

May 7, 1968

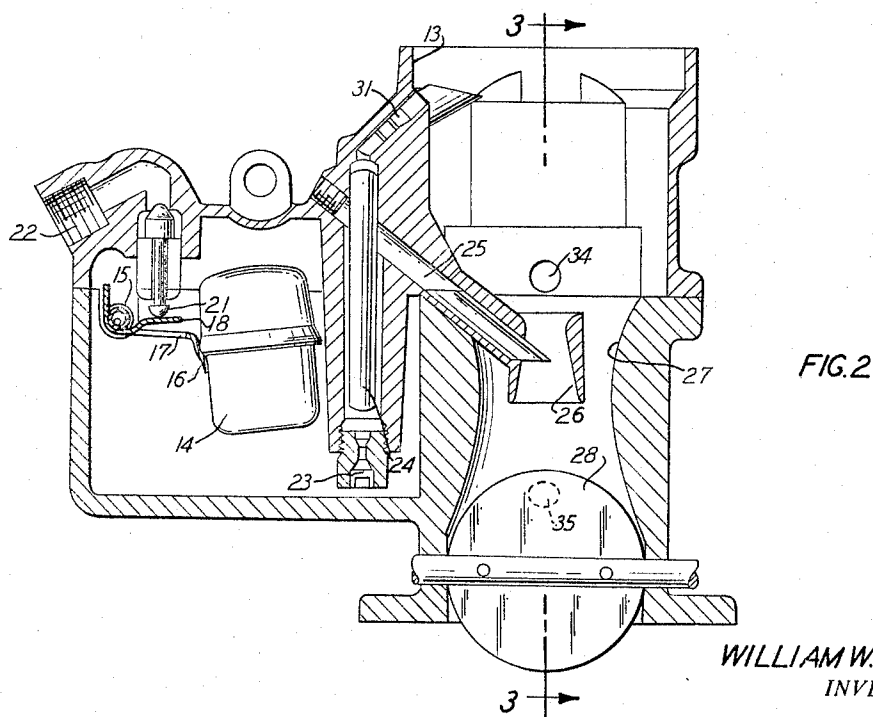
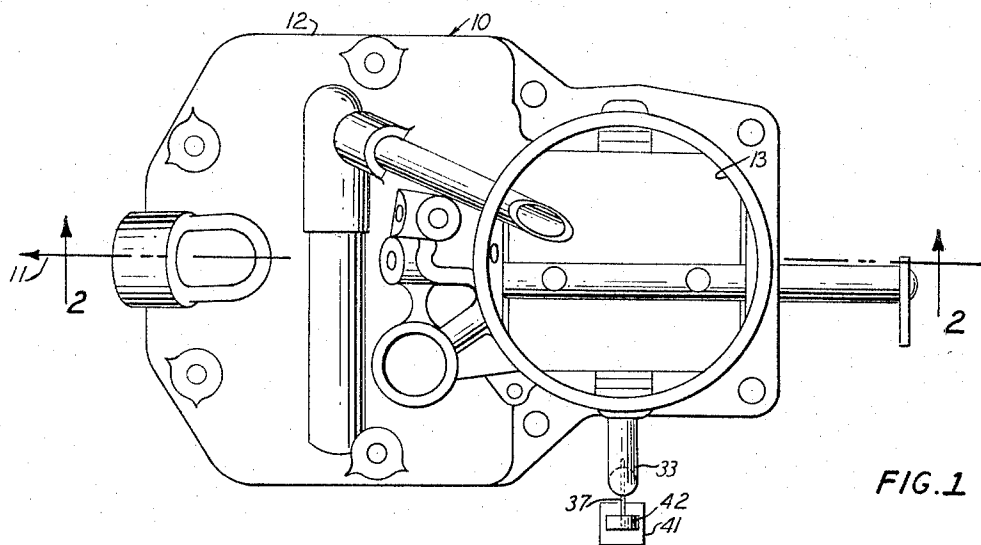
W. W. CHARRON

3,381,945

INERTIA SENSING CARBURETOR METERING CONTROL

Filed June 22, 1966

2 Sheets-Sheet 1



WILLIAM W. CHARRON
INVENTOR.

