Dec. 8, 1936. J. J. GRENAT 2,063,433

CARBURETOR

Filed April 23, 1934 2 Sheets-Sheet 1

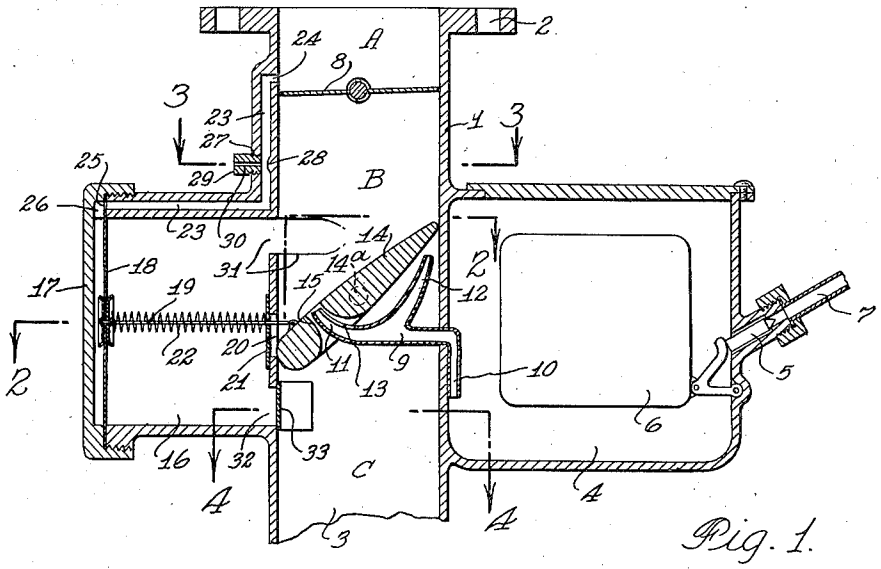

Fig. 1.

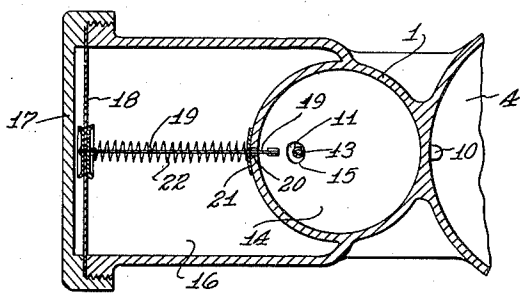

Fig. 2.

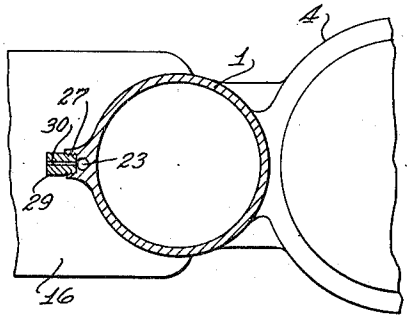

Fig. 3.

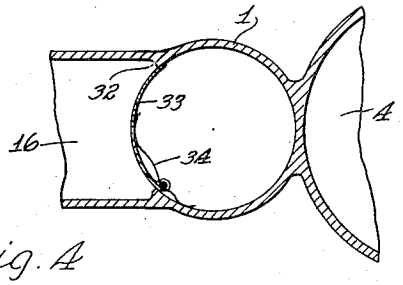

Fig. 4.

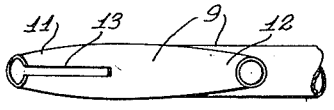

Fig. 5.

INVENTOR

John J. Grenat

BY

ATTORNEYS

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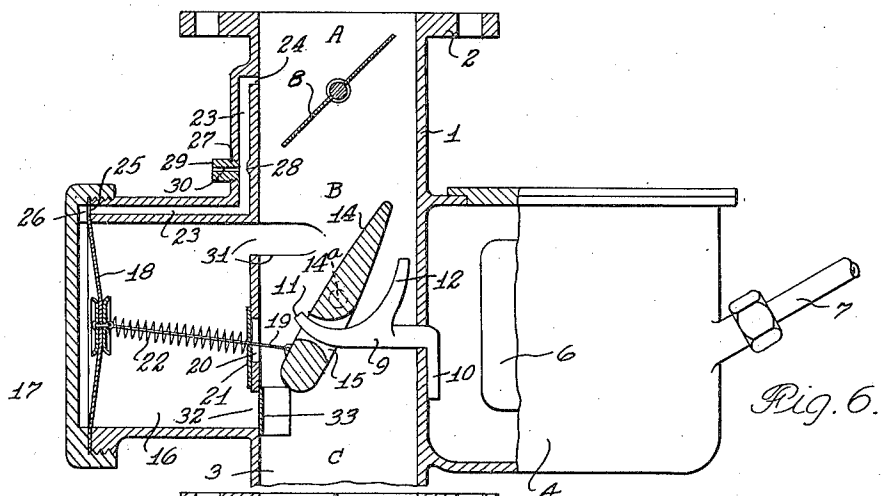

Fig. 6.

