Dec. 14, 1943. S. C. SMITH 2,336,810

CARBURETOR

Filed April 15, 1933 2 Sheets-Sheet 1

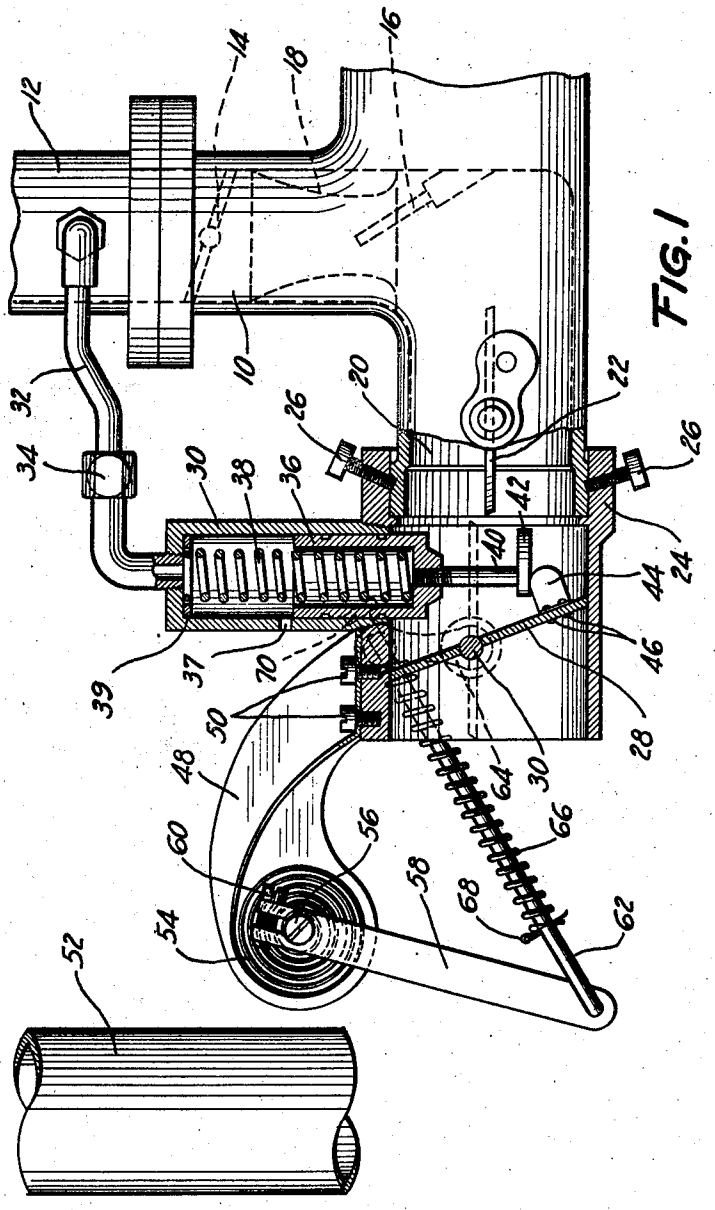


FIG. 1

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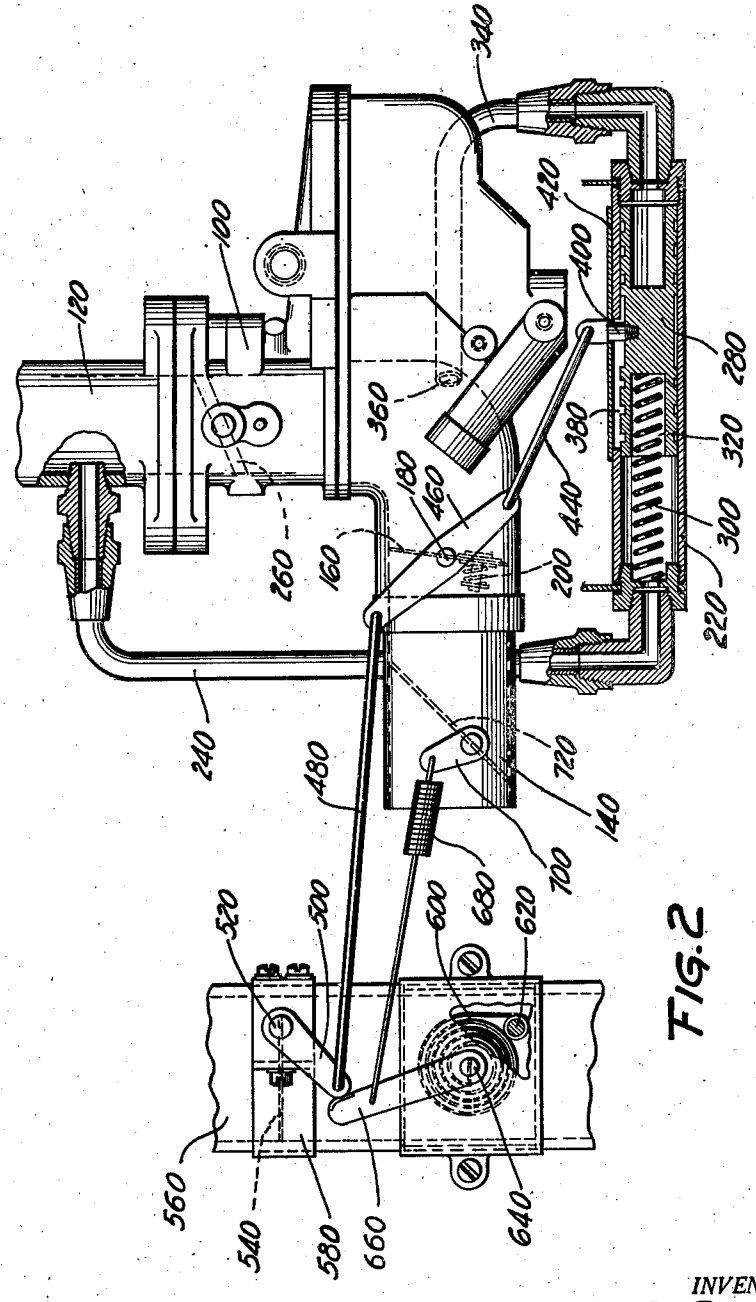


FIG. 2

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UNITED STATES PATENT OFFICE

2,336,810

CARBURETOR

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Application April 15, 1933, Serial No. 666,268

29 Claims. (Cl. 123—119)

This invention relates to carburetors and has for its principal object the provision of a choke valve or carburetor air control that is automatic in its operation and which is actuated by the pressure and suction developed by the engine upon which the carburetor is installed.

Internal-combustion engines using liquid fuel are ordinarily equipped with carburetors having manually operated choke valves for closing the air supply and enriching the fuel mixture for starting the engine. Various means have heretofore been employed to automatically actuate the choke, but as the needs for the variation in fuel mixture are dependent on a number of variables, including engine temperature, manifold vacuum or depression, and exhaust gas pressure, the automatic chokes that have been previously devised do not entirely meet the requirements.

One of the objects of the invention is to provide a carburetor choke that is automatic in its action and which will control the fuel mixture in accordance with the needs of the engine upon which the carburetor is installed.

An important feature of the invention relates to the control of the choke valve by the suction of the manifold.

Another important feature of the invention is in the arrangement of the choke control whereby the control piston is subjected to suction posterior to the throttle on one side of the piston and suction anterior to the throttle on the other side of the piston.

The need for an automatic choke will be apparent to all automobile operators for with the ordinary manual operation, the results obtained are dependent on the skill and experience of the operator, who generally does not attempt to obtain a correct setting of the choke valve, but alternates between no-choke and full-choke positions; the theory of this form of operation being that although neither position is correct, during the transition from one condition to the other there will be some period at which the engine is operating on a correct mixture. This procedure, although in general use, is unsatisfactory, because the engine is at one time over-choked and at another time under-choked, both conditions being detrimental to the engine and uneconomical in the use of fuel.

The period between over-choking and under-choking, during which the engine is getting rid of excess fuel collected in the manifold during the operation in the full-choke position, includes a condition of correct mixture, but this period is of such short duration in comparison with the periods of incorrect mixture that the average operation consumes a quantity of fuel that is far above the requirement for best operation.

