

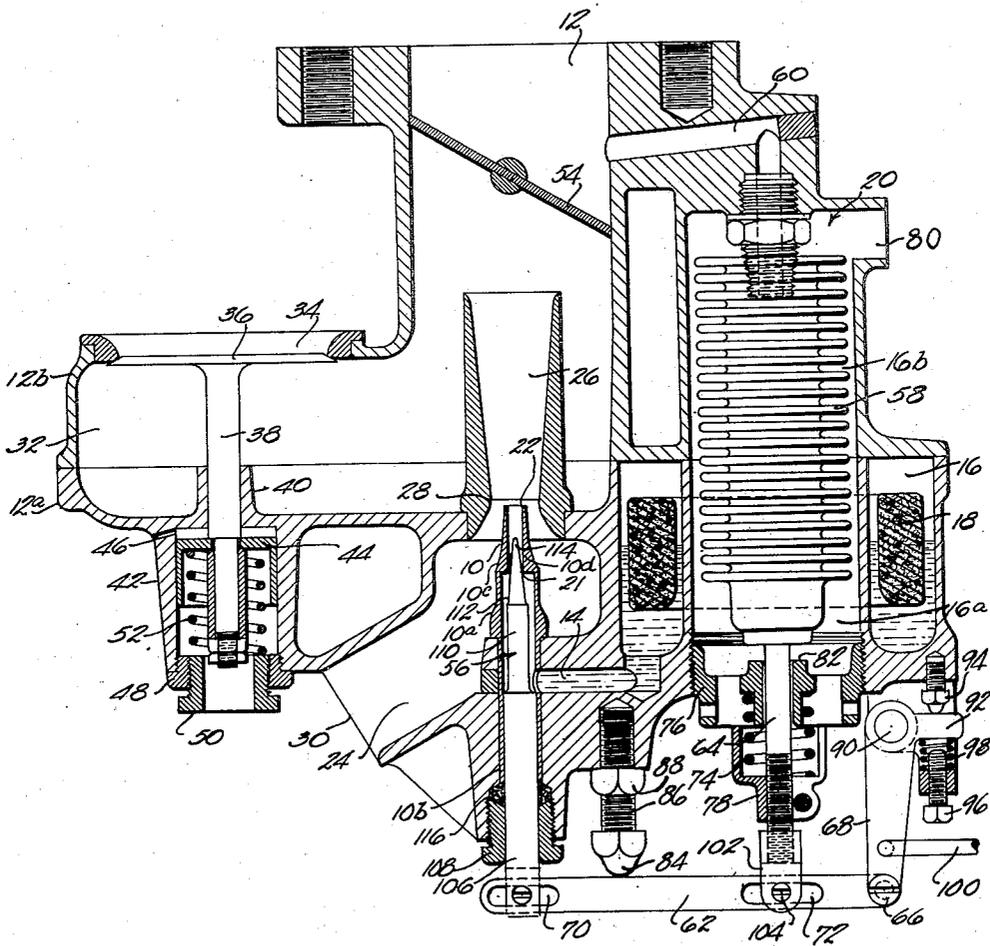
May 24, 1932.

A. MOORE

1,860,329

CARBURETOR

Filed Aug. 16, 1928



INVENTOR
Arlington Moore
BY
Dyke, Holden & Schaines
ATTORNEYS

UNITED STATES PATENT OFFICE

ARLINGTON MOORE, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO
MAXMOOR CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE

CARBURETOR

Application filed August 16, 1928. Serial No. 300,033.

My invention relates to charge mixture metering and supplying apparatus for internal combustion engines, and particularly transportation engines subject to wide momentary variations in power and speed; and the same has for its object more particularly to provide a simple, efficient and reliable apparatus which meters or supplies the fuel and air in response to variations in the intake pressure, and delivers said fuel and air to the intake in accordance with the engine requirements.

Among the further objects of the invention are the following:

To provide an apparatus of the character specified in which the fuel jet at all engine loads and speeds, including idling, supplies the requisite fuel without reliance upon the use of compensating or idling jets and the like expedients.

To provide an apparatus of the character specified in which the fuel jet is caused to deliver the requisite fuel from a source of fuel supply by subjecting the fuel jet to the inductive effects of high velocity air supply throughout the operating range of the engine while controlling the extent of opening of the fuel jet in inverse relation to the variation in intake depression above the throttle.

To provide an apparatus of the character specified in which fuel supplying means and air supplying means are controlled to vary the extent of opening thereof by means mechanically independent of each other actuated in response to variations in pressure in the intake conduit.

