Nov. 2, 1926. 1,605,254

A. A. MARTELL

MECHANISM FOR AUTOMATICALLY CONTROLLING THE FLOW OF FUEL MIXTURE TO AN INTERNAL COMBUSTION ENGINE

Filed July 16, 1924 2 Sheets-Sheet 1

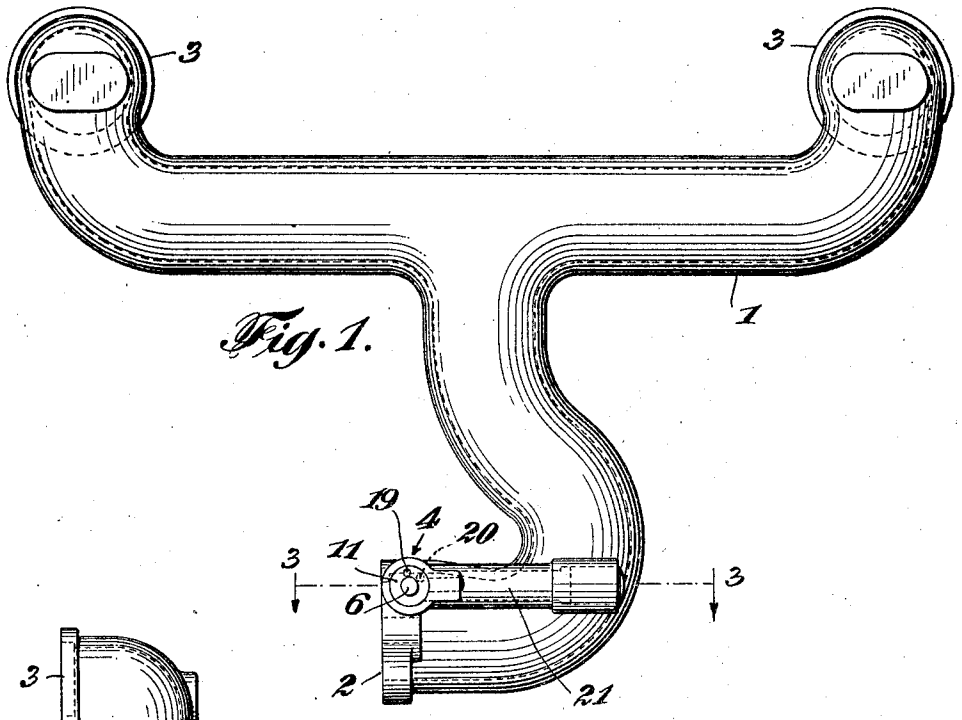


Fig. 1.

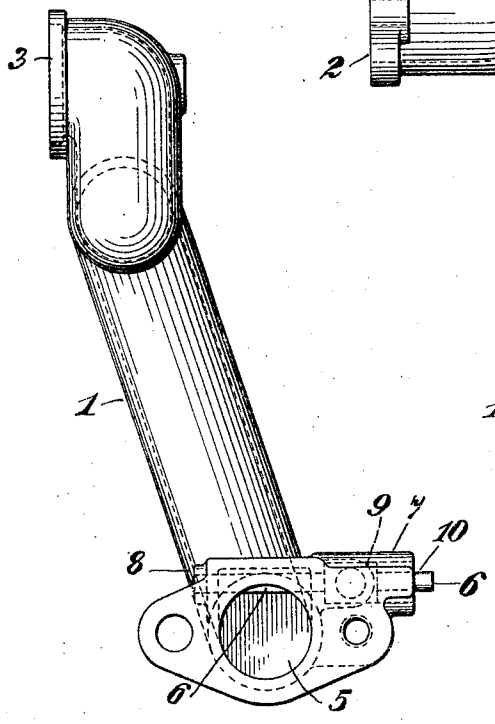


Fig. 2.

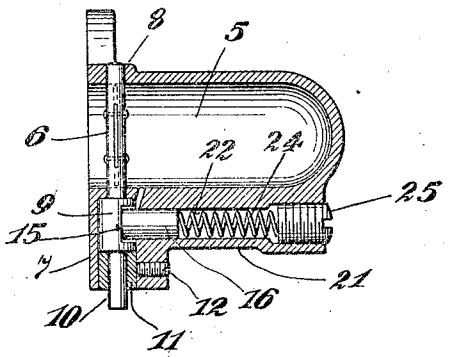


Fig. 3.

