

Jan. 31, 1961

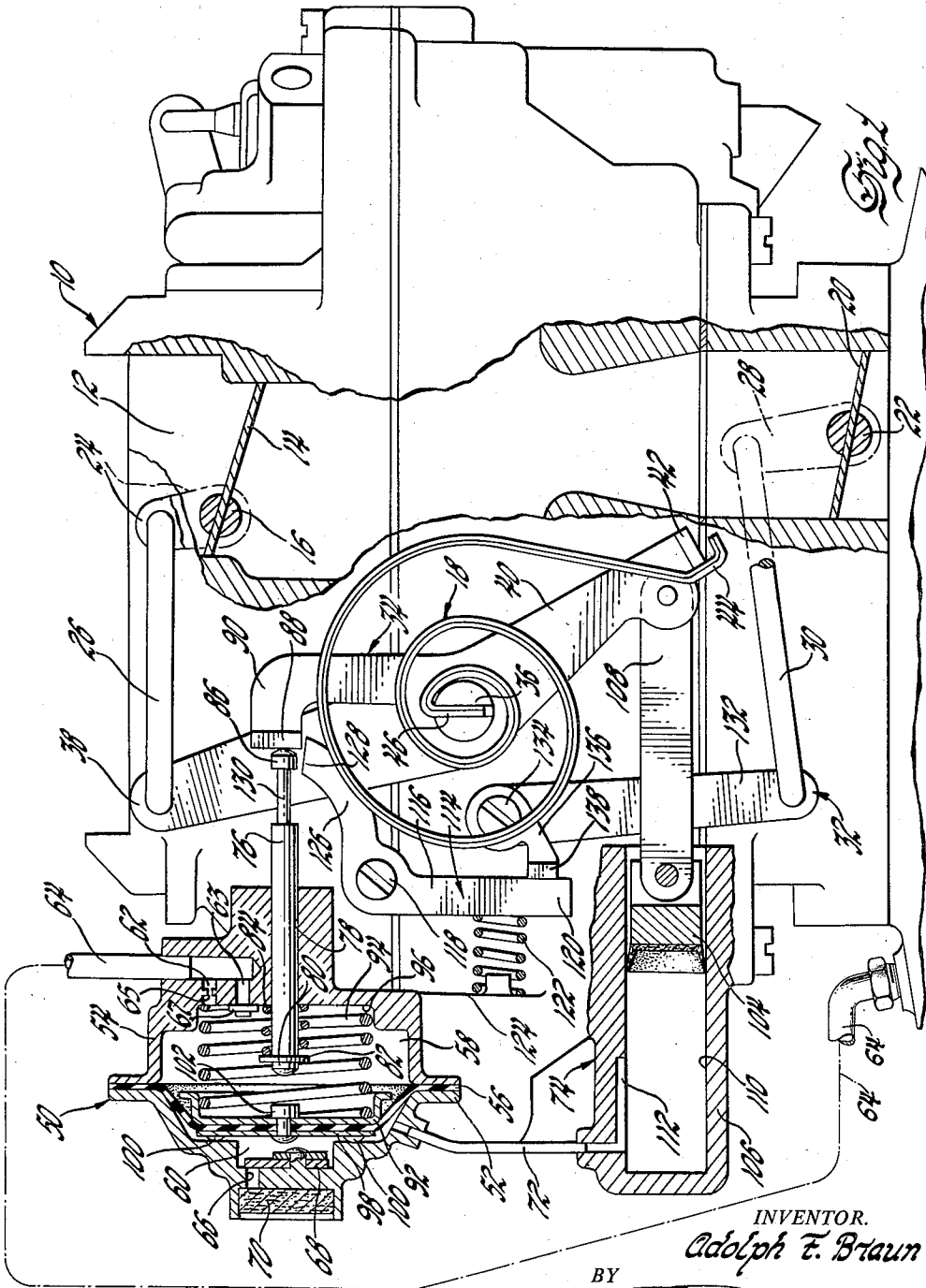
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CHOKES ACTUATING MECHANISM