BY *John R. Faulkner*
Keith L. Zerschling
ATTORNEYS

May 7, 1968

W. W. CHARRON

3,381,945

INERTIA SENSING CARBURETOR METERING CONTROL

Filed June 22, 1966

2 Sheets-Sheet 2

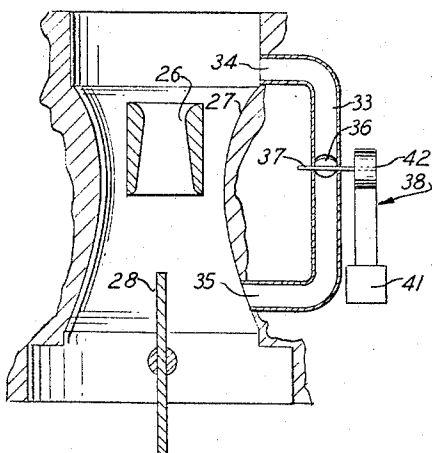


FIG. 3

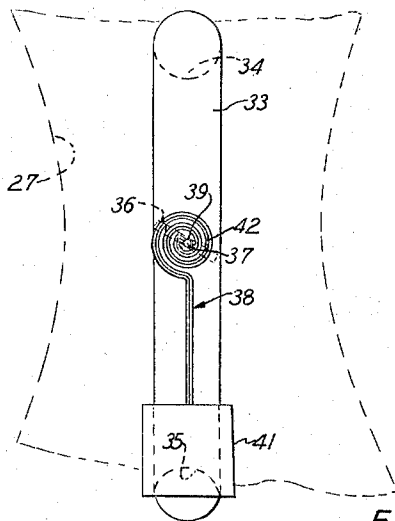


FIG. 4

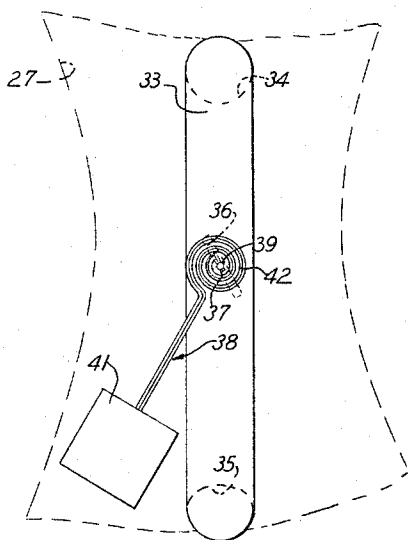


FIG. 6

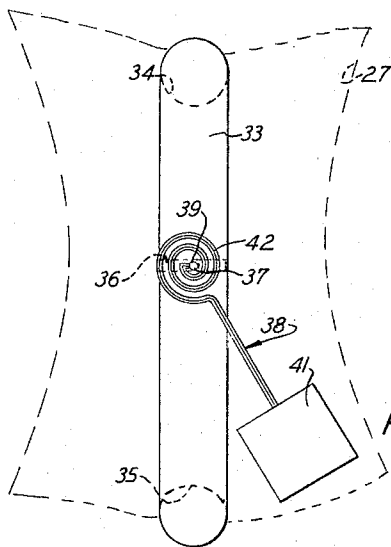


FIG. 5

WILLIAM W. CHARRON
INVENTOR.

BY *John R. Faulkner*
Kurt L. Zerschling
ATTORNEYS

1

3,381,945

INERTIA SENSING CARBURETOR METERING CONTROL

William W. Charron, Livonia, Mich., assignor to Ford Motor Company, Dearborn, Mich., a corporation of Delaware

Filed June 22, 1966, Ser. No. 559,464

3 Claims. (Cl. 261—39)

ABSTRACT OF THE DISCLOSURE

A carburetor for an internal combustion engine having an inertia sensing carburetor metering control in which the fuel-air ratio supplied by a carburetor is continuously increased as a direct function of vehicle acceleration and is continuously decreased as a function of increasing vehicle deceleration and including means in which the fuel-air ratio may be increased by means included in the same control during decreasing ambient temperatures and may be decreased during increasing ambient temperatures, respectively.

This is accomplished by providing an air bypass passage positioned so that it has an entrance above the main and booster venturi and an exit just above the throttle plate. A movable butterfly valve attached to a rotatable shaft is positioned in the bypass passage and it is operated by a weighted pendulum suspended from the shaft external to the carburetor. Additionally, the pendulum arm, that is, the arm that connects the butterfly valve with the weighted pendulum is constructed of a bimetallic material which deflects as a function of changes in environmental temperatures.

