

July 5, 1960

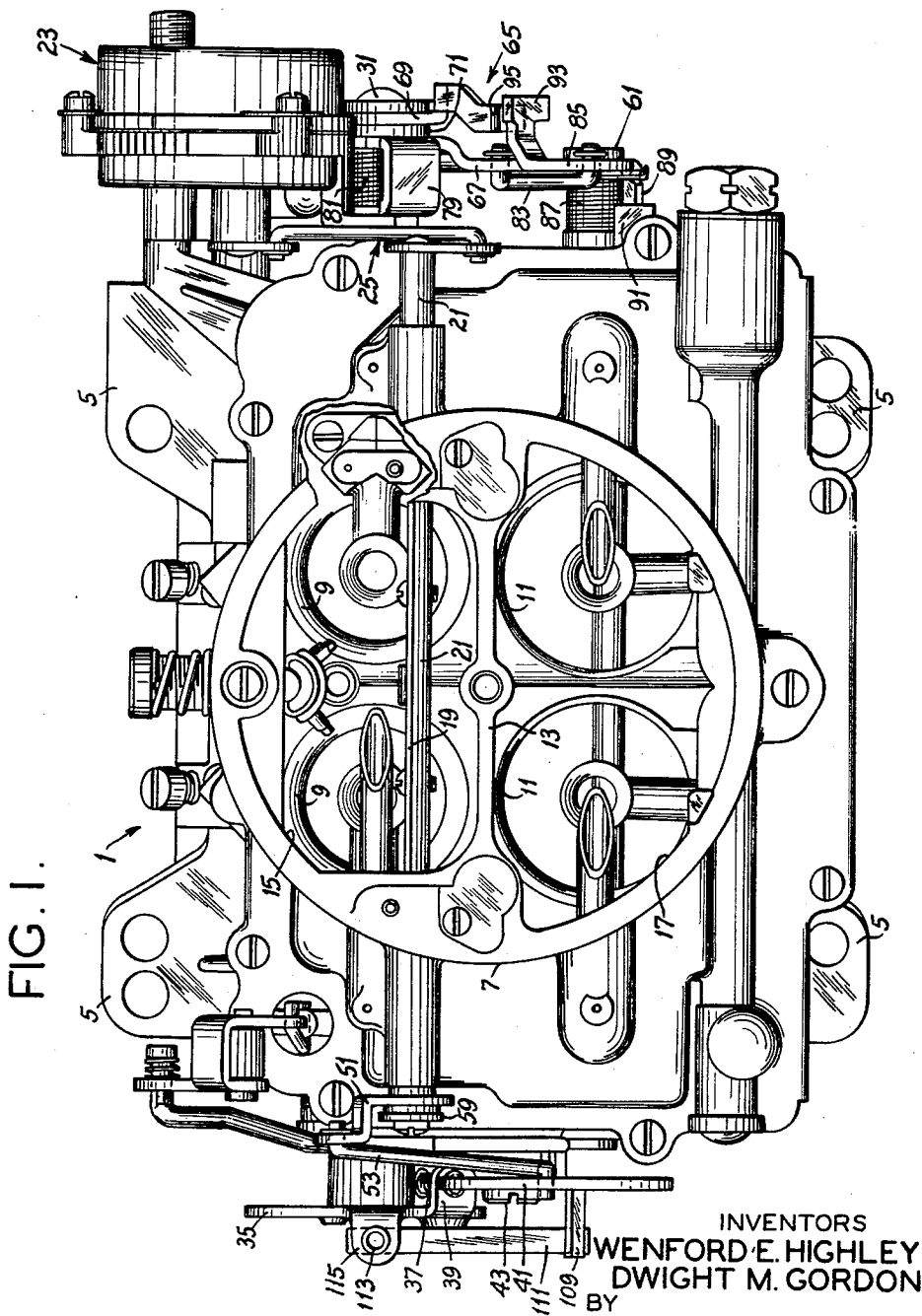
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2,943,848

SEPARATE THERMOSTAT CONTROLLED FAST IDLE CAM

Filed Oct. 6, 1958

3 Sheets-Sheet 1



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FIG. 4.

