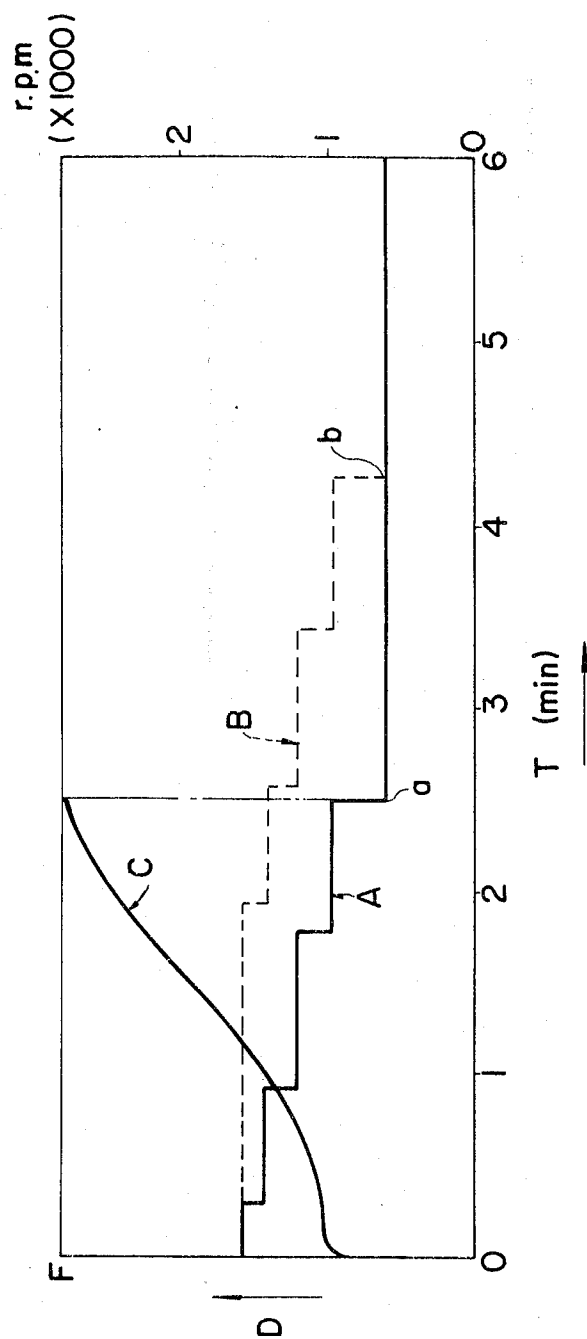


FIG. 9



FAST IDLE ASSEMBLY FOR CARBURETORS HAVING AUTOMATIC CHOKE

BACKGROUND OF THE INVENTION

This invention relates to improvements in the fast idle mechanism of a carburetor equipped with an automatic choke.

DESCRIPTION OF THE PRIOR ART

With a view to combatting the problem of atmospheric pollution, more and more attention has recently been drawn to the reduction of harmful constituents in exhaust gases from vehicles such as automobiles. Naturally, the tendency is toward the use of a gaseous mixture as lean as possible and toward a generally reduced choking effect for engine warmup. In the conventional carburetors the fast idle mechanism for keeping the idle speed before warmup at a relatively high level operates substantially integrally with the choke valve. Thus it is often the case with those carburetors that the fast idle mechanism is released shortly after a cold start, with the consequence that the engine stalls during warmup due to unstable idling.

SUMMARY OF THE INVENTION

This invention has for its object provision of a fast idle assembly of a carburetor equipped with an automatic choke which, for the purpose of eliminating the foregoing disadvantages, affords an angular difference between the choke valve opening and functioning of the fast idle cam, so that the fast idle is maintained for a certain period after the choke valve has fully opened and thus allowing the engine to idle stably until it warms up.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front view, partly in section, of a carburetor of a conventional design;

FIG. 2 is a side view showing the inside of the choke case of the carburetor in FIG. 1;

FIG. 3 is a front view, partly in section, of a carburetor having an automatic choke with a fast idle assembly embodying the present invention;

FIGS. 4 and 5 are side views showing the inside of the choke case of the carburetor shown in FIG. 3;

FIG. 6 is a front view, partly in section, of another embodiment of the invention;

FIGS. 7 and 8 are side views showing the inside of the choke case of the carburetor shown in FIG. 6; and

FIG. 9 is a graph giving characteristic curves representing changes of choke opening and fast idle speed with time.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will be more fully described below with reference to the accompanying drawings illustrating preferred embodiments thereof.