Too rich mixtures are also objectionable, because they form carbon deposits that are injurious to the engine surfaces and are a source of ignition trouble. The present invention eliminates the necessity of manual choke operation and substitutes therefor an automatic control, which is operated by the engine in a manner to at all times provide a choke setting that will give an efficient operating mixture.

A better understanding of the invention may be had by reference to the following description, taken in connection with the accompanying drawings, wherein I have shown different embodiments of the invention installed in a carburetor of conventional design and arranged adjacent the engine exhaust pipe. In the drawings,

Figure 1 is a side elevation, partly in section, of an apparatus embodying the invention; and

Figure 2 is a similar view of another embodiment.

In the embodiment shown in Figure 1, 10 is a carburetor communicating with an engine manifold 12 and having a throttle valve 14, a fuel nozzle 16 arranged within a Venturi tube 18, and a main air inlet passage 20. The ordinary manually controlled choke valve 22 is also shown but may be removed if desired. The choke is shown as installed in a carburetor of the plain tube type for purposes of illustration, but if desired it may be adapted to other types of carburetors without departing from the principles involved in the illustrative embodiment.

At the outer end of the air inlet 20 is mounted a sleeve 24, which is held in position on the carburetor by any desired means such as screws 26 and within which is an unbalanced choke valve 28 pivotally mounted on a shaft 30, having its axis slightly above the center line of the sleeve 24. Valve 28 is preferably arranged at a slight inclination, in a manner to be opened by the air flowing into the passage 20 of the carburetor. Opening into the upper portion of sleeve 24 is a cylinder 30 which has its upper end closed, except for a connection to the inlet manifold 12 by means of a pipe 32, preferably secured to the cylinder by a fitting 34. Within cylinder 30 is slidably mounted a piston 36, having a depression on its upper side, within which is a spring 38 coacting with the bottom of the depression and the upper end of the cylinder 30.

Immediately above the upper edge of piston 36 is an atmospheric opening 37, communicating

with the interior of the cylinder. Opening 37 preferably is of small size and arranged to be closed by the piston 36 during its initial upward movement. At the upper end of cylinder 30 is a gasket 39 which coacts with the upper face of the piston to seal the pipe 32 against admission of air when piston 36 is in its extreme upper position. The piston 36 is provided with an extension 40, having a foot 42, which presses against the rounded nose of lug 44, secured to the choke valve 28 by securing means such as rivets 46. An arm 48 is secured to the sleeve 24 by screws 50 and projects toward the engine exhaust pipe 52 in order to bring the thermostat 54 in position to be influenced by the heat of the exhaust pipe. Thermostat 54 is preferably a spiral bimetallic member having one end secured to arm 48 and having its opposite end connected to a shaft 56. An arm 58 is secured to shaft 56 by a clamping screw 60 in a manner to be rotated by the movement of the thermostat. At the lower end of arm 58 is pivoted rod 62 having a slidable connection with lever 64 which is secured to the shaft 30.

Surrounding rod 62 is a spring 66 coacting against cotter pin 68 and the lever 64 to urge valve 28 to its closed position. A head 70 is provided on rod 62 which when the thermostat 54 is hot bears against the lever 64 and urges valve 28 to its open position shown in dotted lines in the drawings.

The operation of the device is as follows: When the engine is cold, the choke parts will assume the positions shown in full lines in the drawings. The throttle 14 will be slightly opened and the engine may be cranked in the ordinary manner. Under starting conditions, the engine is cranked slowly and the depression in manifold 12 will be communicated to the air passage 20 of the carburetor past the throttle valve 14, and the pressures posterior and anterior to the throttle 14 will be substantially the same or at least the pressure posterior to the throttle valve will be but slightly less than the pressure anterior thereto.

