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[54] **CONTROL MECHANISM FOR CARBURETOR AUTOMATIC CHOKE**

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[52] **U.S. Cl.** **261/52**

[51] **Int. Cl.** **F02m 1/10**

[58] **Field of Search** 261/52

[56] **References Cited**

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[57] **ABSTRACT**

A control mechanism is provided for a carburetor having an automatic choke which includes a cam carried on the valve shaft of the choke valve and a stopper member movable to be brought into engagement with the cam so as to restrict the opening of the choke valve at the time of engine starting. The restriction effected by engagement of the stopper with the cam is removed when the ambient temperature of the carburetor is sufficiently high or when the engine has reached a sufficiently warmed-up condition.

5 Claims, 8 Drawing Figures

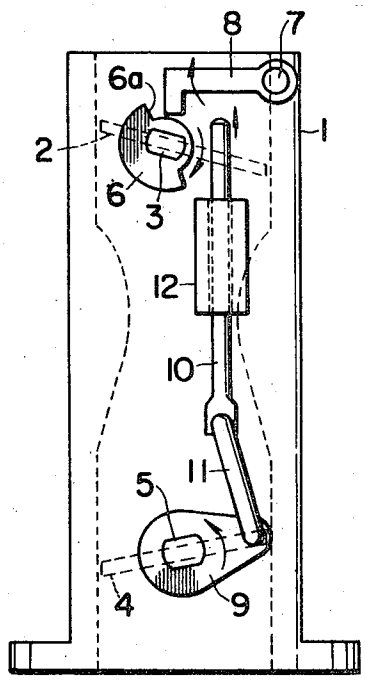


FIG. 1

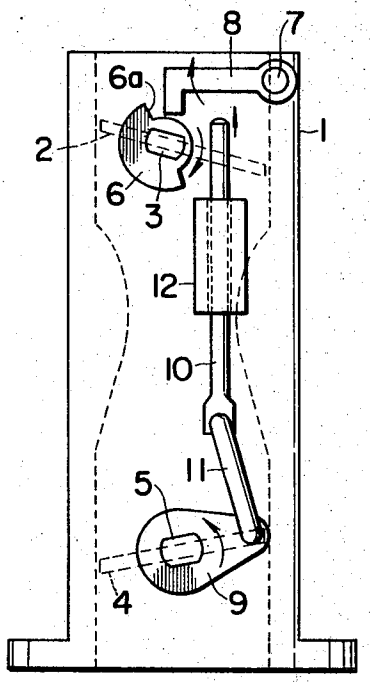


FIG. 2

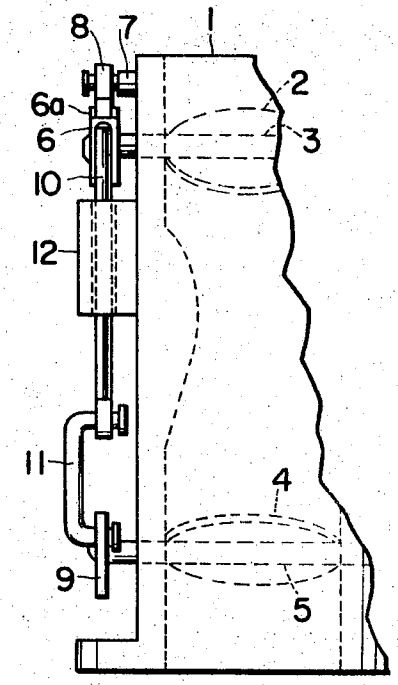


FIG. 3

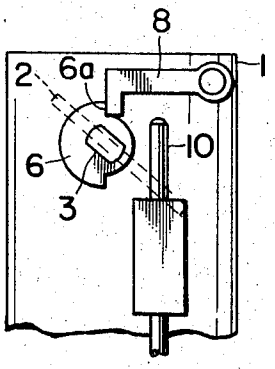


FIG. 4

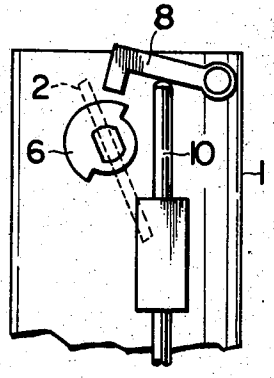


FIG. 5

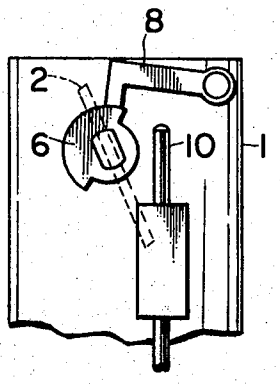


FIG. 6

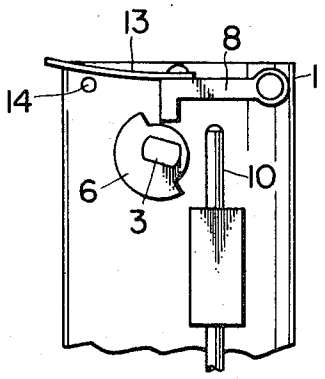


FIG. 7

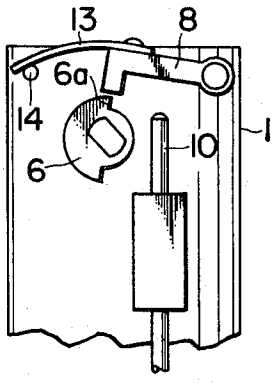
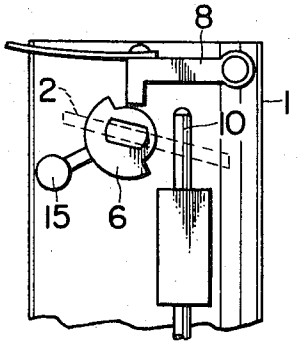


FIG. 8



CONTROL MECHANISM FOR CARBURETOR AUTOMATIC CHOKE

BACKGROUND OF THE INVENTION

The present invention relates generally to an automobile carburetor having an automatic choke capable of automatically controlling air flow to an engine in accordance with the temperature level of the engine. More particularly, the present invention relates to a carburetor of the type described which operates to attain as lean an air-fuel mixture as is practically possible from the standpoint of alleviating air pollution problems while at the same time improving starting performance and idling operation of the engine when it is not sufficiently warmed up.

It is well known to include in most automatic chokes a thermostatic device such as a bimetallic coil spring to control operation of the choke. At the time of engine starting and also during idling operation when the engine is relatively cool, the opening of the choke valve is maintained small by the biasing force of the bimetallic spring thereby to restrict air flow and to enrich the air-fuel mixture. As the engine is warmed up, however, the choke valve is gradually opened in response to increase of the temperature of the engine and/or of the flow rate of the engine intake. From the standpoint of minimizing air pollution problems, it has recently become a requirement to restrain the choking effect in order to render the fuel mixture as lean as possible. To this end, many arrangements have been proposed including, for example, off-center mounting of the valve shaft of the choke valve to enable easy opening thereof, or utilization of the gravity or a vacuum piston to bias the choke valve to its open position and to render the choke valve responsive to slight temperature increases of the engine or of the environs of the carburetor.