Filed Aug. 13, 1958

2 Sheets-Sheet 1



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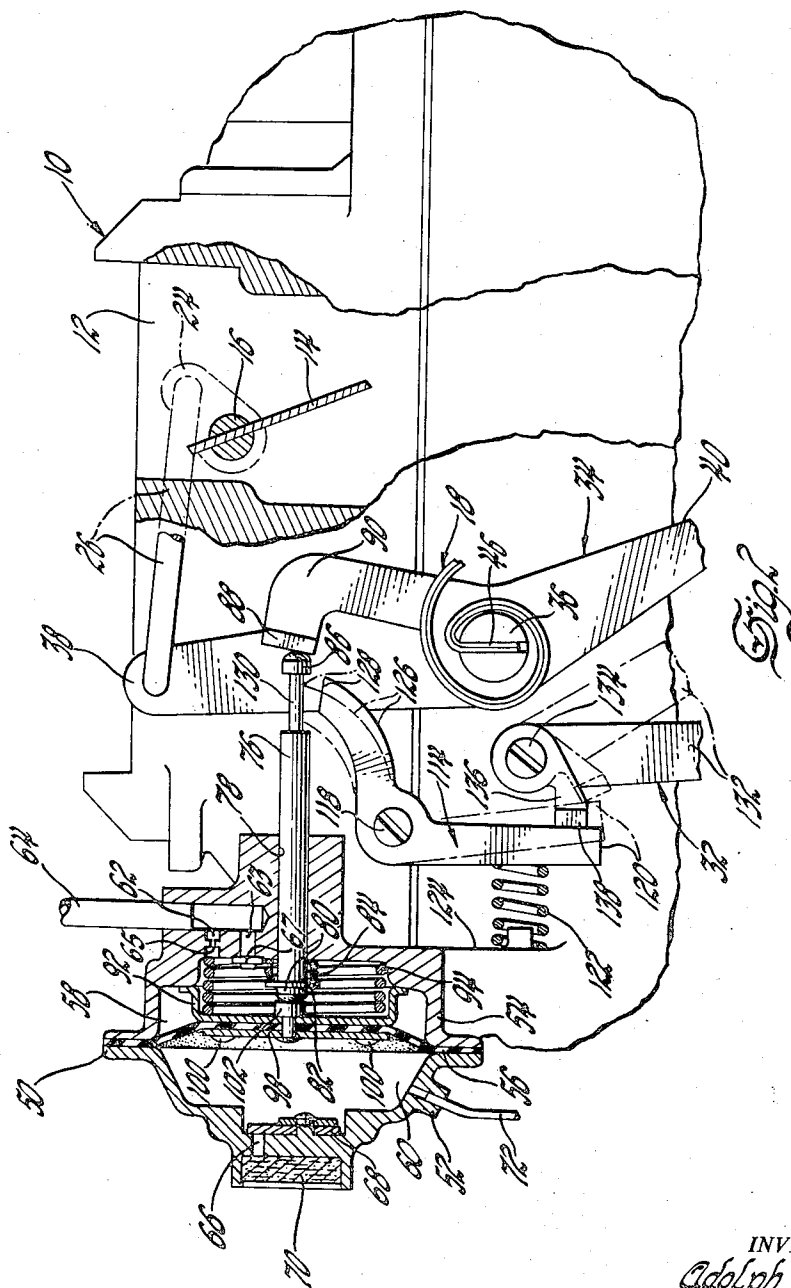
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CHOKE ACTUATING MECHANISM

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Filed Aug. 13, 1958, Ser. No. 754,841

12 Claims. (Cl. 123—119)

The present invention relates to an actuating mechanism in which the choke valve is moved toward a closed position during accelerating or high load operating conditions when the engine is only partially warm. In addition to providing means for moving the choke valve in a closed or enriching direction, the present device includes a throttle controlled latching mechanism for preventing the choke from being fully closed and thereby preventing overenrichment.