As piston 36 has its upper face subjected to manifold depression and its lower face subjected to the suction within the body of the carburetor, there will be practically no tendency for the piston to be moved to its upper position, but if there should be a slight differential in pressure between the upper and lower faces this will be counteracted by the atmospheric opening 37 and the piston will remain in its lower position. The closed position of the choke will deliver the necessary rich mixture of fuel to start the engine, which will then immediately start to run at a higher rate of speed and the vacuum in the manifold 12 cannot be communicated past the throttle 14 because of the quantity of air which must pass it to equalize the pressure. The piston 36 will be drawn upwardly by the manifold vacuum and close the atmospheric passage 37, after which it will be immediately drawn to its upper position against the gasket 39. The movement of piston 36 from its lowermost position to its uppermost position will, under running conditions of the engine, be extremely rapid for, as soon as foot 42 ceases to press upon the valve lug 44, the inrushing air will cause valve 28 to open and relieve the suction within the body of the carburetor which acts upon the lower face of the piston, and cause the differential in pressure above and below the piston to rapidly increase in value.

Under normal running conditions of the engine, the valve 28 will either assume a horizontal position as shown in dotted lines in the drawings, or some intermediate position, which will be dependent on whether or not the force of the inrushing air is sufficient to overcome the force of spring 66. After a few minutes of operation, exhaust pipe 52 will become heated and thermostat 54 will move arm 58 in a clockwise direction, thus decreasing the pressure of spring 66 and finally permitting valve 28 to assume its horizontal position under the influence of a small volume of incoming air. If, for any reason, the air supply should become too great and weaken the mixture to a point where the engine will not fire, the vacuum in manifold 12 will immediately fall and allow spring 38 to force the piston downwardly and close valve 28 to again enrich the mixture.

After the engine has reached an operating temperature high enough to operate with no restriction in the air passage, thermostat 54 will have moved to its extreme position in a clockwise direction and head 70 will coact with the lever 64 and hold the valve 28 in full open position until the thermostat is cooled. Exhaust pipe 52 will ordinarily retain its heat for a period of several minutes after the engine has been stopped so that if an attempt is made to start the engine immediately, the choke valve will remain open and the engine will not be flooded by fuel such as would result if the choke were allowed to assume its closed position as soon as the engine stopped.

It will be seen from the above description that I have provided an automatic choke valve which is normally in a closed position due to its unbalanced arrangement, and the operation of which is controlled by the suction within the manifold and carburetor as modified by the thermostat.

In the embodiment illustrated in Figure 2, 100 is a carburetor communicating with the engine manifold 120, and having an air intake horn 140. Within the air horn is mounted a butterfly choke valve 160 adapted to be rotated by shaft 180 and having a small spring-loaded poppet valve 200, which is adapted to be opened by the suction of the engine and to permit a small quantity of air to pass therethrough.

The engine manifold 120 is connected to one end of cylinder 220 by means of a pipe 240 which communicates suction from posterior to the throttle 260 to one side of the piston 260 that is urged toward the opposite end of cylinder 220 by spring 300, which coacts with one end of the cylinder 220 and the bottom of a recess 320, formed in the piston 280. The opposite end of cylinder 220 is connected to the air passage of the carburetor anterior to the throttle 260 by means of a pipe 340 which terminates at 360 within the body of the carburetor. The upper portion of cylinder 220 is provided with a slot 380 within which is a stud 400 preferably threaded into the piston 280 and slidable therewith. A cover 420 may also be slidably mounted with respect to the cylinder for preventing the entrance of foreign objects such as dust to the interior of the cylinder.

Stud 400 is pivotally connected by link 440 to one end of a lever 460 which is secured to shaft 180 for operating the choke valve 160. The opposite end of lever 460 is connected by a link 480 to a lever 500, operatively secured to a shaft 520, upon which is mounted an unbalanced flapper valve 540, adapted to be operated by the exhaust pressure within the exhaust pipe 560. The assembly of the flapper valve 540, and its oper-

ating connections, may be made removable from the exhaust pipe 560, and held in place by any desirable means, such as band 580. Adjacent the exhaust pipe 560 is mounted a thermostat 600 preferably formed of a bimetallic, spirally wound member, having one end secured to an anchor 620, and the other end secured to the shaft 640 in a manner to rotate it in a clockwise direction, as shown in the drawings, upon an increase in temperature.