To provide an apparatus of the character specified in which the fuel jet is caused to deliver fuel from a source of fuel supply by subjecting the jet to the action of high velocity air passing through a primary air passage about the jet while controlling the extent of opening of the supplementary or secondary air supplying means for the higher loads and the extent of opening of the fuel jet in response to variations in intake pressure.

To provide an apparatus of the character specified in which the fuel supplying means and the secondary air supplying means are controlled by means mechanically independ-

ent of each other actuated by variations in intake pressure resulting from the actuation of the throttle means for controlling the pressure in the intake conduit.

To provide an apparatus of the character specified in which the means for controlling the quantity of the fuel or other component of the charge mixture delivered into the intake conduit is adjustable from a distance to render the charge mixture richer or leaner as desired.

Other objects will in part be obvious, and in part be pointed out hereinafter.

To the attainment of the aforesaid objects and ends my invention consists in the novel combinations and arrangements of parts hereinafter more fully described and then pointed out in the claims.

In the accompanying drawing:

The figure is a sectional elevation of one form of apparatus constructed according to and embodying my said invention.

In apparatus embodying my invention I provide a fuel jet orifice of variable cross-sectional area having a maximum cross-sectional area of an order of magnitude such as to supply fuel to the air by induction at the higher loads and speeds in proportion to produce a mixture for approximately maximum power, and capable of being controlled to decrease the extent of opening thereof at part throttle positions for supplying fuel to the air stream by induction in proportions to produce a mixture of approximately maximum economy.

The extent of opening of the fuel jet passage is varied throughout the operating range of the engine for supplying by the inductive effects of the engine the requisite fuel to the engine in quantities metered in accordance with the requirements of the engine at different speeds and loads.

In the apparatus of my invention, the opening of the fuel orifice is varied in accordance with the requirements to effect a balance between size of fuel opening and the reduction in pressure about the fuel jet due to the inductive effects of the engine, so that the fuel and air ratio throughout the operating range of the engine more nearly approximates the theoretical value therefor, and the

said reduction in pressure may be accentuated to effect delivery of fuel from the float chamber throughout the operating range of the engine while maintaining the fuel metering characteristics of the jet by orifice area variations.

Referring to the drawing, the fuel jet or nozzle 10 communicating with the intake conduit 12 also communicates through the passage 14 with the fuel receptacle or float chamber 16, the latter being of the constant level type in which the supply of fuel thereto is controlled by the usual valve actuated by the float 18.

The conduit 12 is formed in part in two castings 12^a and 12^b secured together by suitable fastening means. The float chamber 16 in the casting 12^a is preferably annular in form to provide a space 16^a therein registering with the space 16^b in the casting 12^b to form a bellows receiving chamber 20, the lower edge portions of the upper casting 12^b serving to close the float chamber 16.

The nozzle 10 consists of a lower tubular portion 10^a secured within the bore 10^b in the lower casting 12^a, and communicating with the passage 14, and of a tip portion 10^c having a relatively constricted passage 10^d therethrough. The lower end 21 of the passage 10^d is located below the fuel level within the chamber 16, and the upper end 22 thereof is located above said fuel level.

In my invention I provide a primary air passage 24 of a capacity such as to permit of the supply of the requisite air at part load or idling communicating with the intake conduit 12 past the nozzle 10 through the relatively constricted air accelerating means or Venturi passage 26 into which the end 22 of the nozzle projects. The passage 24 below the venturi 26 is relatively enlarged throughout compared to the cross-sectional area of the throat or constriction 28 of the venturi 26, and the same is in open communication with the atmosphere at 30. The additional air required at full load is supplied through the secondary or supplementary air passage 32 communicating with the intake conduit 12 around the venturi 26, and provided with an air inlet 34 from atmosphere controlled by the valve 36.

The valve 36 has a stem 38 sliding through a bore 40 constituting a bearing, and extending into the cylinder 42 formed in the part 12^a. The portion of the stem 38 within the cylinder 42 has secured thereon a piston 44. The interior of the cylinder 42 above the piston 44 is in communication with the atmosphere through the small opening 46, the arrangement last described constituting a dash pot. The open lower end of the cylinder 42 has secured therein a flanged annular member 48 into which is adjustably threaded an annular abutment 50. A spring 52 is interposed between the abutment 50 and the piston

44 for normally retaining the valve 36 on its seat in closed position. The tension of the spring 52 is so adjusted that the valve 36 opens when the difference in the pressure above and below the same exceeds a predetermined value as hereinafter described, the dash pot arrangement retarding the movement of the valve to prevent fluttering of same. A throttle 54 is located in the intake conduit 12 in position above the jet 10 and the valve 36.