In FIGS. 1 and 2 there are shown a carburetor body 1, a choke valve 2, a choke shaft 3, a throttle valve 4, and a throttle shaft 5. To the choke shaft 3 is secured a choke lever 6 in one piece with a piston lever 7. The choke lever 6 is hooked to the outer extremity of a spiraled thermostatic spring 8, the inner extremity of which is fixed to a choke case cap 9. The piston lever 7 is connected at its end with one end of a connecting rod 10, the other end of which is connected to a vac-

uum piston (not shown) in a choke cylinder 11. On the choke shaft 3 is revolvably mounted a fast idle cam 13 having a fast idle lever 12. One end 14a of a relatively weak coil spring 14 is secured to the fast idle lever 12, and the other end 14b of the spring is secured to the choke lever 6. This spring exerts spring force on the fast idle lever 12 and choke lever 6 to preclude any angular difference between the two levers. When the fast idle cam 13 is free from force from any other source, therefore, the two levers 12, 6 are in the relative positions as in FIG. 2. To one end of the throttle shaft 5 is secured a throttle lever 15, which in turn is connected to a fast idle rod 17 through a link 16.

A cam follower 18 secured to the fast idle rod 17 is in contact with the underside of the fast idle cam 13 as long as the driver does not operate the throttle valve 4 of the engine before its warmup. Depending upon the shape and position of the fast idle cam, the follower serves to keep the throttle wider open than during idle after warmup. The fast idle mechanism of the construction so far described has been well known in the art.

Next, an embodiment of the present invention will be described with reference to FIGS. 3 to 5. A spiraled thermostatic spring 8 is formed with a hook 8a for engagement with a choke lever 6 and is also formed with a hook 8b for engagement with a fast idle lever 12'. One end 14a' of a relatively weak coil spring 14' is fixedly inserted through a small hole 19 formed in the fast idle lever 12', the other end 14b' of the spring being also fixedly inserted through a small hole 20 in the choke lever 6. The spring 14' biases the fast idle lever 12' and choke lever 6 to maintain a certain angular displacement (e.g., 15° or 20°) therebetween. It follows that, in the absence of any other force exerted on the fast idle cam 13, the two levers 12', 6 would assume the relative positions as shown in FIG. 4. The rest of the construction is the same as that which has been described in connection with FIGS. 1 and 2.

Another embodiment of the invention will now be described with reference to FIGS. 6 to 8. The fast idle cam 13 is formed in one piece with a fast idle lever 12'' and a spring lever 21 with a certain angular displacement (e.g., 15° or 20°) therebetween. One end 14a'' of a relatively weak coil spring 14'' is connected to the spring lever 21. The spring 14'' biases the spring lever 21 and choke lever 6 lest there should occur any angular difference between the two levers. Therefore, when the fast idle cam 13 is free from any force other than the spring force, the two levers 21, 6 are in contact and in the relative positions as shown in FIG. 8. Hence there occurs an angular displacement between the choke lever 6 and fast idle lever 12''. Before the engine warms up, the thermostatic spring 8 urges the fast idle lever 12'' and choke lever 6 to turn counter-clockwise, and therefore the two levers 12'', 6 are in the relative superposed positions as shown in FIG. 7, or are substantially superposed.

In an ordinary fast idle arrangement, the choke lever 6 and fast idle lever 12 function, as a rule, without an angular difference therebetween. Consequently, whatever the shape of the fast idle cam 13, it is inevitable that, as indicated by the changes of fast idle speed represented by the solid line A in FIG. 9, the fast idle mechanism stops working at the point a shortly after the choke opening D has reached the maximum F, and the engine idles slowly.