Albert A. Martell

INVENTOR

BY George Rawney

ATTORNEY

Nov. 2, 1926. 1,605,254

A. A. MARTELL

MECHANISM FOR AUTOMATICALLY CONTROLLING THE FLOW OF FUEL MIXTURE TO AN INTERNAL COMBUSTION ENGINE

Filed July 16. 1924 2 Sheets-Sheet 2

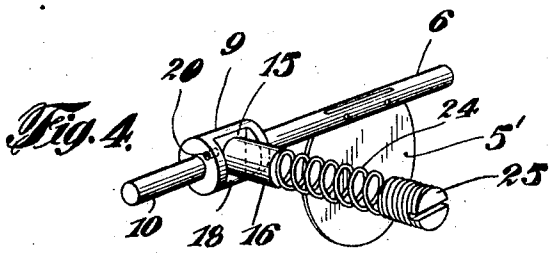


Fig. 4.

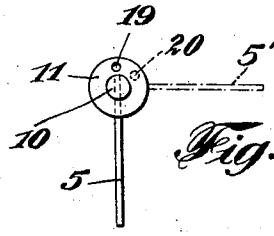


Fig. 5.

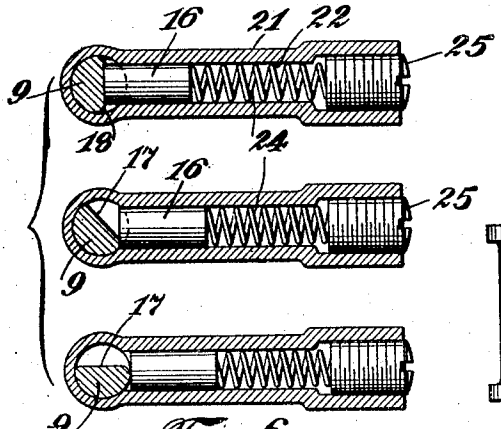


Fig. 6.

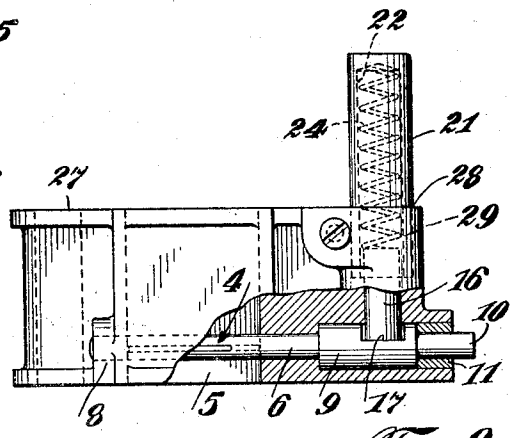


Fig. 8.

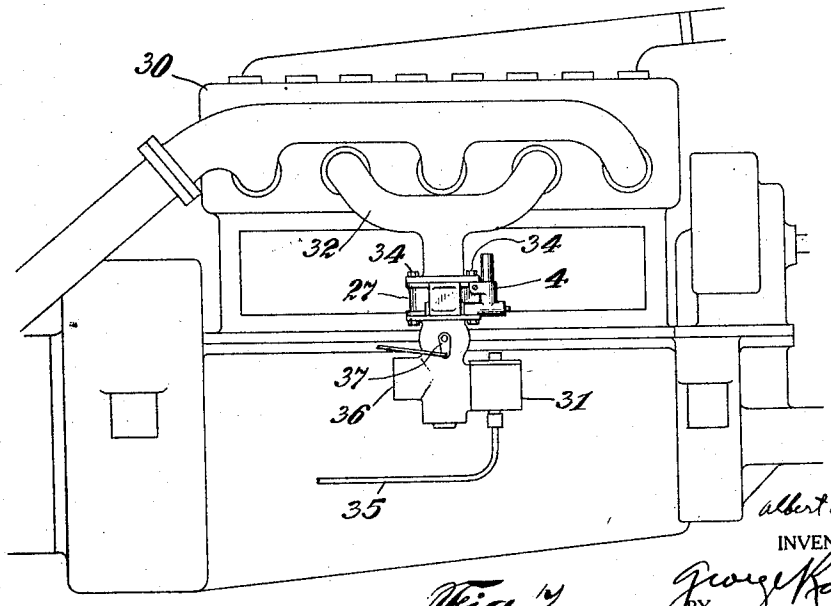


Fig. 7.

albert a martell

INVENTOR

BY George Ramsey

ATTORNEY

Patented Nov. 2, 1926. 1,605,254

UNITED STATES PATENT OFFICE.