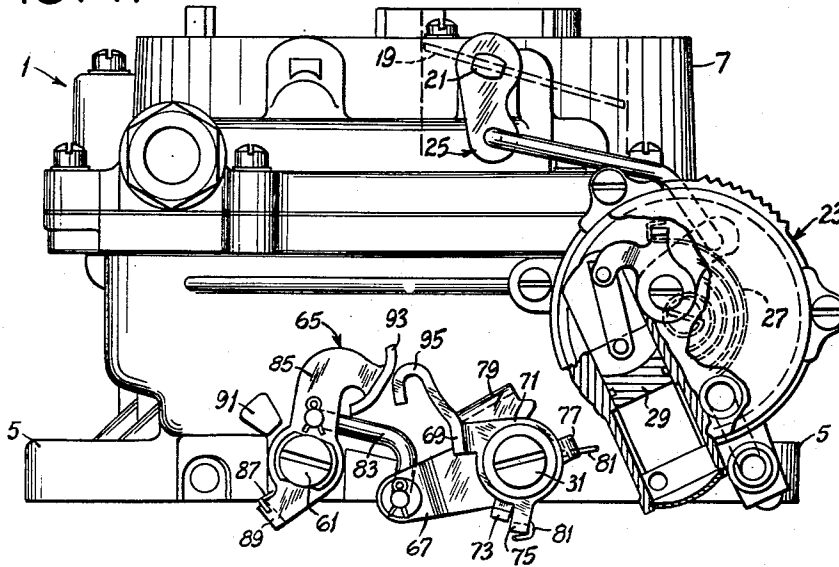


FIG. 5.

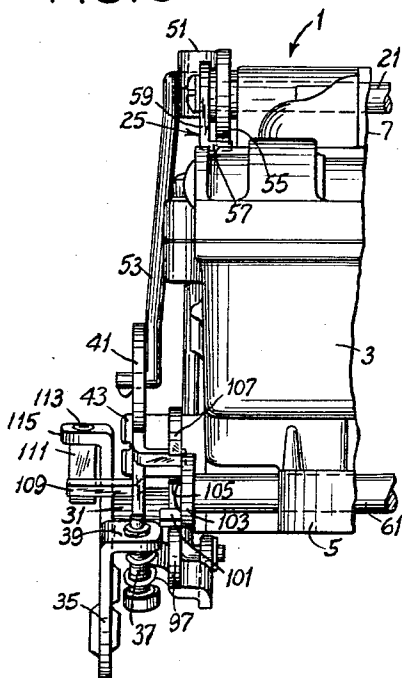
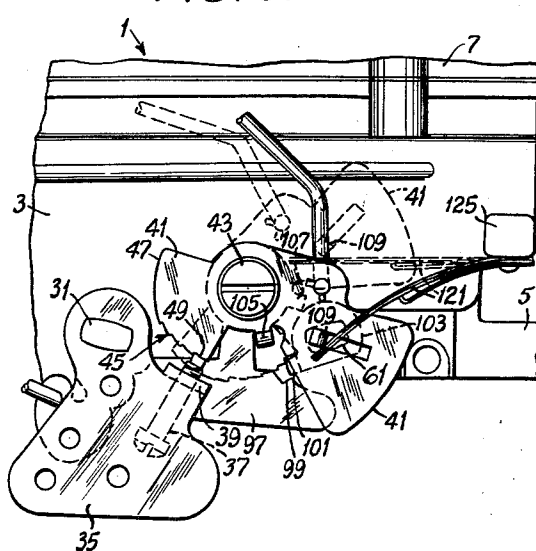


FIG. 6.



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2,943,848

SEPARATE THERMOSTAT CONTROLLED FAST IDLE CAM

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20 Claims. (Cl. 261—39)

This invention relates to carburetors for internal combustion engines, especially of the automotive type, and more particularly to means for controlling the position of the throttle valve of the carburetor at idle in such manner as to insure satisfactory engine idle speed in cold weather when the temperature under the hood of the automotive vehicle may be low.

It will be understood that certain carburetors of the class described have a fast idle cam controlled by the choke valve of the carburetor (the choke valve, in turn, being controlled in response to engine temperature and suction in the intake manifold of the engine) for controlling the position of the throttle valve at idle. The fast idle cam is formed so that, when in a starting position with the engine cold and the choke valve closed, it blocks the throttle valve partly open and, as the engine warms up and the choke valve opens, it blocks the throttle valve open to a lesser degree to provide the correct idle speed. For this purpose, the cam is usually engageable by a screw on the usual throttle operating arm. When the choke valve reaches full open position, the cam may assume a full off or inactive position, to permit the throttle valve fully to close or to close to a preset position, as may be determined either by engagement of the screw with the cam, or by engagement of a lug on the throttle operating arm with a separate adjustable stop on the carburetor body. However, friction between the screw on the throttle arm and the cam due to the force exerted by the usual throttle return spring restrains cam movement until the throttle is opened manually to disengage the screw from the cam and allow the cam to move progressively toward an inactive position. This can occur continuously or on each throttle opening as the engine approaches normal operating temperature. In cold weather, when the temperature under the hood of the vehicle is low prior to complete engine warm-up, and consequently the temperature of the air flowing to the carburetor is low, it has been found desirable to maintain the throttle valve blocked open at idle to provide the correct idle speed, even though the choke valve may be open, until the temperature under the hood is increased by heat from the engine.