This invention relates to an inertia sensing carburetor metering control in which the fuel-air ratio supplied by a carburetor to an internal combustion engine is continuously increased as a direct function of increasing vehicle acceleration and is continuously decreased as a direct function of increasing vehicle deceleration. The fuel-air ratio may also be increased by means included in this same control during decreasing ambient temperatures and may be decreased during increasing ambient temperatures.

In conventional carburetors for internal combustion engines, a two-stage metering system is ordinarily provided to control fuel flow from the discharge nozzle at part throttle and wide open throttle. The fuel flow is normally metered through a main jet at part throttle and then is supplemented with additional fuel through a manifold vacuum sensing valve which opens at any time the vacuum falls below a predetermined level. This added enrichment is required to provide the optimum fuel-air ratio for maximum power. The leaner part throttle mixture provides a compromise fuel-air ratio for both economy and power.

The vacuum operated enrichment valve referred to above is usually of an on-off type and is correlated to engine vacuum only. It does not, therefore, provide the continuously variable type of enrichment which would provide an optimum fuel-air ratio as the vehicle accelerates and decelerates. Furthermore, this on-off type power enrichment valve under certain conditions fails to provide the proper incremental enrichment when it is required, and it often adds excess fuel to the engine when such fuel is not required.

The present invention represents an improvement over the above-described system in that it controls enrichment of the main metering system by bypassing a varying amount of air around the main venturi in the carburetor as a function of various rates of acceleration and deceleration of the vehicle. This has the effect of altering or varying the pressure signal at the main discharge nozzle which

2

is located to sense the vacuum signal present in the venturi of a carburetor.

In the preferred embodiment of the invention, an air bypass passage is positioned so that it has an entrance above the main and the booster venturi of a carburetor or just under the choke plate and has an exit just above the throttle valve. This bypass passage therefore shunts air around the booster and main venturi. A movable butterfly valve which is attached to a rotating shaft is positioned in the bypass passage. A weighted pendulum is suspended from the shaft external to the carburetor. Under normal road load conditions, when the vehicle is neither accelerating or decelerating, this pendulum or weight orients the valve in the bypass passage to a preset position thereby allowing a predetermined quantity of air to bypass the venturi. Should the vehicle accelerate, the pendulum will move toward the rear of the vehicle due to its inertia. The butterfly valve, its shaft and the pendulum weight are so arranged in the vehicle that this will close the butterfly valve and reduce the bypassed air. This not only reduces the amount of air supplied to the engine but it also increases the vacuum signal present at the main and booster venturi. As a result, the fuel-air ratio will increase as a continuous function of the acceleration of the vehicle.

It can be appreciated also that the pendulum weight is responsive to changes in attitude of the vehicle so that when the vehicle is ascending a grade, the pendulum weight will act to close off or reduce the amount of air flowing through the bypass passage thereby increasing the fuel-air ratio at a desired rate.

Conversely, when the vehicle is decelerating or descending a steep grade, the pendulum weight and the butterfly valve positioned in the bypass passage will move in the opposite direction thereby increasing the bypassed air flow around the venturi and reducing the vacuum signal present at the carburetor venturi and the fuel-air ratio.

The valve opening of the butterfly valve positioned in the bypass air passage is established through calibrations at road load to provide satisfactory drivability of the vehicle, including satisfactory economy and power at these road load conditions.

An additional feature of the invention provides satisfactory drivability and a satisfactory fuel-air ratio at all environmental temperatures. This is done by constructing the pendulum arm, that is, the arm that connects the butterfly valve in the bypass air passage with the pendulum weight, of a bimetallic material which deflects as a function of changes in environmental temperatures. The deflection of the bimetallic material will cause a change in orientation between the butterfly valve positioned in the bypass passage and the equilibrium position of the pendulum weight to provide an enriched or increased fuel-air ratio at low ambient temperatures and a leaner or decreased fuel-air ratio at higher ambient temperatures.

An object of the present invention is the provision of a carburetor for an internal combustion engine that provides a continuously variable fuel-air ratio as a function of the acceleration and deceleration of the vehicle in which the carburetor is mounted.

A further object of the invention is the provision of an inertia operated mechanism which provides a continuously variable fuel-air ratio as a function of the acceleration and deceleration of the vehicle in which the carburetor is mounted.

Another object of the invention is the provision of an inertia operated mechanism which provides a continuously variable fuel-air ratio as a function of the acceleration and deceleration of the vehicle in which the carburetor is mounted and in which this mechanism in-

cludes means for altering the fuel-air ratio in accordance with environmental temperatures.