However, such arrangements have been found to include defects in that the choke valve develops a tendency to open excessively before a sufficiently high engine temperature is achieved. This undesirable tendency is particularly notable when the temperature of the engine is in the range from about 10° C to 25°C. Due to a resultant lean fuel mixture, there often occurs engine stall or misfiring in such devices thereby resulting in instability of the idling operation of the engine and, moreover, in increased air pollution problems.

SUMMARY OF THE INVENTION

It is a primary object of the present invention to provide a carburetor having an automatic choke in which excessive opening of the choke valve prior to adequate engine warm-up is avoided in a positive manner by restricting the automatic action of the choke valve which has a tendency to open rather excessively, thereby to avoid further air pollution. To achieve this function of the automatic choke, the choke valve of the invention is connected by a linking mechanism of the throttle valve of the carburetor in such a manner that it is restricted from opening beyond a predetermined angle when the opening of the throttle valve is small, as is the case during engine starting or idling, regardless of whether the temperature of the engine or of the environs of the carburetor is high or low.

Other objects, features and advantages of the invention will become apparent from the following description, taken in connection with the accompanying drawings which illustrate by way of example several preferred embodiments of the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. **1** is a front view of a carburetor schematically illustrating a first specific embodiment of the invention;

FIG. **2** is a lateral or side view of the embodiment of FIG. **1**;

FIGS. **3** through **5** are partial views similar to the view of FIG. **1** illustrating various stages of the operation of the invention;

FIGS. **6** and **7** are partial front views schematically illustrating a second embodiment of the invention; and

FIG. **8** is a partial front view illustrating a third embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, and particularly to FIGS. **1–5** wherein a first embodiment of the present invention is illustrated, a choke valve **2** is mounted on the body of a carburetor **1** by a valve shaft **3** which is affixed to the choke valve **2** in an off-center position in order to facilitate opening of the valve **2**. In a manner well known to those skilled in the art, a bimetallic coil spring (not shown) is connected to the valve shaft **3** in order that the choke valve **2** may be opened or closed automatically in response to engine temperature, the temperature of the environment of the carburetor, or the rate of intake air flow. Fixedly secured on the valve shaft **3** is a cam **6** having at its periphery a stepped portion **6***a*. A stopper lever **8** is pivotally mounted upon a shaft **7** in a position to engage the stepped portion **6***a* during an appropriate phase of operation. A push rod **10** slidably supported in a guide member **12** is arranged beneath the stopper lever **8** with the upper end of the push rod **10** being engageable with the lever **8** when the rod **10** is moved upwardly. The lower end of the rod **10** is connected to a lever **9** which is fixed on a valve shaft **5** of a throttle valve **4** through a linking lever **11**.