ALBERT A. MARTELL, OF WOONSOCKET, RHODE ISLAND.

MECHANISM FOR AUTOMATICALLY CONTROLLING THE FLOW OF FUEL MIXTURE TO AN INTERNAL-COMBUSTION ENGINE.

Application filed July 16, 1924. Serial No. 726,329.

The present invention relates to an apparatus for controlling the flow of fuel mixture through the intake manifold of an internal combustion engine. The apparatus is adapted for use in connection with the usual commercial types of engines provided with suction carburetors and throttle valves.

An object of the present invention is to provide an apparatus for internal combustion engines which will regulate automatically the quality and quantity of a combustible mixture to correspond to the volumetric demand of the engine.

A further object is to provide an attachment comprising an automatic valve which may be readily installed with commercial carburetors and attached to the intake manifold of an engine without material alteration; and also to adapt the valve to be made and sold with the intake manifold or to be applied to automobiles now in use without changing the position of the carburetor or altering the piping thereto.

A further object is the provision of an auxiliary valve adapted to supplement the action of the throttle valve to permit the fuel to be fed in proportion to the volume of air required, and to prevent excessive vacuum in the vicinity of the carburetor spray nozzle, when the position of the throttle is changed, and the resultant excess of fuel for a given volume of mixture.

Another object is to provide a control valve yieldably retained in the path of the fuel and air to the intake manifold and to construct the valve retaining means to offer a high resistance to small displacements of the valve from its normal position and to offer a proportionably less resistance for each succeeding increment of displacement.

A more specific object is to automatically control the valve by means of a cam at the end of its spindle and a plunger which is yieldably retained against the cam by means of a spring mounted in a suitable barrel adapted to receive the plunger; and to provide an atmospheric inlet in the intake manifold to admit additional air, at high speeds of the engine, as determined by the position of the metering valve.

A further and more specific object is to provide a valve in a conduit leading from the carburetor to the intake manifold of an internal combustion engine; to mount the valve on a spindle, one end of which extends exteriorly of the conduit; to mount a cam on the exteriorly extending end of the spindle in operative relation to a follower held against the cam by a suitable spring; and to shape said cam so that a relatively large displacement of said spring results from a small displacement of the metering valve from its normal position, while the displacement of the cam follower per degree of angular movement of the valve decreases to a minimum as the valve reaches its maximum displacement.

A still further object is to provide an inexpensive structure of the above characteristics which is simple in construction and easy to manufacture and one applicable to various types of carburetors with slight adjustments and one which may be applied to engines now in use at a low cost.

Other and further objects of the present invention will be obvious upon an understanding of the illustrated embodiment about to be described, or will be obvious from the accompanying drawings, or indicated in the appended claims; and various advantages secured by the invention other than those herein specifically referred to will occur to one skilled in the art or become evident upon the employment of the invention in practice.

A preferred embodiment of the invention has been selected for the purposes of illustration and description and is shown in the drawings wherein,

Fig. 1 is a diagrammatic illustration of one form of automatic control valve mounted on the intake manifold of an automobile engine,

Fig. 2 is an end elevational view of the same,

Fig. 3 is a cross-sectional view on the line 3—3 of Fig. 1.

Fig. 4 is a perspective view of the control valve and spindle with its cam surface engaged by a spring retained follower.

Fig. 5 is a detailed end view of the spindle and bushing showing the auxiliary air port.

Fig. 6 is detailed views showing the cam operation.

Fig. 7 shows a form of the device mounted in an attachment adapted to be inserted between the carburetor and intake manifold of an internal combustion engine.

Fig. 8 is a detailed view of the attachment shown in Fig. 7.