The main object of the invention is to provide an engine idle speed control which is responsive to more than simply one temperature variable, such as occurs during the action of the choke thermostat in the choke control mechanism as above described.

Another object of the invention is to provide a fast idle device with a temperature control responsive to the temperature of the air flowing to the carburetor, which device operates each time the throttle is closed from an open position to effect a change in the rate of flow of the idle mixture so as to establish an idling engine speed which is stable in spite of mixture temperature fluctuations.

In one form of this invention these objects are accomplished by providing a thermostat controlled means primarily responsive to air temperature and acting as a limiting means on the movement of the fast idle cam toward inactive or off position. In this form, this thermostat

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control of the fast idle cam is superimposed on the usual control for the fast idle cam from the automatic choke mechanism, and is so arranged as to be ineffective and inactive when the throttle is opened so as not to interfere with any other function of any other control mechanism on the carburetor. In other words, it becomes effective only when the throttle is closed, and utilizes this operation to move the cam into an active position, depending upon temperature of the air flowing to the carburetor.

This active position, in turn, determines the degree of throttle closing. Other objects and features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the constructions hereinafter described, the scope of the invention being indicated in the following claims.

In the accompanying drawings, in which several of various possible embodiments of the invention are illustrated,

Fig. 1 is a plan view of a four-barrel carburetor in which the invention is incorporated;

Fig. 2 is a view in elevation of the left end of Fig. 1, showing the fast idle cam of the carburetor in starting position, and showing in solid lines the position of the thermostatic means of this invention at normal temperatures and in dotted lines the position thereof at relatively low temperatures;

Fig. 3 is a view similar to Fig. 2, showing the fast idle cam in an advanced position;

Fig. 4 is a view in elevation of the right end of Fig. 1, with parts broken away and shown in section;

Fig. 5 is fragmentary side elevation; and,

Fig. 6 is a view similar to Fig. 2 illustrating a modification.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

Referring to the drawings, the invention is illustrated in its application to a multi-barrel, multi-stage carburetor 1 of the type commonly referred to as a four-barrel carburetor. Only so much of the construction of the carburetor as is essential to an understanding of this invention will be described herein. Reference may be made to the copending coassigned application of Dwight M. Gordon, Serial No. 752,979, filed August 4, 1958, for example, for such further details as may be desired.

In general, the carburetor 1 comprises a fuel bowl section 3 having lugs such as indicated at 5 by which it may be attached to the intake manifold of the engine on which it is used. Mounted on the fuel bowl section 3 is the usual air horn section 7. The fuel bowl section 3 is formed to provide two primary mixture conduits or barrels each designated 9 and two secondary mixture conduits or barrels each designated 11. The air horn section 7 is formed with a partition 13 dividing it to form a primary inlet 15 and a secondary inlet 17.

A choke valve 19 (shown open in Figs. 1 and 3, closed in Figs. 2 and 4) is provided in the primary inlet 15 for controlling the admission of air to the primary barrels. The choke valve is fixed on a choke shaft 21 which extends across the inlet 15. A choke mechanism housing is indicated at 23. This contains the usual suction and temperature-responsive mechanism such as shown, for example, in the Coffey U.S. Patent 2,325,732. The choke mechanism is connected in the usual manner as indicated at 25 in Fig. 4 to one end of the choke shaft 21, the arrangement being such that the usual choke thermostat 27 in housing 23 tends to hold the choke valve closed and, upon being heated, allows the choke valve to be opened by the usual suction-responsive choke-actuating piston 29. In this respect, it will be understood that the choke thermostat is heated by air supplied to the housing 23 as from a heat pocket in the exhaust manifold of the engine.

At 31 is indicated the primary throttle shaft of the carburetor. This carries the usual pair of primary throttle valves, one for each of the two primary barrels, indicated at 33 in Figs. 2 and 3. Fixed on the end of the primary throttle shaft 31 at the side of the carburetor opposite the choke mechanism housing 23 is the primary throttle arm 35 of the carburetor 1. It will be understood that connection is made to arm 35 from the usual accelerator pedal of the vehicle, spring means being provided biasing the arm in return direction (counterclockwise as viewed in Figs. 2 and 3) to tend to maintain the primary throttles closed. Movement of the primary throttle arm in return (closing) direction is limited by engagement of a screw 37 adjustably threaded in a lug 39 on the arm with the fast idle cam 41 of the carburetor.