In order to improve the economy of carburetor operation, it has been found that except for certain limited operating conditions it is possible to take off or open a choke valve more rapidly than has been done in the past. The result of rapid choke valve come-off is a leaner and more economical fuel-air mixture. However, it is not enough to simply set an automatic choke operating mechanism for leaner operation since there are certain operating conditions under which a partially warmed engine will not function properly on a lean mixture when overloaded. In other words, shortly after an engine has been started and during steady-state operation, e.g. one in which the engine is only lightly or gradually loaded, it is possible to open the choke valve and operate on a relatively lean mixture. However, with the engine only partially warmed and the choke essentially fully open, a sudden loading of the engine as occurs during accelerating conditions will cause the engine to falter due to a too lean fuel-air mixture.

In the present invention a choke controlling mechanism is provided in which the choke is adapted to open and rapidly lean out the fuel-air mixture shortly after starting to increase fuel economy under conditions which have in the past used excessive fuel to cover a few operating contingencies. However, in addition the present choke actuating mechanism includes a device which is adapted to automatically return the choke to a partially closed position when a partially warmed engine is suddenly heavily loaded. In this way the fuel-air mixture is momentarily enriched to accommodate the increased engine load and the engine will continue to function smoothly. After a predetermined time interval the choke valve will again resume its open position returning the carburetor to its most economical type of operation.

An important feature of the present choke actuating mechanism is the provision of the throttle control means for insuring that the choke valve is prevented from closing to too great an extent whereby overenrichment and equally objectionable rough engine operation is avoided.

More specifically, the present invention includes a vacuum actuated servo device which is adapted after the engine becomes operative to crack open the choke valve to thereby partially lean out the fuel-air mixture beyond that required for initial starting. The present choke actuating mechanism includes a temperature responsive coil adapted to maintain the choke valve in a closed position with a force inversely proportional to engine temperature and further which choke valve is unbalanced so as

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to be opened in accordance with the quantity of air flow through the induction passage.

In addition, the choke actuating mechanism includes a pressure responsive device operable in conjunction with the vacuum actuated servo device to momentarily close the choke valve when the load on the engine increases beyond a predetermined value causing a corresponding drop in manifold vacuum. This choke closing mechanism also includes means for rendering itself inoperative after the choke valve has opened beyond a predetermined extent. The desirability of this feature is apparent when it is realized that after the engine has warmed sufficiently it is unnecessary to cover the engine operation by partial closing of the choke valve and as a matter of fact such chocking operation with a fully warmed engine would be detrimental in terms of loss of power and economy.

Finally the present choke actuating mechanism also includes a throttle controlled mechanism operating in conjunction with the vacuum servo and pressure responsive devices for preventing the temperature responsive element from moving the choke valve to a fully closed position.

The details as well as other objects and advantages of the present invention will be apparent from a perusal of the description which follows.

In the drawings:

Figure 1 is a diagrammatic representation of the subject choke actuating mechanism; and

Figure 2 is a partial view of Figure 1 showing the parts in position when engine becomes operative.

The present choke actuating mechanism is adapted for use with any carburetor employing what may be termed an automatic type choke. For the purposes of the present invention, an automatic choke mechanism may be considered to include a choke valve whose operation is automatically controlled in accordance with certain engine operating conditions such as temperature and air flow. As suggested, any type of carburetor, such as that shown in Patent 2,771,282 Olson et al., may be used in conjunction with the present type choke actuating mechanism and the carburetor does not, per se, constitute a part of the present invention except insofar as elements thereof are combined with such mechanism. For illustrative purposes a carburetor is schematically shown at 10 and includes an air induction passage 12 which is adapted to supply air to the intake manifold of an internal combustion engine. A choke valve 14 is pivotally supported on a shaft 16 within induction passage 12 and is adapted to be actuated in order to vary the fuel-air ratio in accordance with certain engine operating conditions. Choke valve 14 is of the unbalanced type such that air flow through induction passage 12 tends to move the choke valve in an opening direction.

The opening movement of choke valve 14 is resisted by a temperature responsive coil element 18 with a force which is inversely proportional to engine temperature. Coil 18 is a part of the choke actuating mechanism and will be considered subsequently in greater detail.