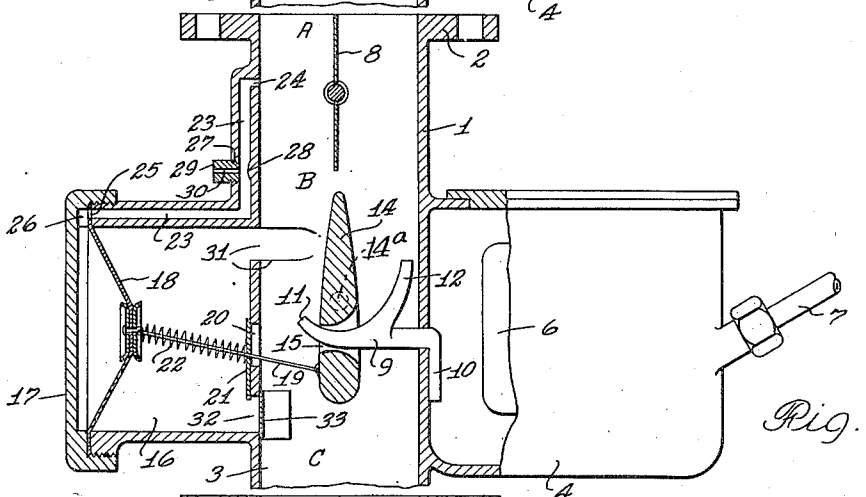

Fig. 7.

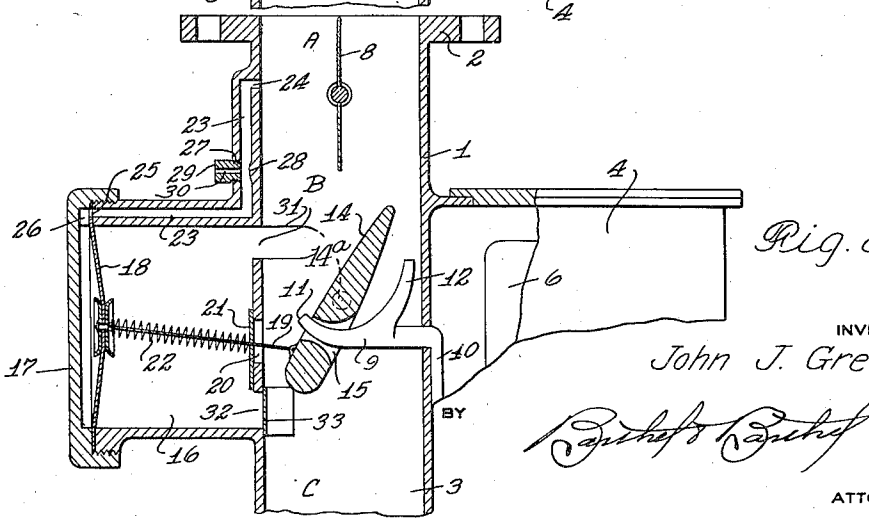

Fig. 8.

INVENTOR

John J. Grenat

BY

ATTORNEYS

Patented Dec. 8, 1936

2,063,433

UNITED STATES PATENT OFFICE

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CARBURETOR

John J. Grenat, Detroit, Mich.

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12 Claims. (Cl. 261—53)

The present invention pertains to a novel carburetor of a type particularly adapted for use on variable speed internal combustion engines.