The extent of opening of nozzle 10 is regulated by a modulating valve pin 56, and provision is made for operating said pin 56 in response to variations in the pressure difference between the engine intake pressure above throttle 54 and the pressure of the atmosphere.

In the form shown, the interior of a pressure responsive member, such as the bellows or expansible-contractible element 58 disposed within the chamber 20 communicates through the inclined drainage channel 60 with the passage 12 leading to the intake manifold, and the bellows 58 operates a lever 62 by means of stem 64; and lever 62, pivoted at 66 to the adjustable arm 68, actuates the fuel modulating pin 56. Pivotal connections are preferably made by slots 70, 72 in lever 62 to facilitate adjustments.

Contracting movement of bellows 58 responsive to pressure reduction in passage 12 moves valve 56 toward its closing position. Such movement is opposed by the spring 74 augmenting the inherent spring effect of the bellows 58. The spring 74 encircles stem 64, and is interposed between the base 76 closing the lower end of the chamber 20 and the adjustable screw collar 78 on the stem 64. The spring tension opposing contraction of the bellows is of a value to prevent movement of the bellows until the intake depression reaches two or three inches of mercury so that variations in speed at full load wide open throttle position will not affect the opening in the fuel jet. The bellows chamber 20 has an opening 80 in its wall for admitting air to the interior thereof. Stem 64 is guided and bellows 58 kept straight by the bearing 82 on the base portion 76, the latter constituting an adjustable stop for limiting the expanding movement of the bellows 58, and retaining the same under initial tension.

As the pressure in bellows 58 rises, the bellows (shown contracted) expands, and valve 56 further opens by this movement which is assisted by the spring 74.

The contracting movement of the bellows is limited by the lever 62 engaging the adjustable stop 84 threaded at 86 into the casting 12^a and locked in position by a nut 88.

The leverage of the member 62 is controlled by adjustment of the arm 68 which is pivoted at 90 to a depending portion of the part 12^a. The arm 68 has an angular projection 92 riding between the adjustable stops 94 and 96

and normally held against the stop 94 by the spring 98. A rod 100 is connected to the arm 68 and extends to a convenient point for actuating the arm from a distance, such as from the dashboard of an automobile. When the arm 68 is moved into engagement with the stop 96 the extent of opening of the fuel jet for each position of the pin 56 is greater, whereby to deliver more fuel to the air, producing a richer mixture. By adjusting the arm 68 the device may be readily adjusted for leanness or richness.

In order to adjustably vary the extent of movement of the pin 56 upon operation of the bellows, the pivotal connection between the stem 64 and lever 62 includes a member or clevis 102 threaded on the end of stem 64 and carrying a pivot pin 104 riding in the slot 72. When the pivot pin 104 and lever 62 are disconnected from the member 102, the latter may be adjusted through one or more 180° turns and the parts reconnected thereto. The angularity of the lever 62 is thus adjusted which controls the extent of movement of the pin 56 for a given movement of the bellows.

The valve 56 has a cylindrical base portion 106 sliding within the bushing or bearing 108 secured within the bore 10^b in the casting 12^a of the device, a relatively constricted intermediate portion 110 disposed within the tubular portion 10^a of the fuel nozzle and providing therewith an annular space 112 for the passage of the fuel, and a calibrated tapered end portion 114 extending into the cylindrical orifice or opening of fuel jet 10, and adapted to vary the size of the opening 21 between the minimum and maximum limits by axial movement for the purpose above described. A suitable packing 116 is disposed between the member 108 and the part 12^a around the valve portion 106 to prevent leakage of fuel from the fuel chamber 16.

The tapered end portion 114 of the modulating valve 56 working in the opening 21 provides an annular orifice at 21 of variable cross-section located below the level of the fuel in the constant level chamber. The constricted character of the said annular orifice upon passage of fuel therethrough tends to disintegrate the fuel, while the portion 10^a of the passage beyond the same is preferably made of relatively greater cross-sectional area, even greater than the area of the fuel jet orifice of the ordinary carburetor, to facilitate the passage of the fuel therethrough in a finely divided state and its delivery to the air stream duly metered without subjecting the same to frictional resistance or capillary effect resulting from constriction of the portion of the fuel jet above the fuel level as is the ordinary practice. Hence, by making the portion of the fuel jet below the fuel level the most constricted portion thereof and capable of variation, the reduction in pressure maintained about the fuel jet pri-

marily by the Venturi means 26 is rendered more effective in lifting the fuel through the distance required, and upon acceleration for preventing lagging of the fuel relative to the air stream. Further, when the engine is at rest, it is not necessary to completely close the fuel orifice passage because the tip of the nozzle 10 is above the fuel level in the float chamber.