A throttle valve 20 is also pivotally mounted within induction passage 12 upon a shaft 22 and is adapted to be suitably connected to an accelerator pedal to control the quantity of fuel-air mixture supplied to the engine.

Choke valve 14 includes a lever 24 fixed to shaft 16 and to which lever one end of a rod 26 is articulated. Similarly, a lever 28 is fixed to throttle shaft 22 and also has one end of a rod 30 articulated thereto. The other ends of rods 26 and 30 are respectively articulated to parts of a choke actuating mechanism indicated generally at 32 and the details of which will now be considered.

Choke actuating mechanism 32 includes a first bifurcated lever 34 which is pivotally mounted upon pivot shaft 36 supported upon carburetor 10. Also fixed to

lever 34, or integrally formed therewith, is a lever 38 articulated at its free end to choke controlling rod 26. Arm 40 of bifurcated lever 34 includes an offset tang 42 formed at one end thereof and which is adapted to be engaged by the free end 44 of thermostatic coil 18. The other end 46 of coil 18 is anchored to pivot shaft 36. Coil 18 is so constructed as to urge levers 34 and 38 in a counterclockwise, or choke valve closing, direction as temperature decreases.

Choke actuating mechanism 32 includes a servo device indicated generally at 50 and having a pair of casing members 52 and 54 peripherally clamping a flexible diaphragm 56 therebetween. Diaphragm 56 coacts with casing members 52 and 54 to provide chambers 58 and 60. Chamber 58 communicates through passages 62 and 63 with a conduit 64 which in turn connects with a source of engine manifold vacuum. Passage 62 has an orifice 65 disposed therein to limit the rate of opening of choke valve 14 as will subsequently be considered in greater detail. A flapper or reed type valve 67 is disposed in chamber 58 and is normally closed by manifold vacuum in conduit 64 preventing air from being evacuated from chamber 58 through passage 63.

Chamber 60 includes an atmospheric passage 66 controlled by a reed type valve 68 adapted to admit air under atmospheric pressure to the chamber as diaphragm 56 moves to the right. A filter 70 is provided at the inlet of passage 66.

In addition, chamber 60 communicates with a second passage 72 formed in casing 52 which is adapted to deliver air under slightly superatmospheric pressure to a second servo device indicated generally at 74. The details of servo device 74 will be considered subsequently.

A control rod 76 is slidably supported within an axial passage 78 formed in servo casing 54. End 80 of rod 76 is disposed within chamber 58 and includes a washer member 82 fixed thereto to provide a seat for a spring member 84. The other end of spring 84 biases against casing 54 to urge rod 76 in a leftwardly direction as shown in Figure 1. The other end 86 of rod 76 is axially aligned with a tang 88 formed at the end of arm 90 of bifurcated lever 34.

Diaphragm 56 includes a dish-shaped washer member 92 mounted centrally thereon and which provides a seat for one end of a spring 94. The other end of spring 94 seats within a counterbored portion 96 of casing 54. Spring 94 normally biases the diaphragm in a leftwardly direction whereby the diaphragm abuts against casing 52. A reinforcing washer 98 is similarly centrally mounted upon diaphragm 56 and includes a plurality of circumferentially spaced projections 100 which slightly space the diaphragm away from the casing to maintain communication between chamber 60 and passage 72 when the diaphragm is in the position shown in Figure 1.

Referring specifically to Figure 1, the parts are in the position which they assume when the engine is inoperative and cold. Under these conditions it will be apparent that thermostatic coil 18 will maintain choke valve 14 in a closed position insuring a rich starting mixture.

As soon as the engine starts, manifold vacuum will be supplied through conduit 64 to chamber 58 moving diaphragm 56 to the right at a rate determined by orifice 65, as shown in Figure 2, in which circumstance abutment 102 on diaphragm 56 will engage end 80 of rod 76 to move the rod to the right against the force of spring 84. In so moving, end 86 of the rod will engage tang 88 of arm 90 rotating levers 34 and 38 in a clockwise direction to partially open choke 14. This actuation of diaphragm 56 opens the choke valve approximately 20° from its closed position and insures a leaning out of the fuel-air mixture commensurate with the cold running requirements of the engine. It is apparent that this leaning out of the fuel-air mixture is necessary since, under any conditions, it requires less enrichment to run the engine than is required for starting purposes. Orifice 65

in passage 62 will be of a size determined by the operating characteristics of the particular engine involved, but at any rate will limit the choke opening rate to a value which will preclude stalling the engine due to a too lean fuel-air ratio.