The fast idle cam 41 is pivoted at 43 on fuel bowl section 3 adjacent the primary throttle arm 35. It is formed with a series of steps such as indicated at 45 for engagement by screw 37 and is rotatable on pivot 43 through a range of positions for bringing the different steps into opposition to the screw. The series of steps includes a so-called starting step 47 which is the highest step (i.e., it is on the greatest radius from the axis of pivot 43), and a final step 49 which constitutes the so-called normal idle step and which is the lowest of the steps. Engagement of screw 37 with the starting step 47 (see Fig. 2) determines a maximum open idling position of the primary throttle valves 33. Engagement of screw 37 with the normal idle step 49 (see Fig. 3) determines a minimum open idling position of the primary throttle valves 33.

A fast idle cam control arm 51 is mounted on the end of the choke valve shaft 21 for rotation relative to the choke valve shaft. A link 53 connects arm 51 and the fast idle cam. Arm 51 has a finger 55 engageable with a tang 57 on an arm 59 fixed on the end of the choke valve shaft. The fast idle cam is overbalanced and hence gravity-biased to tend to swing clockwise as viewed in Fig. 2. When the choke valve opens, arm 59 rotates counterclockwise as viewed in Fig. 2. This permits the fast idle cam to swing clockwise under its gravity bias, arm 51 rotating counterclockwise and following the arm 59 around, whenever the primary throttle arm 35 is moved in opening direction thereby disengaging the screw 37 from the cam. The degree of rotation of the cam is dependent upon the degree of rotation of the choke valve shaft 21 and arms 59 and 51. The arrangement is such that when the choke valve is closed (Fig. 2), the starting step 47 of the cam is positioned for engagement by screw 37 on the primary throttle arm 35, and when the choke valve is fully open (Fig. 3), the normal idle step 49 is adapted to be positioned for engagement by the screw.

At 61 is indicated the secondary throttle shaft of the carburetor. This carries the usual pair of secondary throttle valves, one for each of the two secondary barrels, indicated at 63 in Figs. 2 and 3. As herein illustrated, the secondary throttle valves are adapted to be opened in response to opening of the primary throttle valves by mechanism such as indicated at 65 in Figs. 1 and 4. This mechanism includes a lever 67 mounted on the other end of the primary throttle shaft 31 from the primary throttle arm 35 and rotatable relative to the primary throttle shaft. Fixed to the primary throttle shaft 31 outward of lever 67 is a lever 69. Rotary on the primary throttle shaft between levers 67 and 69 is an arm 71 having a finger 73 engageable behind a finger 75 on lever 69 and having a finger 77 engageable behind a U-shaped portion 79 of lever 67 which receives the shaft 31. A torsion spring 81 surrounding shaft 31 in the U-shaped portion 79 of lever 67 has its ends hooked to fingers 75 and 77 to tend to hold fingers 73 and 75 in engagement. A link 83 connects lever 67 and a lever 85 fixed on the end of the

secondary throttle shaft 61. The latter is biased in secondary throttle closing direction (counterclockwise as viewed in Fig. 4) by a torsion spring 87 (see Fig. 1). Lever 85 has a finger 89 engageable with a stop 91 formed on fuel bowl section 3 to limit the movement of the secondary throttle valves in opening direction (clockwise as viewed in Fig. 4). Lever 85 also has a pad 93 engageable with an arm 95 on lever 69 to prevent opening of the secondary throttle valves until the primary throttle valves have been partially opened (for example, opened half-way) and arm 95 is moved clear of the pad. When the primary throttle valves are closed, finger 77 is spaced from portion 79 of lever 67 (see Fig. 4). As the primary throttles are opened, finger 77 moves around and engages portion 79 of lever 67 when the primary throttles are part-way opened (half-way open, for example), and as the opening of the primary throttle valves is completed, finger 77 drives lever 67 counterclockwise to pull the link 83 down and swing the lever 85 to open the secondary throttle valves.