The primary object of the present invention is to provide a carburetor especially suited for automotive engines which will provide fuel economy at all speeds of operation without sacrificing power, acceleration, and smoothness of operation. It is well known that fuel economy and maximum power can only be attained when the fuel and air are mixed in the carburetor in the correct proportions and conventional carburetors are not constructed in a manner to control the mixture by maintaining a constant ratio of air and fuel at all engine speeds. For example, the well known plain tube carburetor lacks the flexibility which is the objective of the present invention, the reason being that if the air stream capacity is made sufficient for high speed engine operation by the use of a relatively large venturi it results in difficulty in attaining smooth engine performance at moderate speeds. On the other hand, if the venturi is made smaller to adapt the engine to moderate speeds, it must be small enough to provide sufficient air stream velocity to insure vaporization of the fuel at moderate speeds, and is for this reason not efficient at high speeds. The problem resulting from the demand for high speeds has led to the universal adoption of a high speed carburetor and in order to provide for moderate speed of operation accelerating pumps, or auxiliary devices for squiring fuel into the mixing chamber, and so-called idle speed jets have been provided because of the lack of sufficient depression or suction in the engine manifold to lift the fuel from the nozzle in the normal manner.

Another object of the present invention is to devise a carburetor wherein means is provided for automatically varying the velocity of the air stream relative to the fuel nozzle so that a constant ratio is maintained between the air and fuel under all conditions of engine operation. In other words the present carburetor is capable of automatically regulating the air stream velocity so as to provide the most efficient air and fuel mixture at all engine speeds, including idling speed, maximum speed, and any speed between idling and maximum. Furthermore the present device automatically controls the air and fuel ratio under abnormal conditions such as rapid opening of the throttle valve and also when travelling at a moderate speed with the throttle wide open such as would occur in an automotive vehicle under heavy load or when travelling on an up grade.

With the above and other ends in view the invention consists in matters hereinafter set forth and more particularly pointed out in the appended claims, reference being had to the accompanying drawings, in which

Figure 1 is a vertical cross section;

Figs. 2, 3 and 4 are cross sections taken on the lines 2—2, 3—3 and 4—4 respectively of Fig. 1;

Fig. 5 is a plan of the fuel nozzle; and

Figs. 6, 7 and 8 are vertical cross sections illustrating the parts in different positions.

Like characters of reference are employed throughout to designate corresponding parts.

The numeral 1 designates a cylindrical body having its upper end provided with means 2 facilitating its attachment to an intake manifold of an internal combustion engine. The lower end 3, which is broken away, is adapted to be connected to the atmosphere through means of a suitable air filter and fire arrestor. Inasmuch as carburetors and their manner of assembly on automotive vehicles are well known to those versed in this particular art it has been deemed unnecessary to illustrate the intake manifold and the air filter. It is also well known that there are but two substances passing through a carburetor, the air for combustion of the fuel, and the fuel itself, both the air and fuel being drawn from the carburetor by the suction created by the pumping action of the pistons in the cylinders of the engine. The suction stroke of the pistons sets up a partial vacuum in the intake manifold and hereinafter throughout the description and claims the condition in the intake manifold, which will be the same at or about the point A in the body 1, will be termed depression. That part in the body 1 designated as B will be termed the mixing chamber, and that part designated C will be always subject to atmospheric pressure.

At one side of the body 1 is provided a fuel chamber 4 such as is common to all types of carburetors. It consists of a chamber containing a needle valve 5 operated by a float 6, the needle valve controlling the passage of fuel from a supply pipe 7. The float rests upon the gasoline or fuel which is in the bowl 4 so that when the level of fuel in the bowl drops, the needle valve opens, and fuel is admitted through the supply pipe 7 until the correct level is established, at which time the float has been raised to a position where it causes the needle valve to close. The purpose of this construction is to maintain a constant head of fuel in the bowl at all times.

As is also common to all types of carburetors

there is provided a throttle valve 8. This valve is of the well known butterfly type and is operated in a manner well known in the art and therefore not shown here. The throttle valve 8 is located between that part of the body designated A and the part designated B.

The present carburetor includes a specially designed fuel jet 9 having an inlet 10 extending into the bowl 4. The fuel jet 9 has two nozzles 11 and 12 extending in different directions, there being substantially circular openings in the ends of each nozzle. The nozzle 11, when viewed in side elevation, is of arcuate formation and in addition to the circular opening in the end thereof it is provided with a slot 13 in its upper wall.

Pivotally supported by a shaft 14a in the body 1 is an air valve 14. In many respects the air valve 14 resembles a conventional butterfly valve, the exception being that it is of streamlined cross section and when in its closed position it is angularly disposed relative to the body 1. In other words the air valve 14 cannot be moved to a position where it lies in a true transverse plane relative to the body 1. The air valve 14 is formed with a Venturi shaped opening 15 into which the nozzle 11 extends, the parts being so proportioned that the nozzle barely reaches through the Venturi opening when the air valve is in its closed position illustrated in Fig. 1.