Other objects and attendant advantages of the present invention may be more readily realized as the specification is considered in connection with the attached drawings in which:

FIGURE 1 is a top plan view of the carburetor in which the present invention may be mounted;

FIGURE 2 is a sectional view taken along the lines 2—2 of FIGURE 1;

FIGURE 3 is a sectional view taken along the lines 3—3 of FIGURE 2;

FIGURE 4 is a partial side elevational view, partially in section, showing the position of the inertia sensing carburetor metering control of the present invention when the vehicle is operating under road load conditions;

FIGURE 5 is a view similar to FIGURE 4, but showing the inertia sensing carburetor metering control of the present invention in a position during acceleration of the vehicle in which the present invention is mounted, and

FIGURE 6 is a view similar to FIGURE 4, but showing the inertia sensing carburetor metering control of the present invention in a position that it occupies during deceleration conditions of the vehicle in which the present invention is mounted.

Referring now to the drawings in which like reference numerals designate like parts throughout the several views thereof, there is shown in FIGURE 1 a carburetor 10 which is mounted in an automotive vehicle such that a line 11 parallel to the longitudinal axis of the vehicle extends through the carburetor as shown, and the direction of forward movement of the vehicle in which the carburetor 10 has a fuel bowl 12 that is positioned forwardly along the line 11 from the air induction passage or horn 13.

Referring now to FIGURE 2, the fuel bowl is provided with a float 14 that is mounted on a conventional float shaft 15. A supporting arm 16 for the float 14 is affixed to the float and is nonrotatably attached to the shaft 15 by conventional means. The central portion 17 of the supporting arm 16 has a struck-up tab 18 that engages a fuel bowl inlet valve 21 positioned in the fuel inlet passage 22. The fuel inlet passage 22 is adapted to be connected to the fuel pump (not shown) of the vehicle in which carburetor 10 is mounted.

As is conventional in automotive vehicles, the float 14 controls the operation of the inlet valve 21 in a manner to provide a proper fuel level in the fuel bowl 12. Fuel is supplied to the engine from the carburetor fuel bowl via a main metering jet 23, fuel passage 24, fuel and air passage 25 and the opening in the passage 25 positioned in the booster venturi 26. The booster venturi 26 is positioned within the air induction passage 13 concentrically with respect to the main venturi 27.

A throttle valve 28 is positioned below the main venturi 27 and the booster venturi 26 and is operated by a conventional throttle linkage to control the amount of air flow through the air induction passage 13 and hence through the main venturi 27 and the booster venturi 26. Also, as is conventional, a high speed air bleed 31 is positioned in the air induction passage 13 so that the fuel in the fuel passage 24 may mix with the air present in the air bleed 31 to provide a fuel-air mixture in the fuel-air passage 25.

In conventional carburetors for internal combustion engines, there is provided a power enrichment valve which will increase the fuel-air ratio of the engine by dumping additional fuel into the air induction passage 13 when the vacuum in the intake manifold falls below a predetermined value. These power valves are usually of the on-off type and do not provide for continuously variable or gradient type of enrichment which the internal combustion engine in which the carburetor is mounted requires.

The present invention provides a continuously variable

fuel-air ratio as a function of vehicle acceleration and deceleration. To this end a bypass passage 33 is provided that has an entrance 34 positioned above or anteriorly of the booster venturi 26 and the main venturi 27. This bypass passage 33 has an exit 35 posteriorly or below the main venturi 27 and the booster venturi 26 and anteriorly or above the throttle valve 28. A modulating or bypass valve 36, preferably of the butterfly type, is positioned in the bypass passage 33 and is supported on a rotatable shaft 37. An arm 38 that may be constructed of bimetallic material is affixed to the shaft 37 at 39. The other end of the arm 38 supports a weight 41 so that the arm 38 and the weight 41 comprise a pendulum assembly.

The axis of the shaft 37 is positioned substantially transverse to the axis of the automotive vehicle and hence transverse to the section line 2—2 shown in FIGURE 1. Thus, the weight 41 is free to move in response to acceleration and deceleration of the vehicle in which the carburetor 10 is mounted.