In the operation of internal combustion engines, particularly of the type used in automobiles, the combustible mixture furnished the cylinders is formed by the passage of air through a carburetor. The usual type of carburetor consists essential of a contant level fuel chamber with a spray nozzle leading therefrom into a suitable conduit connected to the intake manifold of the engine. On the suction stroke of a single cylinder engine, air is drawn through the conduit, and in a multi-cylinder engine the suction strokes are consecutive and a continuous but fluctuating flow of air passes the carburetor nozzle. A suitable needle valve in the nozzle restricts the liquid fuel outlet to allow the correct proportion to mix with the air and form a combustible mixture of the desired richness. Such needle valves are adjusted for normal speed and the engine operates more economically and satisfactorily at that speed than at any other. In this type of carburetor, that is, those not compensated, the mixture becomes richer as the speed of the engine increases, because of the increased vacuum in the vicinity of the spray nozzle. The reverse of this, that is, a leaner mixture with increasing speed, gives the best operating results.

Automobile drivers are constantly increasing and decreasing the speed of their cars by opening and closing the throttle. In speeding up, the throttle is completely opened until the car reaches the desired speed and then it is partially closed. In other words, the throttle valve is not opened gradually, but substantially instantaneously. The result is that the high suction in the intake manifold due to a closed throttle is communicated to the carburetor nozzle and fuel is sucked out in liquid form and passed to the cylinders in that state which impairs the "pick-up power" of the engine and frequently causes it to choke.

The present invention eliminates the difficulties of the prior art by providing a valve whose position is determined by the rate of flow of fluid to or through the intake manifold. This valve opposes the flow of air at all times and particularly when the displacement of the metering valve from normal is slight. Its opposition decreases as the volumetric flow of gases increases and when the flow of air is a maximum, the restriction of flow is negligible. The present device is to a carburetor what a fly wheel is to an engine, it smooths out the irregularities in carburetion due to abrupt changes in the position of the throttle, due to irregular action of the engine cylinders, and due to the unequal paths of travel of the mixture to the respective cylinders.

For instance, when a driver desires to accelerate an automobile from a standstill to a running speed, the throttle must be opened and closed each time the gears are shifted. The excessive vacuum in the manifold to which the carburetor nozzle would ordinarily be subjected each time the engine was accelerated is communicated gradually by the present invention to the spray nozzle, giving the outside air ample time to respond to the demand of the carburetor. The customary choking is avoided because there is substantially constant suction about the spray nozzle irrespective of the changes in the position of the throttle. The proper carburetion afforded by the present device enables the engine to pick up quickly and run smoothly at all times.

The above advantages may be secured by a supplemental valve, in the conduit leading from the carburetor to the intake manifold, mounted on a spindle which extends exteriorly of the conduit. Suitable means which may comprise a cam follower, actuated by a spring, cooperates with a cam on the free end of the spindle to retain the valve in closed position. The cam surface is shaped to decrease the effectiveness of the spring as the displacement of the valve increases from closed position. Adjustments are provided to increase or decrease the pressure applied to the cam follower. An auxiliary air port controlled by the position of the supplemental valve admits air to the intake manifold during high speed operation of the engine.

Referring to the drawings, there is shown an intake manifold 1 adapted to have a carburetor attached to its lower end 2 and to have its upper end 3 attached to a suitable internal combustion engine. A valve 4 is preferably mounted at the lower end 2 of the manifold and may comprise a thin elliptical disc 5′ which is adapted normally to fit in and close the conduit 5 through the manifold 1.

A spindle 6 fits in a housing and extends through conduit 5 and is attached to the valve 4 to provide an axis about which it may swing to open and close the fuel and air passage through the manifold. The small end of the spindle 6 is adapted to fit in a bearing 8; the other end has an enlarged portion 9 with a small extension 10. A bushing 11 is mounted in one end of the housing 7 and is adjustably retained there by a set screw 12 to receive the extension 10 and form a bearing for one end of the spindle 6. The enlarged portion 9 of the spindle is slotted at 15 to receive a plunger 16 which acts as a cam follower. The bottom 17 of the slot is substantially flat with one longitudinal side rounded at 18. Accordingly, the flat surface is substantially parallel to the plane of the valve disc 5′, so that there is a large displacement of the plunger 16 at the initial opening of the valve and a decreasing rate of displacement as the

valve is opened further. An auxiliary air port 19 is formed in the bushing 11 to register with the aperture 20 extending to the enlarged portion 9 of the spindle to the slot 15 which is in communication with the conduit 5. The angular position of the port 19 may be adjusted by the set screw 12 to admit auxiliary air to the intake manifold at any predetermined position of the valve 4. Preferably, the position of the bushing is such that the port 19 registers with the aperture 20 to admit air when the valve 4 opens to about half its maximum angular displacement.