With the arrangement described above, when the engine is not sufficiently warmed up and with the temperature of the atmosphere surrounding the carburetor lower than, for example, 10°C, the choke valve **2** will be almost completely closed as shown in FIG. **1** and the stepped portion **6***a* of the cam **6** will be positioned to the left of the stopper lever **8** and spaced a certain distance therefrom. With the elements of the devive in this position, the function of the choke will be the same as that of the conventional automatic choke. With subsequent warming up of the engine the biasing force of the bimetallic coil spring will be reduced to open the choke valve **2**. However, when the valve **2** is rotated clockwise as seen in FIG. **1**, the stepped portion **6***a* of the cam **6** will be brought into engagement with the left end portion of the lever **8** at a certain predetermined opening of the choke valve, as seen in FIG. **3**, Thus, the choke valve **2** will be prohibited from further rotation. As a result, the air flow rate will be maintained at a certain fixed value corresponding to the above-mentioned opening of the choke valve **2** and a proper choking effect will be obtained. In the situation described above, there will be little likelihood that an overly rich fuel mixture will be obtained since the opening of the throttle valve **4** is substantially small. Under such circumstances, when the throttle valve is opened through ac-

tuation of the accelerator pedal in order to start or accelerate the automobile, the lever **9** of the throttle valve **4** will be rotated counterclockwise as seen in FIG. **1** and it will, in turn, move the push rod **10** upwardly through the intermediary link **11.** Accordingly, the lever **8** will be pushed upwardly by the push rod **10** and the cam **6** will be released from engagement with the lever **8,** as shown in FIG. **4.** Under these circumstances, the choke valve **2** will be permitted to assume a position providing a proper opening which corresponds to the warming condition of the engine, that is, it will operate in the same way as a conventional automatic choke.

In a situation where the surrounding temperature of a carburetor is relatively high, for example, in the range from about 15°C to 25°C, the choke valve **2** will be slightly opened prior to engine starting and will assume an intermediate position between the positions shown in FIG. **1** and FIG. **3.** When the engine is started under this situation, the dynamic pressure of the suddenly introduced air flow, together with the suction vacuum and the spring force of the bimetallic coil, will act together on the choke valve **2** to effect an abrupt opening thereof. However, since the choke valve **2** is limited to the position shown in FIG. **3,** it will not be opened further until the throttle valve **4** is opened through actuation of the accelerator pedal to such an extent that the stoppper lever **8** is disengaged from the stepped portion **6***a* of the cam **6.** This disengagement will be effected, as previously described, by the upward force which is supplied to the lever **8** by the push rod **10** actuated through the linking mechanism connecting the rod **10** with the throttle valve **4.**

In the event that the temperature surrounding the carburetor is higher than, for example, 30°C, the engine would also be sufficiently warmed and therefore the choke valve **2** would be fully opened. As can be seen from the relative positioning of the elements as shown in FIG. **5,** the stopper lever **8** is located above the cam **6** and beyond a position where the end of the lever **8** can be engaged by the stepped portion **6***a.* Accordingly, the choke valve **2** will be allowed to open freely and to operate independently of the stopper lever **8.** In this condition, the choke valve will not produce any choking effect on the air flow. Furthermore, it is to be noted that the choke valve **2** can also be opened to the position shown in FIG. **5** even if its motion has previously been arrested by engagement of the cam **6** with the stopper lever **8** at the position shown in FIG. **3.** Since at the time of engine starting, the throttle valve **4** will be brought to its fully opened position for at least a short period of time, lifting of the stopper lever **8** will occur thereby freeing the choke valve **2.**

In another embodiment of the present invention illustrated in FIGS. **6** and **7,** there is involved the addition of a bimetallic member **13** which is mounted with one end thereof affixed to the stopper lever **8** and with its opposite free end arranged to engage a stopper lug **14** which is fixedly attached to the body of the carburetor **1** at a proper location. When the bimetallic member **13** is bent into the arcuate form shown in FIG. **7,** its opposite free end will engage the lug **14** in the manner illustrated. With such an arrangemnt, when the temperature surrounding the carburetor is relatively low and the engine is not as yet sufficiently warmed up, the bimetallic member **13** will be maintained out of contact with the stopper lug **14** as illustrated in FIG. **6** and the stopper lever **8** will be permitted to remain in a position where it may engage the stepped portion **6**a of the cam **6** in the manner previously described herein. However, when the temperature surrounding the carburetor becomes sufficiently high, the bimetallic member **13** will be bent into the arcuate form shown in FIG. **7** and, as a result, the free end of the bimetallic member will be brought into contact with the stopper lug **14.** By this engagement, the stopper lever **8** will be pivotally rotated so that its free end is moved upwardly to a position where it cannot be engaged with the stepped portion of the cam **6.**