A lever 660 is secured to shaft 640, to which is secured spring 680, which has its opposite end secured to lever 700 for holding the unbalanced flapper valve 720 in a position to close air horn 140, as shown in the drawings. Lever 660 is preferably projected upwardly to a point where it will contact with lever 500, and force it to the right against the force of spring 300 when the temperature is raised, and lever 660 is moved in a clockwise direction.

In the operation of the device for starting a cold internal-combustion engine, the various parts will first be in the position shown in Figure 2. The operator will open throttle 260 slightly, to deliver a sufficient quantity of fuel to the engine and crank it in the ordinary manner. During the cranking operation, the engine will pump but a small quantity of air through the carburetor and the depression posterior to the throttle 260 will be readily communicated to the space anterior to the throttle, and as the pressures on opposite ends of the piston 280 are substantially equal, piston 280 will not be moved from the position shown in the drawings, and choke 160 will remain closed. Upon initial firing of the engine, the engine will be speeded up, which will result in the opening of poppet valve 200. The suction within the manifold 120, which is communicated to the left end of piston 280, will then cause piston 280 to move to the left and open choke 160 through the medium of stud 400, link 440, and lever 460.

During the normal operation of the engine, it will tend to draw a still greater amount of air through the carburetor and the depression posterior to the throttle 260 will not be readily communicated to the mixing chamber anterior to the throttle, which will assist in the unbalancing of the pressures on opposite sides of the piston 280, and the opening of the choke valve 160 will be further augmented by the pressure of the exhaust gases within pipe 560 which tends to open the choke through valve 540 and link 480. Unbalanced flapper valve 720 will be opened by the inflowing air against the resistance of spring 680 which is preferably selected with a tension that will permit valve 720 to be opened by the air flow during ordinary running of the engine at subnormal temperatures. Valve 720 is preferably located in the air horn anterior to valve 160, and will normally modify the effect of the choke valve by yieldingly restricting the air entering the horn. During continued operation of the engine, thermostat 600 will become heated by the exhaust gases and cause lever 660 to rotate in a clockwise direction, thereby decreasing the tension of spring 680 and finally contacting with lever 500 and forcing it to the right, which causes valve 160 to turn toward its open position.

Under conditions of extreme heat, lever 660 will move a sufficient distance in a clockwise direction to force valve 160 to the open position against the resistance of spring 300 and will hold it in this position until the thermostat is cool. Holding choke 160 wide open under heated engine conditions is important, for if the engine should be stopped while it is hot and an attempt made to start it immediately thereafter, the valve 160 should be in the wide open position in order to prevent delivery of too much fuel, and so-called flooding of the engine.

This application is a continuation in whole of my copending applications, Serial No. 500,179, filed December 5, 1930, and Serial No. 505,261, filed December 29, 1930.

Although this invention has been described in connection with certain specific embodiments, the principles involved are susceptible of numerous other applications that will readily occur to persons skilled in the art. The invention is therefore to be limited only as indicated by the scope of the appended claims.

I claim:

1. A carburetor comprising a throttle, a choke valve, a cylinder having a conduit opening into the carburetor posterior to the throttle, a piston in said cylinder normally pressing said valve toward the closed position, and an opening to atmosphere in the cylindrical wall of said cylinder, adapted to be closed by said piston.

2. A carburetor comprising a throttle, an unbalanced choke valve, a cylinder, a piston in the cylinder operatively connected to the choke valve, said piston having one end subjected to pressures posterior to the throttle and the other end at times to substantially atmospheric pressure, and means for admitting substantially atmospheric air to the side of the piston which is subjected to pressures posterior to the throttle.

3. A carburetor comprising a throttle, an air valve, a cylinder having a piston for restricting the operation of the air valve, and yielding means associated with said piston to urge the valve toward closed position when the engine is at rest, said piston being subjected to internal carburetor pressures at its opposite ends, whereby a differential in pressure draws said piston to an inoperative position.

4. A carburetor comprising an air valve, weighted means for closing said valve, means for automatically removing the influence of the weighted means, and thermostatic means for opening said valve, having a resilient connection therewith.