The end of the housing adjacent the bushing 11 is extended upwardly to form a cylindrical barrel 21 extending parallel to the conduit through the manifold and having a cylindrical bore 22 adapted to receive the plunger 16 and a spring 24. The upper end of the bore is screw threaded to receive a threaded member 25 and give the desired resistance to the opening of the valve 4.

In Figs. 7 and 8, the automatic control valve is shown mounted in an attachment 27 having flanges at its respective ends. The construction of the valve is substantially the same as that of the form mounted directly in the intake manifold and described hereinbefore. The spring housing or barrel is screw threaded at its forward end 28 to be inserted into the aperture 29 to permit the spring to engage the plunger 16. The compression of the spring is controlled by the depth the barrel is threaded into the aperture 29.

Such an attachment may be mounted on an engine 30 by unbolting the carburetor 31 and manifold 32, inserting the attachment so that the flanges at its ends fit the corresponding flanges on the carburetor and manifold, and securing the parts together by bolts 34 of suitable length. Fuel is supplied the carburetor through pipe 35 and is mixed with air entering port 36 and passed through the manifold 32 to the engine cylinders. The speed of the engine is controlled by a throttle valve 37. Certain advantages are attained by mounting the metering valve in an attachment which is saleable as an inexpensive separate appliance suitable for various types of cars and adapted to be mounted between the manifold and the carburetor without otherwise disturbing the various parts of the engine.

In the operation of the device, if the throttle valve 37 is closed, the metering valve 4 will likewise be closed. When the operator of the engine opens throttle valve 37 to accelerate the engine, the vacuum in the manifold produces a reduced pressure on one side of the valve 4, and atmospheric pressure on the other side which will tend to open valve 4, and cause an inrush of air through the air port 36 and conduit 5. This action of the valve 4 tending to open will be opposed by the operation of spring 24 acting through the plunger 16 on the cam surface 17. As heretofore described, the cam surface 17 is shaped so that there will be a relatively large displacement of the plunger 16 for a small opening of the valve 4. The abruptness of the contour of the cam surface decreases as the displacement of the value increases and when the valve 4 is three quarters open, there is little opposition to further opening of the valve and yet there is sufficient pressure to return the valve to its original position when the throttle valve 37 is closed. The substantially flat surface 17 with its rounded edge 18 has a kind of a crank action with the plunger 16 and the point of application of power from the spring changes to render this power less effective as the valve opens.

The valve 4 and its associating mechanism, when located at any point on the upstream side of the carburetor nozzle, supplements the action of the throttle valve 37 and prevents a vacuum in the intake manifold from being communicated suddenly to the spray nozzle of the carburetor because of an abrupt change in the position of the throttle valve. It restricts the flow of air to such a degree that it can be replenished by the inlet to the carburetor without creating an excessive vacuum. This not only permits a quick acceleration of a car without interfering with its ordinary operation, but it also smooths out any irregularities in the carburetion and therefore affords better operating characteristics and greater fuel economy.

It will be noted that there is provided in this invention a structure of simple and inexpensive construction and highly efficient action. As various embodiments may be made in the invention above set forth and as many changes may be made in the structure and its location in the intake manifold hereinbefore described, it is to be understood that all matter is to be interpreted as illustrative and not in a limiting sense. As a matter of convenience, the expression "butterfly valve disc" has been used in the claims to designate the fluid obstructing element of the butterfly valve. The word "disc" is used in a sense broad enough to include a butterfly valve element of any suitable shape and is not limited to a circular or elliptical valve element.

Having thus described my invention, what I claim is:

1. An attachment for an internal combustion engine comprising a conduit, a spindle extending through said conduit and having a cam surface on the end thereof externally of said conduit, a valve on said spindle controlling the conduit, a housing enclosing said spindle, a plunger for engaging said cam to yieldably retain said valve in closed

position, and a barrel associated with said housing for receiving said plunger.

2. An intake manifold for an internal combustion engine comprising means establishing a fuel mixture passage; a shaft extending transversely through said passage adjacent one side thereof; a butterfly valve disc secured to said shaft adjacent one edge of the disc to nearly block the mixture passage when the valve is closed and to furnish substantially no obstruction when the valve is open, said valve being movable from its closed to its open position by the action of the fuel mixture upon the disc; and a cam and spring pressed follower operatively associated with said shaft to bias said valve in its closed position, said cam being shaped to furnish a strong bias while the valve is moving through an angle of approximately 45 degrees from its closed position and to substantially eliminate the bias as the valve approaches its open position.