The bellows 58 controls the pin 56 to meter the fuel in accordance with the engine requirements without the entire dependence therefor being placed, as in the ordinary carburetor, upon the metering effects of the variations in pressure reduction at the fuel orifice for effecting the elevation of the fuel to the tip of the fuel nozzle.

In operation, at idling, when the throttle 54 is cracked, the valve 36 is closed and all of the air required for engine operation enters the engine through the opening 30, and passes through the constriction 28 around the nozzle 10, producing a reduction in pressure sufficient for raising the fuel under atmospheric pressure through the nozzle 10. Inasmuch as the additional air required at full load is delivered through a separate passage 32, the constriction 28 of the venturi 26 is of a cross-sectional area to permit of the passage of sufficient air at idling or low load and to produce a greater reduction of pressure about the fuel jet than would be possible if the venturi were of a cross-section to deliver also all of the air required at full load. Further, with the throttle cracked and the valve 36 closed, the nozzle 10 due to the relatively small air inlet 30 from the atmosphere is subject also to a slight extent to the general intake depression above the throttle. At idling the modulating pin 56 provides a fuel jet opening of minimum size such as to deliver the requisite quantity of fuel under the action of the reduction in pressure existing at the time about the nozzle 10.

As the throttle 54 opens the requirements for air increase. When the capacity of the venturi 26 for supplying the requisite air is exceeded, the difference in pressure above and below the valve 36 overcoming the adjusted spring 52 causes the valve 36 to open for admitting the additional air required, the extent of valve opening depending upon and varying in accordance with the decrease in pressure below the same, the pressure below the throttle 54 depending upon the extent of opening of the throttle and upon the intake depression above the same. As the valve 36 opens the venturi continues to function to deliver its proportionate quantity of air, and to exert together with the general decrease in pressure below the throttle 54 a fuel elevating effect on the nozzle 10. As the intake depression above the throttle decreases the pin 56 opens to a greater extent to deliver fuel in the proportions required, the nozzle orifice

control means being adjusted and calibrated to effect a balance between the extent of opening of the nozzle 10 and the reduction in pressure about the same to insure the delivery of the requisite fuel for the air being delivered.

With the apparatus embodying my invention more exact proportionment of air and fuel in accordance with the engine requirements may be obtained because the admission of both the air at full load and the fuel throughout the range of operation is controlled in accordance with variations in pressure within the intake conduit. The pressure responsive means for controlling the air is entirely independent mechanically of the pressure responsive means for controlling the fuel, so that each means may be calibrated and adjusted individually to properly function independently of each other in response to variations in pressure within the conduit. The fuel controlling means responds to variations in pressure above the throttle 54 while the air controlling means responds to variations in pressure below the throttle.

In my invention the throttle 54, without mechanical interconnection with the air and fuel controlling means, controls the pressures within the intake conduit above and below the throttle, and these variations in pressure are utilized directly to vary the air and fuel controlling means, whereby to obtain a more sensitive and accurate variation in the quantity of air and fuel delivered than could be obtained for instance by controlling the admission of air and fuel mechanically by the throttle directly. Further, as the pressure within the intake conduit varies with the engine speed, the throttle remaining in fixed position, such variations in pressure are effective to actuate the said air and fuel controlling means independently of throttle movement.

The quantity of fuel required for a given engine throughout the operating range may be readily ascertained, and the inclination of the tapered portion 114 designed accordingly to vary the opening 21 to supply the requisite fuel as the bellows moves between its limits.

Among other features of advantage obtained are simplicity of construction, enabling expensive and troublesome idling and compensating jets and the like to be dispensed with and yet metering the fuel accurately for all requirements by means of the modulating pin operated by pressure differential and in substantially inverse relation thereto; there is no appreciable loading up of fuel on the intake passage walls at periods of engine deceleration; and the fuel is self-regulating at all loads and speeds, and efficiently delivered into the air stream. For example, the fuel nozzle can be of opening area adapted, when such entire area is in use, for full load operation at low engine speed, and as the engine speeds up, for example, in accelerating,

the additional supply of fuel required is obtained by increased air velocity past the jet 10 and by increased intake depression resulting from increased piston speed without decrease in the size of the jet orifice, the spring tension on the bellows preventing the fuel inlet opening from being reduced by movement of the modulating valve in response to the slight increase in intake depression due to increased piston speed.