The body 1 is formed with a tubular projection 16, the axis of which extends in a radial direction relative to the body 1. On the outer end of the tubular projection is screwthreaded a hollow cap 17 and a flexible diaphragm 18 has its edges interposed between the cap and the end of the projection. A rod 19 has one end connected to the diaphragm and its other end extends through a slot 20 in the wall of the body 1 and connected to the air valve 14. A plate 21 is carried by the rod 19 and is held in a position where it covers the slot 20 by a spring 22 which is sleeved around the rod 19 so that it is slightly compressed by engagement of one end thereof with the diaphragm while its opposite end engages the plate 21.

A passage 23 is formed in the wall of the body 1 and opens as at 24 into the part of the interior of the body above the throttle valve 8 and designated A. The passage 23 extends through the wall of the tubular projection 16 and communicates with an aperture 25, the aperture 25 registering with a slot 26 which is in communication with the interior of the cap 17. The wall of the body 1 is provided with a screwthreaded bore 27 communicating with the passage 23, the passage 23 preferably being formed with a slight restriction 28 directly opposite to the bore. Received in the bore 27 is an air bleeder 29 having an air bleeding passage 30. In order to vary the bleeding capacity various bleeders are made with different sized bleeding passages and the capacity is changed by removing the bleeder and inserting another of different capacity.

The wall of the body 1 is provided with an opening 31 which provides communication between the mixing chamber B in the body 1 and the interior of the tubular projection 16. The body 1 also has another opening 32 providing communication between the interior C of the body 1 and the interior of the tubular projection 16. The opening 32 is normally covered by a plate 33 having a spring 34 urging it toward its closed position. The plate 33 constitutes a backfire valve so that in the event an explosion takes place in the intake manifold or part A of the body 1 or in the mixing chamber B the force of the back fire will not harm the parts above described but will exhaust through the opening 32 into the air supply C.

In describing the operation reference will first be had to Fig. 1 wherein the parts are shown in their idle speed positions. The air valve 14 is so located that it completely closes the cylindrical body 1 and air entering the end 3 cannot pass through the carburetor except for that amount which passes through the Venturi shaped opening 15. The air is caused to flow from the part c, through the Venturi opening 15, because of the fact that a depression exists in the part A and due to the fact that the throttle valve 8 almost, but not completely, obstructs the passage of air through the carburetor. Because of the fact that air at atmospheric pressure cannot rapidly dissipate the depression at A because of the throttle valve 8, the depression is greater in the part A than it is in part B. Therefore the depression which is realized in the hollow cap 17 through the passage 23, plus the pressure of the spring 22, is sufficient to overbalance the depression in the tubular projection 16 (which depression is equal to that in the mixing chamber B) and move the diaphragm 18 to a position maintaining the air valve 14 in its closed position. This balanced condition of the diaphragm exists regardless of the bleeder 29 whose function will become apparent as the description progresses. During this operation the slot 13 along the top of the nozzle 11 acts as an air bleed when the air valve 14 is in its closed position.

As the speed of the engine increases to what might be termed cruising speed the throttle valve 8 will be in approximately the position illustrated in Fig. 6. With the throttle valve 8 in the position illustrated in Fig. 6 very little difference exists between the depression A and the depression B. The air bleeder 29 admits enough air at atmospheric pressure into the passage 23 to cause a differential in depressions on opposite sides of the diaphragm 18. That is to say the depression in the tubular projection 16 is greater than the depression in the cap 17 and the diaphragm 18 is biased so as to move the rod 19 which in turn causes pivotal movement of the air valve 14. As the air valve 14 is thus opened the Venturi opening 15 passes backwardly over the nozzle 11 and gradually reduces the capacity of the slot 13 as an air bleeder. A greater portion of the nozzle 11 is exposed through the opening 15, or in other words is extended into the air stream passing around the air valve, and a greater amount of fuel is thus supplied to the increased volume of air passing through the carburetor. When the air valve 14 is moved from its closed position an air flow takes place past its upper end and the nozzle 12 is so positioned as to be in this air flow. Thus the nozzle 12 is out of action until the air valve 14 is partly opened and functions to supply fuel from the time of partial movement throughout the full speed range of the engine.