As previously mentioned, choke actuating mechanism 32 is designed for the purpose of providing more economical carburetor operation during the warm-up period. Accordingly, thermostatic coil 18 is adapted to wind in a clockwise direction rather rapidly as the engine begins to warm causing the free end 44 thereof to move away from arm tang 42 and permitting air flow through the induction passage 12 to open choke valve 14. While this fast opening choke operation is desirable for steady-rate operation, it is found that while the engine is still not fully warmed the rapid come-off of the choke valve may cause operating difficulties when the engine is subjected to severe loads as may occur during acceleration conditions or when climbing a hill. In order to insure that the engine will not stumble under such high load operating conditions, a choke closing or kicker device 74 is provided.

Kicker device 74 comprises a piston member 104 slidably mounted within cylindrical casing 106. Piston 104 is articulated to arm 40 of lever 34 through a link 108. Piston cylinder 110 communicates with passage 72 which, as already noted, communicates at its other end with servo chamber 60. The operation of the kicker device 74 is as follows: when the manifold vacuum reaches a sufficiently high value to draw diaphragm 56 to the right, as shown in Figure 1, atmospheric air will be drawn into chamber 60 past valve 68. With the engine only partially warm and choke valve 14 only partially opened, a sudden increase in load on the engine, as would occur during accelerating conditions, causes the manifold vacuum in chamber 58 to drop below a predetermined value, e.g. 6 inches of mercury, permitting spring 94 to move the diaphragm to the left. In so moving valve 68 is closed thereby increasing the pressure of the air trapped in chamber 60 to a slightly superatmospheric value. The air under pressure is conveyed through passage 72 to piston cylinder 110 causing piston 104 to be moved to the right. This piston movement rotates levers 34 and 38 in a counterclockwise direction and moves choke valve 14 in a closing direction. In this way the fuel-air mixture is temporarily enriched to provide the requisite power under the increased engine load conditions.

During accelerating conditions as just noted, the pressure in conduit 64 is substantially atmospheric, accordingly, the leftward movement of diaphragm 56 by spring 94 will open flapper valve 67 so as not to limit the closing action of choke 14 as would otherwise occur because of orifice 65 in passage 62.

In order that kicker or choke closing device 74 be rendered inoperative after the choke has opened beyond a predetermined amount indicating a fully warmed engine, a relieved portion 112 is provided in piston cylinder casing 106. After the choke valve has been opened sufficiently to move piston 104 into adjacent relationship to relieved portion 112, any pressure in passage 72 will be communicated with both sides of the piston thereby rendering the same ineffective to move the choke valve in a closing direction.

While it is desired to move the choke valve in a closing direction under the high load conditions with a partially warmed engine as just described, it is undesirable that the choke valve be moved to a fully closed position. Accordingly, a throttle controlled latch mechanism is provided and indicated generally at 114. Mechanism 114 comprises a bell crank type lever 116 pivotally mounted on a shaft 118. Arm 120 of lever 116 is adapted to be engaged by one end of a spring element 122, the other end of which is supported upon a seat 124. Spring 122 normally urges the lever 116 in a counterclockwise direction. Arm 126 of lever 116 includes an end portion 128

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adapted to coact with a circumferentially relieved portion 130 formed on rod 76 when the rod is moved by diaphragm 56 to its choke valve opening position as shown in Figure 2.

A lever 132 is pivotally mounted on a shaft 134 and includes an arm 136 having a tang 138 adapted to coact with arm 120 of lever 116. The other end of lever 132 is articulated to throttle control rod 30. When the throttle is in a closed position, as shown in Figure 1, lever 132 is adapted to rotate bifurcated lever 114 in a clockwise direction moving end 128 of arm 126 out of engagement with notch 130 in control rod 76.