During normal road load conditions, the weight 41 lies in a vertical line through the center of the shaft 37 and the valve 36, and the weight will position the valve 36 to provide a calibrated amount of bypass air through the bypass passage 33. The position of the valve 36 is set to provide the proper fuel-air ratio to establish satisfactory power and economy conditions when the vehicle is operating under road load. It can be readily appreciated that the amount of bypass air has a significant effect upon the vacuum signal generated by the passage of air through the booster venturi 26 and the main venturi 27 that is present at the end of the fuel-air passage 25 positioned in the booster venturi. When the amount of bypass air is large, this vacuum signal will obviously be lowered since the pressure below the two venturis and above the throttle plate will be increased. This is brought about because there is substantially an unrestricted air flow passage between the entrance 34 of the bypass passage 33, which is at substantially atmospheric pressure when the choke of the carburetor is open, and the exit 35. Conversely, when the valve 36 is closed there will be an increased vacuum signal at the end of the fuel-air passage 25 positioned in the booster venturi, since the bypass air is substantially shut off and there will no longer be air feeding into the induction passage from the exit 35 in the bypass passage 33.

FIGURE 5 shows the position of the butterfly valve 36 positioned in the bypass passage 33 under vehicle acceleration conditions. It is moved into this position by the movement of the weight 41 rearwardly with respect to the forward motion of the vehicle during acceleration conditions by the inertia effect of the weight. Thus, during acceleration conditions, the amount of air flowing through the bypass passage is decreased and at the same time the vacuum signal present at the end of the fuel-air passage 24 positioned in the booster venturi 25 is increased. This increases the fuel-air ratio as required when the vehicle is accelerating under high power conditions of the internal combustion engine. It can be appreciated also that this increase in the fuel-air ratio is continuously variable as a function of this acceleration since the valve 36 will move from the road load condition to its fully closed condition gradually and at a continuously variable rate as a function of the acceleration.

The position of the valve 36 in the air bypass passage 33 under deceleration conditions is shown in FIGURE 6. When the vehicle decelerates, the weight 41 will move forwardly with respect to the forward motion of the vehicle and with respect to the carburetor structure thereby increasing the opening of the valve 36 as a function of the deceleration. This, of course, increases the amount of bypass air existing from the exit 35 of the bypass passage thereby decreasing the vacuum signal present at the opening in the fuel-air passage 25 positioned in the booster venturi 26. This has the effect of reducing the fuel-air ratio at a continuously variable rate as required

by the internal combustion engine under conditions in which the power is removed from the engine by the closing of the throttle valve 28.

It can also be appreciated that the weight 41 is responsive not only to acceleration and deceleration of the automotive vehicle, but also to its attitude. When the vehicle is ascending a steep grade, the weight 41 will remain stationary due to the force of gravity as shown in FIGURE 4. The carburetor structure, however, will be rotated in a clockwise direction about the axis of the shaft 37 thereby moving the valve 36 toward its closed position and increasing the fuel-air ratio. Conversely, when the vehicle is descending a steep grade, the carburetor structure will be rotated counterclockwise with respect to the axis of the shaft 37 thereby opening the valve 36 and reducing the fuel-air ratio.

As stated previously, the arm 38 connecting the shaft 37 and the weight 41 may be constructed of a bimetallic material. As a result, the valve 36 in the bypass air passage 33 will move in response to environmental temperatures. The bimetal is constructed so that as environmental temperatures increase, the coiled portion 42 will be coiled into a smaller configuration thereby rotating the valve 36 clockwise. This provides additional bypass air through bypass passage 33 to increase the fuel-air mixture and provide a leaner mixture for warm weather operation. It should be pointed out that the weight 41 serves as the anchor point for the bimetal arm 38 and coil 42 during environmental temperature changes. Conversely, as the environmental temperatures decrease, the coil portion 42 will unwind thereby rotating the valve 36 in a counterclockwise direction from its position shown in FIGURE 4 towards its closed position. This results in an increased fuel-air ratio and a richer mixture which is required by the internal combustion engine as environmental temperatures are lowered.

A carburetor incorporating the inertia temperature sensing carburetor metering control described above, is capable of providing adequate enrichment to many engines when they are operated at maximum power conditions, particularly those types of economy engines that have functioned satisfactorily in the past with a small percentage increased requirement of the fuel-air ratio under maximum power conditions. It may be desirable, however, to provide increased enrichment at wide open throttle. If this is deemed necessary, it may be accomplished by a simple mechanical enrichment device operated by the movement of the throttle when it reaches the wide open position.

The present invention thus provides an inertia sensing metering control for a carburetor that changes the fuel-air ratio as a continuously variable function of the acceleration and deceleration of the vehicle. Additionally, it provides a means incorporated in this mechanism for adjusting or varying the fuel-air ratio as a function of environmental temperatures.