5. A carburetor comprising an air valve, means frictionally engaging the valve for urging said valve to the closed position, and thermostatic means operatively connected to said valve independently of said first-mentioned means and adapted to modify the effect of the closing means.

6. In a carburetor, a throttle, a choke valve, a cylinder, a piston in the cylinder for influencing the operation of the choke valve, said cylinder being so connected to the carburetor that the opposite faces of the piston are subjected to pressures respectively posterior and anterior to the throttle, and a port in the cylindrical wall of the cylinder opening to atmosphere and positioned to be controlled by the movement of the piston.

7. In a carburetor having a throttle and a choke valve, a cylinder having its opposite ends communicating with the carburetor posterior and anterior to the throttle and having a port opening to atmosphere intermediate its ends, a piston in said cylinder adapted to control said port, and means associated with said piston for influencing the operation of the choke valve.

8. In a carburetor having a throttle and an unbalanced choke valve, a cylinder communicating adjacent one end with the carburetor pos-

terior to the throttle and adjacent the other end with a source of higher pressure, a passage in the cylinder wall adapted to communicate with substantially atmospheric pressure, a piston in said cylinder operatively connected to the choke valve and adapted to control said passage, and temperature responsive means associated with said piston for influencing the operation of the choke valve.

9. Control mechanism for a carburetor, comprising an air valve, gravity actuated means for closing the valve, means for diminishing the influence of the gravity actuated means, and temperature-responsive means for opening the valve.

10. Control mechanism for a carburetor, comprising an air valve, gravity actuated means for influencing the opening and closing movements of the valve, means for diminishing the influence of the gravity actuated means, and temperature-responsive means for opening the valve having a resilient connection therewith.

11. In a carburetor comprising an induction passage, a choke valve therein, means for resiliently holding the valve in closed position, means frictionally engaging the valve and cooperating with the first-named means to hold the valve in closed position, and means operative upon the development within the induction passage of a predetermined degree of suction for rendering the second-named means inoperative to affect the position of the valve.

12. A carburetor comprising a throttle, a choke valve, a cylinder having a conduit opening into the carburetor posterior to the throttle, a piston in said cylinder operatively connected to said choke, means normally pressing said valve toward the closed position, and a passage in the wall of said cylinder communicating with a source of substantially atmospheric pressure, said passage being adapted to be controlled by said piston.

13. In a carburetor for an engine having an inlet manifold and an exhaust manifold, the combination of a choke valve, and means for controlling the choke valve including a thermostat and means jointly operated by pressures within the inlet and exhaust manifolds.

14. In a carburetor for an engine having an inlet manifold and an exhaust manifold, the combination of a choke valve, a liquid fuel-nozzle between the choke valve and the inlet manifold, a flapper valve in said exhaust manifold, a piston operated by inlet manifold suction, and means operatively connecting said valve and said piston to said choke tending to open it upon increase of exhaust pressure or increase of manifold suction.

15. In a carburetor for an engine having an inlet manifold and an exhaust manifold, the combination of a choke valve, a flapper valve in said exhaust manifold, a piston operated by inlet manifold suction, means operatively connecting said valve and said piston to said choke, and means urging said choke valve to the closed position.

16. In a carburetor for an engine having an inlet manifold and an exhaust manifold, the combination of a throttle, a choke valve, means operatively connected to the choke valve and movable by the differential in pressure posterior and anterior to the throttle, and means movable by exhaust manifold pressure connected to the choke valve to modify the effect of the first means.

17. In a carburetor for an engine having an inlet manifold and an exhaust manifold, the combination of a throttle, a choke valve, and means causing exhaust pressure and temperature and inlet manifold suction posterior to the throttle to jointly coact and open the valve.

18. In a carburetor for an engine having an inlet manifold and an exhaust manifold, the combination of a throttle, a choke valve, means causing exhaust pressure and inlet manifold suction posterior to the throttle to jointly coact and open the valve, and means whereby suction anterior to the throttle reduces the effect of the first means.

19. In a carburetor for an engine having an inlet manifold and an exhaust manifold, the combination of a choke valve, means for operating said choke valve by the joint action of exhaust pressure and suction within the carburetor, and temperature responsive means adapted to render both exhaust and suction means inoperative to close the choke.