With the engine running, rod 76 will be in its rightward position as shown in Figure 2. If then the throttle is opened to increase engine speed, lever 132 will be rotated in a counterclockwise direction moving tang 138 away from arm 120 of lever 114 permitting spring 122 to rotate the lever in a counterclockwise direction and thereby moving arm portion 128 into engagement with rod notch 130. This operation then locks control rod 76 in its choke cracking position. Thus, even though the manifold vacuum in chamber 58 drops below said predetermined value causing spring 94 to move diaphragm 56 to the left and thereby to move the piston 104 causing the choke valve to be moved in a closing direction, tang 88 of lever 34 will engage end 86 of rod 76 preventing the choke valve from being fully closed. In this way overenrichment due to complete closing of the choke is avoided.

When the throttle is returned to its closed position lever 114 will again be moved out of locking relationship with rod 76 and movement of the rod will again be under the control of diaphragm 56 and spring 84.

In summary, it will be seen that a choke controlling mechanism is provided which will insure a rapid come-off or opening of the choke valve for providing for maximum economy of operation and which mechanism further provides means for temporarily moving the choke valve toward a closed position when the engine is only partially warmed and subjected to high load conditions. Finally, such mechanism provides throttle controlled means for preventing the choke from being closed to too great an extent during the aforesaid high load operating conditions insuring against overenrichment.

It is apparent that various structural modifications may be made within the scope of the invention as set forth in the hereinafter appended claims.

I claim:

1. A charge forming device for an internal combustion engine comprising an induction passage, a throttle valve rotatably disposed in said passage, a choke valve rotatably mounted in said passage, a temperature responsive element operatively connected to said choke valve and adapted to urge the same in a closing direction with a force inversely proportional to engine temperature, a first servo mechanism adapted to move said choke valve to a partially opened position when said engine becomes operative, a second servo device operatively connected to said choke valve and adapted to move said choke valve in a closing direction when the load on said engine exceeds a predetermined value, and a throttle controlled device adapted to coact with said choke valve to prevent said second servo device from moving said choke valve to a fully closed position.

2. A charge forming device for an internal combustion engine comprising an induction passage, a throttle valve rotatably mounted within said induction passage, an air flow responsive choke valve disposed in said induction passage anteriorly of said throttle valve, a temperature responsive element operatively connected to said choke valve and adapted to urge the same in a closing direction with a force inversely proportional to engine temperature, an engine manifold vacuum responsive servo mechanism adapted to coact with said choke valve to move the latter to a partially open position when said manifold vacuum exceeds a predetermined value, a throttle con-

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trolled lever mechanism adapted to coact with said servo mechanism to prevent said choke valve from being moved to a fully closed position, and a second servo device coacting with said first servo device to move the choke valve in a closing direction when manifold vacuum falls below a predetermined value.

3. A charge forming device for an internal combustion engine comprising an induction passage, a throttle valve rotatably mounted within said induction passage, an air flow responsive choke valve disposed in said induction passage anteriorly of said throttle valve, a temperature responsive element operatively connected to said choke valve and adapted to urge the same in a closing direction with a force inversely proportional to engine temperature, an engine manifold vacuum responsive servo mechanism including a diaphragm, a control rod and spring means adapted to maintain said rod out of operative engagement with the choke valve, said diaphragm being adapted to engage said rod to move the choke valve to a partially open position when manifold vacuum exceeds a predetermined value, a throttle controlled lever mechanism adapted to coact with said servo mechanism to prevent said choke valve from being moved to a fully closed position, and a second servo device operable by said first servo device to move the choke valve in a closing direction when manifold vacuum falls below a predetermined value.

4. A charge forming device as set forth in claim 3 in which the throttle controlled mechanism includes a pivotally mounted lever having one end adapted to lockingly engage the control rod to limit the closing movement of the choke valve by the second servo device.