At 97 in Figs. 2, 3 and 5 is indicated a latch for locking the secondary throttle valves against opening until the choke valve is fully open. This latch 97 is pivoted on pivot 43 along with the fast idle cam 41. It has a notch 99 in which is engageable a lug 101 extending from a member 103 fixed on the end of the secondary throttle shaft 61 adjacent the fast idle cam. The latch 97 is gravity biased to swing counterclockwise as viewed in Figs. 2 and 3 to latching position in which lug 101 is caught in the notch 99 (see Fig. 2) to prevent movement in opening direction (counterclockwise as viewed in Fig. 2) of the secondary throttle shaft 61. The fast idle cam has a finger 105 engageable with the latch 97 to swing it clockwise and downward away from its latching position of Fig. 2 to release lug 101 when the fast idle cam swings from its Fig. 2 to its Fig. 3 position. Finger 105 is also engageable upon return of the fast idle cam with a lug 107 formed on the latch member 97 to swing the latter back to latching position.

In accordance with this invention, the fast idle cam 41 is formed with a finger 109 adapted for engagement by a thermostatic element 111 carried by the primary throttle arm 35. Element 111 is constituted by a bimetallic blade which is riveted as indicated at 113 to an ear 115 formed on the arm 35. The blade 111 extends under the finger 109. The blade is responsive to temperature of air supplied to the carburetor. As shown in solid lines in Fig. 2, blade 111 when at a relatively high ambient air temperature is substantially straight and projects from arm 35 in such direction that, when the fast idle cam is in starting position and screw 37 on arm 35 is in engagement with the starting step 47 on the cam, the blade is spaced below and clear of the finger 109 to allow the fast idle cam to rotate clockwise as viewed in Fig. 2 without restriction away from starting position. If the ambient air temperature should be relatively low, however, as in cold weather, blade 111 bends up as illustrated in dotted lines in Fig. 2 into engagement with finger 109 to hold the fast idle cam against rotating clockwise away from its starting position. As the underhood temperature rises due to engine heat, blade 111 bends down away from the Fig. 2 dotted line position, thus permitting the cam to rotate away from its starting position to a degree dependent upon the degree of bending of the blade.

Operation is as follows:

Assuming that the weather is relatively warm so that it is relatively warm under the hood of the vehicle, the thermostatic blade 111 will occupy a position such as indicated in solid lines in Fig. 2 clear of the finger 109 on the fast idle cam. After the engine has been started and as it warms up, the automatic choke mechanism in housing 23 will open up the choke valve 19. As the choke valve opens, the fast idle cam swings from its starting position of Fig. 2, to its normal idle position of Fig. 3.

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Under these circumstances, the blade 111 does not interfere with the normal choke-controlled action of the cam.

Now, assuming that the weather is cold so that it is cold under the hood of the vehicle, the thermostatic blade 111 will occupy a position such as indicated in dotted lines in Fig. 2 bearing up against the finger 109 on the fast idle cam. After the engine has been started, and as it warms up, the automatic choke mechanism will open up the choke valve 19 as before. However, under these circumstances, blade 111, as long as it is cold, holds up the fast idle cam and prevents it from advancing. Thus, the starting step 47 of the cam remains in opposition to screw 37 to keep the primary throttle blocked open a maximum degree to provide the correct idle speed, even though the choke valve is open. It will be observed that the choke valve can open while the fast idle cam remains in starting position, due to the provision in the connection between the choke valve and the cam for the lost-motion between arm 55 and finger 57. Thus, opening of the choke valve without movement of the cam is permitted by reason of the fact that arm 59 (which is fast on the choke shaft) can rotate away from arm 57 (which is loose on the choke shaft). Ultimately, the underhood temperature rises due to engine heat, and blade 111 bends back to a condition such as indicated in solid lines in Figs. 2 and 3, in which it is clear of the finger 109 on the fast idle cam to permit the latter to swing all the way to its normal idle position of Fig. 3 for bringing the normal idle step 49 into opposition with the screw 37, also for releasing the secondary throttle latch 97.

It will also be observed that with the blade 111 mounted on the primary throttle arm 35, even if the underhood temperature is low and the blade is bent into the condition shown in dotted lines in Fig. 1, opening of the primary throttles (by swinging arm 35 clockwise from its Fig. 2 position) results in swinging of the blade 111 clear of the finger 109 on the fast idle cam. Accordingly, it is then possible for the cam to swing counter-clockwise from its starting position of Fig. 2 to a position such as shown in Fig. 3 to release the secondary throttle latch 97. Thus, the arrangement is such that there is no interference with the function of the fast idle cam to actuate the secondary throttle lockout.