Referring now to FIG. **8,** there is illustrated a third embodiment of the present invention wherein a weight **15** attached to the cam **6** of the choke valve **2** is utilized in order to bias the choke valve toward the closed position. As will be evident from FIG. **8,** the weight **15** is attached to the cam **6** in a manner to effect rotation thereof in a counterclockwise direction, as viewed in FIG. **8** and by virtue of the inclusion of weight **15,** the choke valve **2** will be urged into its completely closed position during the operating stage of the device before engine starting. This will occur even though the temperature surrounding the carburetor may be considerably high or despite the fact that the engine may be sufficiently warmed. Thus, air flow through the choke valve **2** will be forced to undergo the restriction of the choke under all circumstances.

It will be seen from the foregoing that the carburetor arranged in accordance with the present invention operates so that the choke valve may not move beyond a certain predetermined opening at the time of idling operation of the engine, unless the temperature is extremely high or except in the case that the engine is sufficiently warmed-up. By this arrangement, a proper choke effect is obtained and stable idling operation is insured. Thus, it will be seen that an important advantage provided by the present invention resides in the fact that the choke effect is minimized during the time when the engine is sufficiently warmed without producing any detrimental effects upon the starting performance or idling operation of the engine. Furthermore, a carburetor equipped in accordance with the present invention will produce superior operating charactertistics as compared with conventional carburetors inasmuch as the exhaust gases will be, by comparison, relatively pure and will not contain as high a level of unburnt components. Since the restriction to opening of the choke valve is readily removed by operation of the throttle valve **4** there is little likelihood that an excessively rich air-fuel mixture will develop during phases of engine operations when such a rich mixture is not desired such as, for example, when the vehicle is operating under normal road conditions. Furthermore, in the case of the second embodiment of the invention, an arrangement is provided wherein the choke valve may be released from the restricting means preventing its further opening when the temperature is considerably high or when the engine is sufficiently warmed. Thus, the choke valve is closed only when necessary and therefore the invention provides means whereby an overly rick fuel mixture adversely affecting engine performance may be positively avoided. Similarly, in the case of the third embodiment of the invention, improved engine starting and more stable idling operation are obtained when the temperature is considerably high or when the engine is sufficiently warmed up. Further

operating advantages, in addition to the foregoing, are provided by virtue of the fact that the arrangement of the present invention enables the provision of an automatic choke which can be attained with few changes in the structure of conventional arrangements without requiring excessive or prohibitive modifications or alterations thereof.

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. In a carburetor for an internal combustion engine having a carburetor body, a throttle valve, an automatic choke mechanism including a choke valve, and means for automatically controlling operation of said choke mechanism in response to temperature or air flow conditions in said engine, the combination comprising: a cam connected to move with said choke valve; stopper means pivotally mounted on said carburetor body and positioned for engagement with said cam to restrict opening of said choke valve; and a push rod mounted for reciprocal movement in response to movement of said throttle valve; said stopper means being located in the path of said push rod to be engaged thereby for pivotal motion of said stopper means to a position preventing engagement thereof with said cam; said choke valve being restricted from opening beyond a predetermined position by engagement of said cam with said stopper means when said throttle valve opening is less than a predetermined degree, with said restriction being removed by engagement of said push rod with said stopper means when said throttle valve opening is greater than said predetermined degree.

2. A carburetor according to claim **1** wherein said cam comprises a rotatable member having a radially extending abutment surface defined thereon, and wherein said stopper means comprises an arm member pivotally mounted at one end and located to have its opposite free end placed in a position where it will abut said abutment surface thereby to restrict rotation of said cam, said stopper means being also pivotable to place said opposite free end in a position where it will not engage said abutment surface thereby to remove said restriction.

3. A carburetor according to claim **2** wherein said push rod is operable in response to movement of said throttle valve to effect pivoting of said arm member to place said opposite free end in said position where it will not engage said abutment surface.

4. A carburetor according to claim **1** further comprising a bimetallic member secured to said stopper means, said bimetallic member being of a substantially elongated configuration and adapted to bend in response to temperature change, and a stopper lug mounted on said carburetor body for engagement with said bimetallic member, said bimetallic member being arranged to move said stopper means by engagement with said lug to a position where engagement of said stopper means by said cam is prevented when the ambient temperature at said bimetallic member is above a predetermined level.

5. A carburetor according to claim **1** including a weight attached to said choke valve, said weight being arranged to apply to said choke valve a force in the direction of closing whereby the choke valve will be maintained in a closed position prior to starting of said engine.

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