5. A charge forming device for an internal combustion engine comprising an induction passage, a throttle valve rotatably mounted within said induction passage, an air flow responsive choke valve disposed in said induction passage anteriorly of said throttle valve and adapted to be moved in an opening direction by air flow through said induction passage, and a choke valve actuating mechanism comprising first lever means articulated to said choke valve, a temperature responsive element connected to said first lever means and adapted to rotate the same to urge said choke valve in a closing direction with a force inversely proportional to engine temperature, a manifold vacuum responsive servo device adapted to coact with said first lever means to move said choke valve to a partially open position when manifold vacuum exceeds a predetermined value, a second lever means articulated to said throttle valve, said second lever means adapted to coact with said servo device to prevent the choke valve from being fully closed when said throttle valve is moved to a partially open position, and a second servo device operatively connected to said first lever means and coacting with said first servo means to move said choke valve in a closing direction when manifold vacuum decreases beyond a predetermined value.

6. A charge forming device for an internal combustion engine comprising an induction passage, a throttle valve rotatably mounted within said induction passage, a choke valve disposed in said induction passage anteriorly of said throttle valve, and a choke valve actuating mechanism comprising first lever means articulated to said choke valve, a temperature responsive element connected to said first lever means and adapted to rotate the same to urge said choke valve in a closing direction with a force inversely proportional to engine temperature, a manifold vacuum responsive servo device adapted to coact with said first lever means to move said choke valve to a partially open position when manifold vacuum exceeds a predetermined value, a second lever means articulated to said throttle valve, said second lever means adapted to coact with said servo device to prevent the choke valve from being fully closed when said throttle valve is moved to a partially open position, and a second servo device operatively connected to said first lever means and coact-

ing with said first servo means to move said choke valve in a closing direction when manifold vacuum decreases beyond a predetermined value.

7. A charge forming device for an internal combustion engine comprising an induction passage, a throttle valve rotatably mounted within said induction passage, an air flow responsive choke valve disposed in said induction passage anteriorly of said throttle valve and adapted to be moved in an opening direction by air flow through said induction passage, and a choke valve actuating mechanism comprising first lever means articulated to said choke valve, a temperature responsive element connected to said first lever means and adapted to rotate the same to urge said choke valve in a closing direction with a force inversely proportional to engine temperature, a manifold vacuum responsive servo device including a diaphragm, a control rod, and spring means adapted to maintain said rod out of operative engagement with the choke valve, said diaphragm being adapted to engage said rod to move into engagement with the first lever means to partially open the choke valve when manifold vacuum exceeds a predetermined value, a second lever means articulated to said throttle valve, said second lever means adapted to coact with said control rod to prevent the choke valve from being fully closed when said throttle valve is moved to a partially open position, and a second servo device operatively connected to said first lever means and operable by said first servo means to move said choke valve in a closing direction when manifold vacuum decreases beyond a predetermined value.

8. A charge forming device as set forth in claim 3 in which said second servo device comprises a cylinder, a piston slidably disposed in said cylinder, link means operatively connecting said piston to said choke valve, a conduit connecting said first servo device and said cylinder

whereby said spring means will move the diaphragm in a direction causing superatmospheric pressure air to be transmitted through said conduit to move said piston in a choke closing direction.

9. A charge forming device as set forth in claim 8 in which said second servo device includes means for rendering such device inoperative when the choke valve is opened beyond a predetermined amount.

10. A charge forming device as set forth in claim 9 in which said means for rendering the second servo device inoperative comprises a passage formed in said cylinder, said passage communicating with said conduit to admit the superatmospheric pressure air to both sides of said piston after the latter has moved beyond a predetermined position within said cylinder.

11. A charge forming device as set forth in claim 2 in which the engine manifold vacuum responsive servo mechanism includes a flexible diaphragm, conduit means adapted to communicate manifold vacuum with said diaphragm and passage means intermediate the conduit means and the diaphragm to provide relatively slow movement of the diaphragm in the choke opening direction and fast movement in the opposite direction.

12. A charge forming device as set forth in claim 11 in which the passage means includes a first passage having an orifice therein, a second unrestricted passage and a valve member associated with the second passage, manifold vacuum normally closing said valve to prevent flow through the second passage.

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