Fig. 6 illustrates a modification which may be used where there is no problem of interference with a secondary throttle lockout, or if interference with the lockout is disregarded for the period required to bring up the underhood temperature in cold weather. The Fig. 6 modification is much the same as that of Figs. 1-5 except that the thermostatic blade, designated 121 in Fig. 6, instead of being mounted on the primary throttle arm, has one end fixed as indicated at 123 to a lug 125 on the fuel bowl section 3 of the carburetor. The other end of the blade reaches under the finger 109 on the fast idle cam 41. At relatively high ambient temperature, blade 121 is curved as illustrated in solid lines in Fig. 6 and projects in such direction as to allow the fast idle cam to swing to its normal idle position. However, if the temperature ambient to the carburetor is low, the blade 121 bends up as shown in dotted lines in Fig. 6 and holds the cam in starting position.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

We claim:

1. In a carburetor for an internal combustion engine, said carburetor having a mixture conduit, a choke valve and a throttle valve in said conduit, and means connected

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to the choke valve for limiting closing of the throttle valve at idle in accordance with engine temperature, thermostatic means responsive to temperature ambient to the carburetor for restricting the range of active positions of said position-controlling means at relatively low ambient temperatures independently of engine temperature and adapted upon increase of ambient temperature to release said position-controlling means.

2. In a carburetor for an internal combustion engine, said carburetor having a mixture conduit, a choke valve and a throttle valve in said conduit, a fast idle cam connected to the choke valve for limiting closing of the throttle valve at idle, and means responsive to engine temperature for controlling the position of said cam, thermostatic means responsive to temperature ambient to the carburetor for restricting the movement of said cam at relatively low ambient temperatures independently of engine temperature and adapted upon increase of ambient temperature to release said cam for response to engine temperature.

3. In a carburetor for an internal combustion engine, said carburetor having a throttle valve, a choke valve, and means controlled by the choke valve for limiting closing of the throttle valve at idle, thermostatic means responsive to temperature ambient to the carburetor for restricting the range of active positions of said position-controlling means at relatively low ambient temperatures independently of the choke valve and adapted upon increase of ambient temperature to release said position-controlling means for control by said choke valve.

4. In a carburetor for an internal combustion engine, said carburetor having a throttle valve, a choke valve, and a fast idle cam controlled by the choke valve for limiting closing of the throttle valve at idle, thermostatic means responsive to temperature ambient to the carburetor for restricting the movement of said cam at relatively low ambient temperatures independently of the choke valve and adapted upon increase of ambient temperature to release said cam for control by said choke valve.

5. In a carburetor for an internal combustion engine, said carburetor having a throttle valve, a choke valve, a fast idle cam for limiting closing of the throttle valve at idle, said cam being biased to move away from a starting position, and a connection between the choke valve and the cam adapted to hold the cam in starting position when the choke valve is closed, adapted to allow movement of the cam away from its starting position on opening of the choke valve, and adapted to allow movement of the choke valve independently of the cam, thermostatic means responsive to temperature ambient to the carburetor for restricting the movement of said cam at relatively low ambient temperatures independently of the choke valve and adapted upon increase of ambient temperature to release said cam for control by said choke valve.

6. A carburetor comprising a mixture conduit, a throttle in said mixture conduit, adjustable stop means for limiting the closing of said throttle, thermostat means substantially responsive to the temperature of air supplied to said mixture conduit, an operating connection between said thermostat means and said adjustable stop means tending to restrict the range of active positions of said adjustable stop at low air temperatures, and means responsive to movement of said throttle toward closed position to actuate said adjustable stop means.

7. A carburetor comprising a mixture conduit, a throttle valve and a choke valve in said mixture conduit, adjustable stop means for limiting the closing of said throttle, thermostat means responsive to engine operating temperatures to actuate said choke valve, a connection between said thermostat means and said stop means for limiting the closing of said throttle for operating said stop means into a range of active positions to increase engine idling speed by limiting the closing of said throttle when the engine is below normal operating temperature, a separate

thermostat means substantially responsive to the temperature of air supplied to said mixture conduit, and a connection between said separate thermostat means and said throttle limiting stop means operating to restrict the range of active positions of said throttle limiting stop means at low air temperatures.

8. A carburetor comprising a mixture conduit, a throttle valve and a choke valve in said mixture conduit, adjustable stop means for limiting the closing of said throttle, thermostat means responsive to engine operating temperatures to actuate said choke valve, a connection between said thermostat means and said stop means for limiting the closing of said throttle for operating said stop means into a range of active positions to increase engine idling speed by limiting the closing of said throttle when the engine is below normal operating temperatures, a separate thermostat means substantially responsive to the temperature of air supplied to said mixture conduit, an operating connection between said separate thermostat means and said throttle limiting stop means tending to restrict the range of active positions of said limiting stop means at low air temperatures, and means responsive to movement of said throttle toward closed position to actuate said stop means.