3. In an internal combustion engine construction; means establishing a passageway for fuel mixture; a shaft for supporting a butterfly valve disc in said passageway; a butterfly valve disc secured to said shaft to nearly block said passage when the valve is closed and to furnish substantially no obstruction when the valve is open, said valve being movable from its closed to its open position by the action of the fuel mixture upon the valve disc; and a cam and spring-pressed follower operatively associated with said shaft to bias said valve in its closed position, said cam being shaped to furnish a strong bias when the valve is near its closed position and to substantially eliminate the bias as the valve approaches its open position.

4. An intake manifold for an internal combustion engine comprising means establishing a fuel mixture passage; a substantially horizontal shaft extending transversely through the mixture passage near its wall; a butterfly valve disc secured to said shaft adjacent an edge of the disc to nearly block the mixture passage when the valve is closed and to furnish substantially no obstruction when the valve is open, said valve being movable from its closed to its open position by the action of the fuel mixture upon the valve disc; and means operatively associated with said shaft to bias said valve in its closed position, said means furnishing a strong bias when the valve is near its closed position and substantially no bias as the valve approaches its open position.

5. In an internal combustion engine construction; means establishing a passageway for fuel mixture; a shaft for supporting a butterfly valve disc in said passageway; a butterfly valve disc secured to said shaft to nearly block said passage when the valve is closed and to furnish substantially no obstruction when the valve is open, said valve being movable from its closed to its open position by the action of the fuel mixture upon said disc; a cam and spring-pressed follower operatively associated with said shaft to bias said valve in its closed position, said cam being shaped to furnish a strong bias when the valve is near its closed position and to substantially eliminate the bias as the valve approaches its open position; and means associated with said shaft to admit air directly to said passage when the valve is approximately half way open.

6. An intake manifold for an internal combustion engine comprising means establishing a fuel mixture passage; a shaft for supporting a butterfly valve in said passage; a butterfly valve disc secured to said shaft to nearly block the mixture passage when the valve is closed and to furnish substantially no obstruction when the valve is open, said valve being movable from its closed to its open position by the action of the fuel mixture upon the valve disc; means operatively associated with said shaft to bias said valve in its closed position, said means furnishing a strong bias when the valve is near its closed position and substantially no bias as the valve approaches its open position; and means associated with said valve to admit air directly to the fuel mixture passage when the valve has opened a predetermined amount.

7. An attachment for internal combustion engines comprising a shaft adapted to support a butterfly valve in a fuel mixture passage for the engine, a cam operatively associated with said shaft, a plunger shaped follower cooperating with said cam; a barrel to receive said follower, a spring within said barrel urging said plunger against said cam to bias said valve in a closed position, and means to vary the compression of said spring.

8. An attachment for internal combustion engines comprising a shaft adapted to support a butterfly valve in a fuel mixture passage for the engine to be moved under the action of the mixture flowing in said passage, a butterfly valve attached to said shaft, a cam operatively associated with said shaft, a plunger-shaped follower cooperating with said cam, a barrel retaining said plunger-shaped follower, a coil spring within said barrel to urge said plunger against said cam and bias the valve in its closed position, and an adjustable plug threaded into said barrel to vary the compression of said coil spring.

9. An attachment for internal combustion engines comprising a shaft adapted to support a butterfly valve disc in a fuel mixture passage for the engine, a cam operatively associated with said shaft, a plunger-shaped follower cooperating with said cam, a barrel

to receive said follower, a spring within said barrel urging said plunger against said cam to bias said valve in its closed position, and means associated with said cam to admit air directly to the fuel mixture passage when the cam has reached a predetermined angular position.

10. An attachment for internal combustion engines comprising a shaft adapted to support a butterfly valve disc in a fuel mixture passage for the engine; a cam operatively associated with said shaft; a plunger-shaped follower cooperating with said cam; a barrel to receive said follower; a spring within said barrel urging said plunger against said cam to bias said valve in its closed position; and means associated with said cam to admit air directly to the fuel mixture passage when the cam has reached a predetermined angular position, said means comprising a bushing having a passageway extending through the wall thereof, which bushing is adjustably mounted as to angular position to vary the point at which air is admitted directly to the fuel mixture passage.

ALBERT A. MARTELL.