The reduction of pressure about the fuel jet 10 together with the relatively constricted annular orifice through which the fuel passes into the enlarged tip portion also aids materially in securing a thorough atomizing of the fuel including the heavier ends thereof, and the delivery thereof to the air stream into homogeneous admixture therewith.

I claim:

1. In an apparatus of the character described, an intake conduit having primary and secondary air inlets, a throttle therein above said air inlets, a venturi in said primary air inlet of a capacity restricted to pass the air required for low fractional loads and at engine idling and to maintain high air velocity therethrough, a fuel jet below the throttle subject to air velocity through the venturi in said primary air inlet, means responsive to the pressure variations in the intake conduit below the throttle for controlling said secondary air inlet, and means responsive to the variations in the differential between atmospheric pressure and the intake pressure above the throttle for varying the extent of opening of the fuel jet in inverse relation to the differential variations resulting from throttle movement.

2. In apparatus of the character described, an intake conduit, a fuel jet, a valve controlling said fuel jet, a collapsible-contractible element responsive to variations in pressure, means adjustably connecting the same to said valve, and means operable from a distance for actuating said connecting means for adjusting the leverage thereof relative to said element and said valve to feed fuel in richer or leaner quantities as desired as said valve automatically varies.

3. In apparatus of the character described, an intake conduit, a valve controlling the admission of a component of the charge mixture thereto, an expansible-contractible element responsive to variations in pressure, a movable support, a lever pivoted to said support, and having a slotted connection with said valve and said element, stops limiting the movement of said movable support, a spring normally maintaining said movable support in engagement with one stop, and means for moving said movable support towards the other of said stops.

4. In apparatus of the character described, an intake conduit, a valve controlling the admission of a component of the charge mix-

ture thereto, an expansible-contractible element responsive to variations in pressure, means connecting said element to said valve for actuating the latter; said means being adjustable relative to said element and said valve to vary the leverage, means for normally retaining said connecting means in one adjustable position thereof, and means for actuating said connecting means from a distance to move the same to the other of the adjusted positions thereof.

5. In apparatus of the character described a fuel nozzle, a valve movable longitudinally therein, an expansible-contractible element responsive to variations in pressure, a stem thereon in parallelism with said valve, a pivoted support, a member pivoted at one end to said support and having a slotted connection with said stem and said valve, stops for limiting the movement of said pivoted support, means for normally maintaining said pivoted support in engagement with one of said stops, and means operable from a distance for moving said pivoted support towards the other of said stops.

6. In apparatus of the character described, an intake conduit, means for supplying fuel thereto, valvular means for controlling said fuel supplying means, means responsive to pressure variations for actuating said valvular means, and a connection between said valvular means and said pressure responsive means adjustable relatively thereto to regulate the rate of movement of said valvular means relative to the rate of movement of said pressure responsive means, and means for effecting said adjustment from a distance.

7. In an apparatus of the character described, an intake conduit having a relatively restricted primary air inlet for supplying air for low loads and engine idling, a venturi disposed in said restricted primary inlet for maintaining relatively high velocity of air flow therethrough, a fuel jet disposed in said venturi, a throttle disposed in said conduit beyond said air inlet and said fuel jet, a valved secondary air inlet communicating with said conduit between the venturi and throttle for supplying additional air at the higher loads, and means responsive to the variations in intake depression at the cylinder side of the throttle for varying the fuel passage area of the fuel jet in inverse relation to the intake depression variations resulting from throttle movement.

8. In apparatus of the character described, an intake conduit, a fuel jet, a valve controlling the flow of fuel through said fuel jet, pressure responsive means, a lever connecting said means with said valve, and means operable from a distance for shifting the fulcrum of said lever relative to the connection thereof to said means and said valve to feed fuel in richer or leaner quantities as desired as said valve automatically varies.

9. In apparatus of the character described, an intake conduit, a fuel jet, a valve for controlling the flow of fuel therethrough, a pressure responsive device, a movable support, a lever pivoted to said support, and having a slotted connection with said valve and said device, and means for actuating said movable support from a distance to vary the fulcrum of said lever relative to the slotted connections.

In testimony whereof, I have signed my name hereto.

ARLINGTON MOORE.