9. In a carburetor for an internal combustion engine, said carburetor having a throttle shaft, a throttle valve on said shaft, an arm on said shaft, and stop means engageable by said arm for limiting closing of said throttle valve at idle in accordance with engine temperature, thermostatic means responsive to temperature ambient to the carburetor for holding said stop means in an initial fast idle position at relatively low ambient temperatures independently of engine temperature and adapted at higher ambient temperatures to release said stop means, said thermostatic means comprising a part on said arm and a part on said stop means, the part on said arm being free to move with said arm in the direction away from the part on said stop means when said arm is moved to open the throttle valve.

10. In a carburetor for an internal combustion engine, said carburetor having a throttle shaft, a throttle valve on said shaft, an arm on said shaft, a fast idle cam engageable by said arm biased from fast idle position to normal idle position limiting closing of said throttle valve at idle, and means responsive to engine temperature for adjusting the position of said cam, thermostatic means responsive to temperature ambient to the carburetor for holding said cam in its fast idle position at relatively low ambient temperatures independently of engine temperature and adapted at higher ambient temperatures to release said cam for movement to its normal idle position, said thermostatic means comprising a thermostatic element carried by said arm, and a part on said cam engageable by the thermostatic element when the latter is cold, said thermostatic element being adapted to bend away from said part on being heated and being free to move with said arm away from said part when said arm is moved to open the throttle valve.

11. In a carburetor for an internal combustion engine, said carburetor having a throttle shaft, a throttle valve on said shaft, an arm on said shaft, a choke valve, and stop means actuated by the choke valve engageable by said arm for limiting closing of said throttle valve to between fast idle and normal idle positions, thermostatic means responsive to temperature ambient to the carburetor for holding said stop means in an initial fast idle position at relatively low ambient temperatures independently of the choke valve and adapted at higher ambient temperatures to release said stop means for control by said choke valve, said thermostatic means comprising a part on said arm and a part on said stop means, the part on said arm being free to move with said arm in the direction away from the part on said stop means when said arm is moved to open the throttle valve.

12. In a carburetor for an internal combustion engine,

said carburetor having a throttle shaft, a throttle valve on said shaft, an arm on said shaft, a choke valve, and a fast idle cam normally controlled by the choke valve engageable by said arm for limiting closing of said throttle valve at idle, thermostatic means responsive to temperature ambient to the carburetor for holding said cam in a fast idle starting position at relatively low ambient temperatures independently of the choke valve and adapted at higher temperatures to release said cam for control by said choke valve, said thermostatic means comprising a thermostatic element carried by said arm, and a part on said cam engageable by the thermostatic element when the latter is cold, said thermostatic element being adapted to bend away from said part on being heated and being free to move with said arm away from said part when said arm is moved to open the throttle valve.

13. In a carburetor for an internal combustion engine, said carburetor having a throttle shaft, a throttle valve on said shaft, an arm on said shaft, a choke valve, a fast idle cam engageable by said arm for limiting closing of the throttle valve at idle, said cam being biased to move away from a starting position, and a connection between the choke valve and the cam adapted to hold the cam in starting position when the choke valve is closed, adapted to allow movement of the cam away from its starting position on opening of the choke valve, and adapted to allow movement of the choke valve independently of the cam, thermostatic means responsive to temperature ambient to the carburetor for holding said cam in its starting position at relatively low ambient temperatures independently of the choke valve and adapted at higher ambient temperatures to release said cam for control by said choke valve, said thermostatic means comprising a thermostatic blade fixed at one end on said arm, and a part on said cam engageable by said blade when the latter is cold, said blade being adapted to bend away from said part on being heated and being free to move with said arm away from said part when said arm is moved to open the throttle valve.

14. In a carburetor for an internal combustion engine, said carburetor having a throttle shaft, a throttle valve on said shaft, an arm on said shaft, and means engageable by said arm for limiting closing of said throttle valve at idle in accordance with engine temperature, thermostatic means responsive to temperature ambient to the carburetor for holding said position-controlling means in an initial position at relatively low ambient temperatures independently of engine temperature and adapted at higher ambient temperatures to release said position-controlling means, said thermostatic means comprising a thermostatic element having one end fixed to the body of the carburetor and its other end engageable with said position-controlling means.