It will be understood that the invention is not to be limited to the exact construction shown and described, but that various changes and modifications may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. A carburetor for an internal combustion engine comprising, an air induction passage, a venturi positioned in said air induction passage, a throttle plate positioned in said air induction passage downstream of said venturi, a fuel bowl, means coupled to said fuel bowl and to said venturi for feeding fuel into said induction passage as a function of a vacuum signal generated by said venturi as a result of air flow through said air induction passage, a bypass air passage having an inlet positioned upstream of said venturi and an outlet downstream of said venturi, but upstream of said throttle plate, valve means positioned in said bypass air passage, means coupled to said

valve means and responsive to acceleration and deceleration of the vehicle in which said carburetor is mounted for decreasing the air flow through said bypass air passage as a function of increasing acceleration of the vehicle and increasing the air flow through said bypass air passage as a function of increasing deceleration of the vehicle whereby the fuel-air ratio supplied to the engine is increased as a function of increasing acceleration and is decreased as a function of increased deceleration, and means coupled to said valve means for opening said valve means for increasing the air flow through said bypass passage as a function of increasing environmental temperatures and for decreasing the air flow through said bypass passage as a function of decreasing environmental temperatures.

2. A carburetor for an internal combustion engine mounted in an automotive vehicle comprising, an air induction passage, a venturi positioned in said air induction passage, a throttle plate positioned in said air induction passage posteriorly of said venturi, a fuel supply means, means coupled to said fuel supply means and projected into said air induction passage adjacent said venturi for feeding fuel into said induction passage as a function of the vacuum signal generated by said venturi as a result of air flow through said induction passage, and means bypassing said venturi responsive to the acceleration and deceleration of the vehicle in which said carburetor and internal combustion engine are mounted for increasing the vacuum signal generated by said venturi as a continuous function of vehicle acceleration and for decreasing the vacuum signal as a continuous function of vehicle deceleration, said last mentioned means comprising valve conduit means coupled at one end to said induction passage at a point anteriorly of said venturi and at the other end at a point intermediate said venturi and said throttle plate for bypassing a continuously variable quantity of air flowing into said induction passage around said venturi as a function of the acceleration and deceleration of the vehicle, said last mentioned means including means for decreasing said variable quantity of air as a function of decreasing environmental temperatures of the carburetor and for increasing said variable quantity of air as a function of increasing environmental temperatures of the carburetor.

3. A carburetor for an internal combustion engine comprising, an air induction passage, a venturi positioned in said air induction passage, a throttle plate positioned in said air induction passage downstream of said venturi, a fuel bowl, means coupled to said fuel bowl and to said venturi for feeding fuel into said induction passage as a function of a vacuum signal generated by said venturi as a result of air flow through said air induction passage, a bypass air passage having an inlet positioned upstream of said venturi and an outlet downstream of said venturi, but upstream of said throttle plate, valve means positioned in said bypass air passage, means coupled to said valve means and responsive to acceleration and deceleration of the vehicle in which said carburetor is mounted for decreasing the air flow through said bypass air passage as a function of increasing acceleration of the vehicle and increasing the air flow through said bypass air passage as a function of increasing deceleration of the vehicle whereby the fuel-air ratio supplied to the engine is increased as a function of increasing acceleration and is decreased as a function of increasing deceleration, said means coupled to said valve means and responsive to the acceleration and deceleration of the vehicle comprising a weight mounted on a shaft having an axis that is substantially transverse to the longitudinal axis of the vehicle in which the carburetor is mounted, and a bimetallic arm means attached to said weight and said valve means for increasing the air flow through said bypass air passage as a function of increasing environmental temperatures and for decreasing air flow through said bypass air

passage as a function of decreasing environmental temperatures.

References Cited

UNITED STATES PATENTS

1,120,772	12/1914	Wallman	261—63	X
1,259,291	3/1918	Rich	261—63	X
2,082,294	6/1937	Linga	261—56	
2,283,694	5/1942	Perrine	261—63	

5

2,836,403	5/1958	Volcher	261—18
2,986,380	5/1961	Read	261—39
3,246,886	4/1966	Goodyear et al.	261—39

FOREIGN PATENTS

493,271	4/1919	France.
---------	--------	---------

HARRY B. THORNTON, *Primary Examiner.*

T. R. MILES, *Assistant Examiner.*