20. In a carburetor for an engine having an inlet manifold and an exhaust manifold, the combination of a choke valve, a throttle, means for operating said choke valve by the combined action of exhaust pressure and the pressure differential posterior and anterior to the throttle, and temperature responsive means adapted to render the first-mentioned means inoperative to close the choke.

21. In a carburetor for an engine having an inlet manifold and an exhaust manifold, the combination of a choke valve, a throttle, a piston having its opposite faces subjected respectively to pressures posterior and anterior to the throttle operatively connected to said choke valve, an exhaust pressure operated member connected to said valve for modifying the action of the piston, and temperature responsive means adapted to force the valve to the open position upon a rise in temperature.

22. In a carburetor for an engine having an inlet manifold and an exhaust manifold, the combination of a choke valve, a throttle, a piston having its opposite faces subjected respectively to pressures posterior and anterior to the throttle operatively connected to said choke valve, an exhaust pressure operated member connected to said valve for modifying the action of the piston, a spring urging said valve to the closed position, and heat responsive means adapted to force the valve to the open position upon a rise in temperature, against the tension of the spring.

23. In a carburetor, a pressure-responsive choke valve, a thermostatic spring tending to close the valve and becoming inoperative at high temperatures, and means responsive to a pressure generated by operation of the engine for varying the effectiveness of the thermostatic spring.

24. In a carburetor for an engine having an intake manifold, the combination of an air horn, a choke valve controlling the air horn, a throttle valve, a piston for opening and closing the choke valve having its opposite ends subjected respectively to intake manifold pressure and to pressure existing between the throttle and the choke valve, and a spring urging the piston to a position corresponding to the closed position of the choke valve.

25. An automatic choke valve adapted to be secured to the carburetor of a gas engine including a chamber having a port and a choke valve cooperating with the port, a control valve adapted to be secured to the air intake manifold of the gas engine, means including a weight extending between said choke valve and said control valve whereby the choke valve may be partly closed during the running of the engine and whereby

said choke valve will be automatically entirely closed when the engine has stopped running, and adjustable means for limiting the stroke of the choke valve.

26. A carburetor comprising a throttle, an air valve, a cylinder having a piston for restricting the operation of the air valve, said piston having its opposite ends subjected to pressures above and below the throttle respectively, and means for admitting atmospheric air to one side of the piston, at one end of the piston stroke.

27. In combination with an internal combustion engine, means for forming an explosive mixture for said engine, a member movable to vary the proportions of the mixture, a temperature-responsive element for moving said member, a second means for moving said member, and provision for preventing operation of said second means from imposing strains on said temperature-responsive element.

28. Control mechanism for a carburetor comprising a pressure responsive air inlet valve, thermostatic means for yieldingly opposing opening of said valve with a force varying with temperature, resilient means engageable with said valve for urging the valve to closed position, and means responsive to engine operation for moving said resilient means out of effective engagement with the valve whereby the valve operates solely under the control of said thermostatic means.

29. Control mechanism for a carburetor comprising a pressure responsive air inlet valve, thermostatic means for yieldingly opposing opening of said valve with a force varying with temperature, a cylinder and a piston therein connected to said valve through a lost motion connection, and resilient means urging said piston in a direction to close the valve, said cylinder being connected to a source of pressure which varies with the speed of the engine and said piston being actuated by said pressure for overcoming the force of the resilient means.

STUYVESANT C. SMITH.

CERTIFICATE OF CORRECTION.

Patent No. 2,336,810. December 14, 1943.

STUYVESANT C. SMITH.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, second column, line 51, beginning with "23. In a carburetor" strike out all to and including "spring." in line 56, comprising claim 23, and for the claims now appearing as "24", "25", "26", "27", "28" and "29" read --23--, --24--, --25--, --26--, --27-- and --28-- respectively; in the heading to the printed specification, line 7, for "29 Claims" read --28 Claims--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 6th day of June, A. D. 1944.

Leslie Frazer

(Seal) Acting Commissioner of Patents.