In Fig. 7 the parts are in their positions incident to the highest speed of the engine, or in other words the throttle 8 is wide open. With the throttle valve 8 wide open the conditions of depression in the portion A and the mixing chamber B are the same. Therefore the depression in the tubular projection 16 is the same as that at the point 24 where the passage 23 opens into the part A. The air bleeder 29 admits air at atmospheric pressure to the passage 23 and sufficiently dissipates the depression in the cap 17

that the diaphragm 18 is biased sufficiently to move the air valve 14 to a position where it offers the least amount of resistance to the air flow. When in this position a still greater amount of the slot 13 in the nozzle 11 is exposed to the air stream while the nozzle 12 remains exposed. It will be appreciated that the spring 22, in order to permit such a function, is extremely light, it having barely enough strength to hold the diaphragm and air valve in their closed positions when the engine is at rest. However, the air bleeder, which permits atmospheric pressure to enter the passage 23, is an important factor, inasmuch as it gives the mixing chamber B depression the advantage over the depression in the manifold and realized at A and permits the mixing chamber depression to bias the diaphragm to move the air valve to its open position.

Fig. 8 illustrates positions of the parts under abnormal conditions of operation of the engines. The conditions might be a heavy load on the automotive vehicle or might result from travelling on an up-grade, or they might result from rapid opening of the throttle valve. Under any of the above named conditions the engine is operating at a slower speed than is ordinary for the amount of throttle opening. Therefore the pumping action of the pistons in the engine is not so great as at higher speed and the depression in the portions A and B, although equal in both places, is not as great as in the case of the wide open throttle shown in Fig. 7. The air bleeder 29 functions to dissipate the depression in the cap 17 and the depression in the tubular projection 16 accordingly becomes overbalanced and tends to bias the diaphragm to move the air valve 14 to a position where it offers a partial obstruction to the air stream. In other words the air valve forms a restricted passage adjacent to the nozzles 11 and 12 and with a given volume of air passing through the carburetor in a given time it will be found that the velocity of the air as it passes the nozzles is greater than at any other point in the carburetor.

From the foregoing it becomes obvious that the function of the air valve is to provide an almost constant air stream velocity at the part of the carburetor adjacent to the nozzles, regardless of variations in the volume of air passing through the carburetor. The air valve is balanced in the air stream in such a way that the pull of the air stream directly striking against it does not open or close it, the air valve being operated through its connection with the diaphragm. Therefore the velocity of the air stream over the nozzles is controlled automatically by conditions set up within the carburetor under varying operating conditions of an engine, or in other words the depression in the upper part of the carburetor and the depression set up in the mixing chamber are the controlling factors.

When operating at moderate speed with the throttle part open, the air valve will be maintained in a position which will result in just sufficient air stream velocity for good vaporization of the fuel picked up from the nozzles, without obstructing the air stream to any detrimental extent. This valve operating at any given engine speed will find its most economical position automatically, which will be at the balance of the diaphragm between the two depressions above and below the throttle valve. The result is low fuel consumption in the engine and absence of special arrangements or devices to furnish the mixture for low or idle speeds and the absence of squirt guns and so called accelerator pumps.

Although a specific embodiment of the present invention has been illustrated and described it will be understood that various changes may be made within the scope of the appended claims without departing from the spirit of the invention, and such changes are contemplated.

What I claim is:—

1. In a carburetor, a fuel jet formed with a pair of nozzles, an air valve, said air valve being adapted to close off the passage of air through said carburetor and to cover one of said nozzles when in a closed position, said valve having a Venturi shaped opening into which the other of said nozzles extends.

2. In a carburetor, a fuel jet formed with a pair of nozzles, an air valve, said air valve being adapted to close off the passage of air through said carburetor and to cover one of said nozzles when in a closed position, said valve having a Venturi shaped opening into which the other of said nozzles extends, and automatic means for regulating the position of said valve to permit passage of air around said valve and to uncover said first named nozzle.

3. In a carburetor having a passage wherein suction at one end creates an air stream therethrough, means for regulating the volume of the air stream, a fuel nozzle in said passage, adjustable means for restricting said passage at a point adjacent to said nozzle to maintain a constant air velocity at the nozzle when the volume of air passing through said passage is varied by said first named means, and means responsive to pressure conditions on opposite sides of said means for regulating the air stream for actuating said adjustable means.

4. In a carburetor wherein suction at one end creates an air stream through the same, a throttle in said carburetor for regulating the volume of the air stream, a fuel nozzle in said carburetor, means for maintaining a constant air velocity adjacent to said nozzle when the volume of the air stream is varied by said throttle, and movable means adapted to move in response to the changing pressure conditions on opposite sides of said throttle for actuating said adjustable means.