The embodiment shown in FIGS. 3 to 5 operates in the following manner. Normally, under the urging of the spring 14', a certain angular displacement is maintained between the choke lever 6 and fast idle lever 12'. Thus, assuming that a fast idle cam of the shape substantially the same as that in FIGS. 1 and 2 is employed, a time lag corresponding to the angular difference will cause a change in the fast idle speed. The fast idle mechanism will now be able to work with the choke valve fully open. As the temperature inside the choke case rises with the lapse of time, the hooks 8a, 8b of the thermostatic spring 8 turn clockwise. Because the choke valve 2 is fully open, the spring is kept from further turning and its hook 8a is brought out of contact with the choke lever 6, while the other hook 8b causes the fast idle lever 12' to turn clockwise against the urging of the spring 14 until it stops at the point shown in FIG. 5. Here it is possible to adopt an alternative arrangement in which the fast idle lever 12' goes on turning so that no excessive force is exerted on the thermostatic spring 8. If the fast idle cam 13 is of such a shape that the fast idle mechanism is released when it has reached the position shown in FIG. 5, then the fast idle is maintained for an additional period of time between the point where the choke valve 2 is fully open and the point at which the thermostatic spring 8 arrives as shown in FIG. 5. As a consequence, the fast idle speed undergoes changes as represented by the broken line B in FIG. 9. In the graph, the point b indicates release of the fast idle mechanism and the curve C represents changes in the choke opening D.

The operation of the second embodiment shown in FIGS. 6 to 8 is as follows. The choke lever 6 and spring lever 21 are biased by the spring 14'' so that there is practically no angular difference therebetween as shown in FIG. 8. However, because the spring force of the spring 14'' is relatively weak, the fast idle lever 12'' is hooked by the outer end of the thermostatic spring 8 and is turned counter-clockwise against the urging of the spring 14'', with the result that the choke valve 2 is closed as in an ordinary carburetor.

As the engine gradually warms up and the temperature in the choke case rises, the outer end of the thermostatic spring 8 turns clockwise away from the choke lever 6 because the choke valve 2 is not opened any more. In this case, the fast idle lever 12'' continues to turn clockwise in contact with the outer end of the thermostatic spring 8 until the choke lever 6 and spring lever 21 are forced into contact with each other by the spring 14'' (to the state shown in FIG. 8). It then follows that the fast idle cam 13 can go on turning for an additional period of time from the point where the choke valve 2 is full open to the state of FIG. 8. In the same way as with the first embodiment illustrated in FIGS. 3 to 5, it is possible, by selecting a suitable shape for the fast idle cam 13, to attain the changes of fast idle speed as represented by the broken line B in FIG. 9.

The fast idle mechanism of a conventional carburetor

of the automatic choke type is released once the choke valve is fully opened and, moreover, it is a recent trend that the choke valve is often set to open rather prematurely for the purpose of emission control. This causes the release of the fast idle mechanism prior to the engine warmup and sometimes results in unstable idling or even engine stall.

According to the present invention, as shown in FIG. 9, the fast idle mechanism can continue to work after the choke valve opening D has reached the full open position F, and, even with early opening of the choke, the engine is enabled to idle stably before it warms up. Thus, with adequate control of the exhaust emissions, the invention is contributory to the prevention of air pollution. This purpose can be fully achieved with only a slight modification of an existing fast idle assembly in accordance with the present invention.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. A carburetor of the automatic choke type including a fast idle mechanism for an internal combustion engine comprising a throttle valve, a choke valve, a choke shaft having said choke valve fixedly mounted thereon, a choke lever mechanism fixedly mounted to said choke shaft, a fast idle cam revolvably mounted to said choke shaft, linkage means operatively interconnecting said fast idle cam and said throttle valve to control the idling position of said throttle valve, first spring means operatively connected between said choke lever mechanism and said fast idle cam to effect a predetermined angular displacement therebetween, and second spring means having a first and a second end with the first end of said second spring means fixed relative to said carburetor and with the second end of said second spring means including a first engagement member for engaging said choke lever and a second engagement member for engaging said fast idle cam, said second spring means being thermostatically responsive to the operating temperature of said engine to control the opening of said choke valve and the working angle of said fast idle cam, said second thermostatically responsive spring means cooperating with said first spring means to effect continued operation of said fast idle mechanism for a period of time after said choke valve has fully opened.

2. A carburetor according to claim 1 wherein said first spring means and said second thermostatic spring means are arranged to effect integral control of both said choke valve and said fast idle cam by said second thermostatic spring means before said choke valve is fully opened, and control of said fast idle cam alone by said second thermostatic spring means after said choke valve has fully opened.

* * * * *