15. In a carburetor for an internal combustion engine, said carburetor having a throttle shaft, a throttle valve on said shaft, an arm on said shaft, a fast idle cam engageable by said arm for limiting closing of said throttle valve at idle, and means responsive to engine temperature for controlling the position of said cam, thermostatic means responsive to temperature ambient to the carburetor for holding said cam in its starting position at relatively low ambient temperatures independently of engine temperature and adapted at higher ambient temperatures to release said cam for response to engine temperature, said thermostatic means comprising a thermostatic element having one end fixed to the body of the carburetor and its other end engageable with said cam.

16. In a carburetor for an internal combustion engine, said carburetor having a throttle shaft, a throttle valve on said shaft, an arm on said shaft, a choke valve, and means controlled by the choke valve engageable by said arm for limiting closing of said throttle valve at idle, thermostatic means responsive to temperature ambient to the carburetor for holding said position-control-

ling means in an initial position at relatively low ambient temperatures independently of the choke valve and adapted at higher ambient temperatures to release said position-controlling means for control by said choke valve, said thermostatic means comprising a thermostatic element having one end fixed to the body of the carburetor and its other end engageable with said position-controlling means.

17. In a carburetor for an internal combustion engine, said carburetor having a throttle shaft, a throttle valve on said shaft, an arm on said shaft, a choke valve, and a fast idle cam controlled by the choke valve engageable by said arm for limiting closing of said throttle valve at idle, thermostatic means responsive to temperature ambient to the carburetor for holding said cam in its starting position at relatively low ambient temperatures independently of the choke valve and adapted at higher temperatures to release said cam for control by said choke valve, said thermostatic means comprising a thermostatic element having one end fixed to the body of the carburetor and its other end engageable with said cam.

18. In a carburetor for an internal combustion engine, said carburetor having a throttle shaft, a throttle valve on said shaft, an arm on said shaft, a choke valve, a fast idle cam engageable by said arm for limiting closing of the throttle valve at idle, said cam being biased to move away from a starting position, and a connection between the choke valve and the cam adapted to hold the cam in starting position when the choke valve is closed, adapted to allow movement of the cam away from its starting position on opening of the choke valve, and adapted to allow movement of the choke valve independently of the cam, thermostatic means responsive to temperature ambient to the carburetor for holding said cam in its starting position at relatively low ambient temperatures independently of the choke valve and adapted at higher ambient temperatures to release said cam for control by said choke valve, said thermostatic means comprising a thermostatic blade fixed at one end on the body of said carburetor and having its other end engageable with said cam.

19. In a multi-stage carburetor for an internal combustion engine, said carburetor having a primary throttle shaft, at least one primary throttle valve on said primary throttle shaft, an arm on said primary throttle shaft, a secondary throttle shaft, at least one secondary throttle valve on said secondary throttle shaft, a latch for locking the secondary throttle valve in closed position, a choke valve, and means controlled by the choke valve for releasing said latch and engageable by said arm for

controlling the position of the primary throttle valve at idle, thermostatic means responsive to temperature ambient to the carburetor for holding said choke-controlled means in an initial position at relatively low ambient temperatures independently of the choke valve and adapted at higher ambient temperatures to release said choke-valve-controlled means for control by said choke valve, said thermostatic means comprising a part on said arm and a part on said choke-valve-controlled means, the part on said arm being movable with said arm in the direction away from the part on said choke-valve-controlled means when said arm is moved to open the primary throttle valve thereby to allow said choke-valve-controlled means to release said latch though the ambient temperature may be low.

20. In a multi-stage carburetor for an internal combustion engine, said carburetor having a primary throttle shaft, at least one primary throttle valve on said primary throttle shaft, an arm on said primary throttle shaft, a secondary throttle shaft, at least one secondary throttle valve on said secondary throttle shaft, a latch for locking the secondary throttle valve in closed position, a choke valve, a fast idle cam engageable by said arm for controlling the position of the primary throttle valve at idle and also adapted to release said latch, said cam being biased to move away from a starting position, and a connection between the choke valve and the cam adapted to hold the cam in starting position when the choke valve is closed, adapted to allow movement of the cam away from its starting position on opening of the choke valve, and adapted to allow movement of the choke valve independently of the cam, thermostatic means responsive to temperature ambient to the carburetor for holding said cam in its starting position at relatively low ambient temperatures independently of the choke valve and adapted at higher ambient temperatures to release said cam for control by said choke valve, said thermostatic means comprising a thermostatic blade fixed at one end on said arm, and a part on said cam engageable by said blade when the latter is cold, said blade being adapted to bend away from said part on being heated and being movable with said arm away from said part when said arm is moved to open the primary throttle valve thereby to allow said cam to release said latch though the ambient temperature may be low.

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