5. In a carburetor having a passage wherein suction at one end creates an air stream therethrough, a fuel nozzle in said passage, means for regulating the volume of said air stream, said means being disposed between said nozzle and the suction end of said carburetor and being adapted to create different pressures on opposite sides thereof, and means actuated by the different pressures on opposite sides of said regulating means for restricting said passage at a point adjacent to said nozzle to maintain a constant air velocity at the nozzle when the volume of the air stream changes.

6. In a carburetor having a passage wherein suction at one end creates an air stream therethrough, a fuel nozzle in said passage, means for regulating the volume of said air stream, said means being disposed between said nozzle and the suction end of said carburetor and being adapted to create different pressure zones in said passage, means for restricting said passage at a point adjacent to said nozzle, and means connected with said pressure zones and actuated by the difference in pressure therebetween for operating said means for restricting said passage whereby the latter maintains a constant air ve-

locity when the volume of the air stream is changed.

7. In a carburetor having a passage wherein suction at one end creates an air stream therethrough, a throttle for regulating the volume of said air stream, said throttle being adapted to set up zones of different pressures on opposite sides thereof, a fuel nozzle having a plurality of jets, a valve adapted to restrict said passage, said valve having a Venturi opening through which one of said jets extends and a portion normally obstructing air flow adjacent to the other jet, and means operated by the difference in pressure between said zones for automatically moving said valve for maintaining a constant air velocity at the nozzle when the volume of the air stream changes.

8. In a carburetor having a passage wherein suction at one end creates an air stream therethrough, a throttle for controlling the volume of the air stream, a fuel nozzle, a valve mounted in said passage to restrict the same whereby to govern the velocity of the air stream at a point in said passage adjacent to said nozzle, and means operted by pressure conditions set up in said passage on opposite sides of said throttle by movement of said throttle, said means maintaining a constant air velocity at the point of restriction when the volume of the air stream is changed by movement of said throttle.

9. In a carburetor having a passage wherein suction at one end creates an air stream therethrough, a nozzle in said passage, a valve spaced from the discharge end of said nozzle and adapted to regulate the volume of the air stream, adjustable means adjacent to said nozzle and adapted to be moved to regulate the velocity of the air stream at a zone adjacent to the outlet of said nozzle, a chamber communicating with said passage on one side of said valve, a movable element in said chamber operatively connected to said means adjacent said nozzle, and means connecting said chamber on the other side of said movable element to said passage on the other side of said valve, said last named means having a restricted port opening into the atmosphere.

10. In a carburetor having a passage wherein suction at one end creates an air stream therethrough, a nozzle in said passage, a valve spaced from the discharge end of said nozzle and adapted to regulate the volume of the air stream, adjustable means adjacent to said nozzle and adapted to be moved to regulate the velocity of the air stream at a zone adjacent to the outlet of said nozzle, a chamber communicating with said passage on one side of said valve, a movable element in said chamber operatively connected to said means adjacent said nozzle, means connecting said chamber on the other side of said movable element to said passage on the other side of said valve, and means normally held closed by yieldable means for providing communication between said chamber and said passage at a point to one side of said velocity regulating means when an abnormal high pressure is present in said chamber.

11. In a carburetor having a passage wherein suction at one end creates an air stream therethrough, a valve in said passage for regulating the volume of said air stream, a nozzle in said passage, a regulating element located adjacent to said nozzle and adapted to be moved to regulate the velocity of said air stream, a diaphragm chamber, a diaphragm in said chamber and connected to said regulating element, means providing communication between said chamber on one side of said diaphragm and said passage on one side of said valve, means providing communication between said chamber on the other side of said diaphragm and said passage on the other side of said valve, and a restricted port in said last named means opening into the atmosphere.

12. In a carburetor having a passage wherein suction at one end creates an air stream therethrough, a nozzle in said passage, a valve spaced from the discharge end of said nozzle and adapted to regulate the volume of the air stream, adjustable means adjacent to said nozzle and adapted to be moved to regulate the velocity of the air stream at a zone adjacent to the outlet of said nozzle, a diaphragm chamber, a movable diaphragm in said chamber operatively connected to said adjustable means, means providing communication between said chamber on one side of said diaphragm and said passage on one side of said valve, means providing communication between said chamber on the other side of said diaphragm and said passage at a point between said valve and said adjustable means, and normally closed yieldable means adapted when opened to provide communication between said chamber and said passage at a point on the opposite side of said movable element when an abnormally high pressure is present in said chamber.

JOHN J. GRENAT.