Dec. 6, 1932. G. L. HOLZAPFEL 1,890,058

GAS CARBURETOR AND METHOD OF CARBURATION

Filed Aug. 26, 1929

Fig. 2.

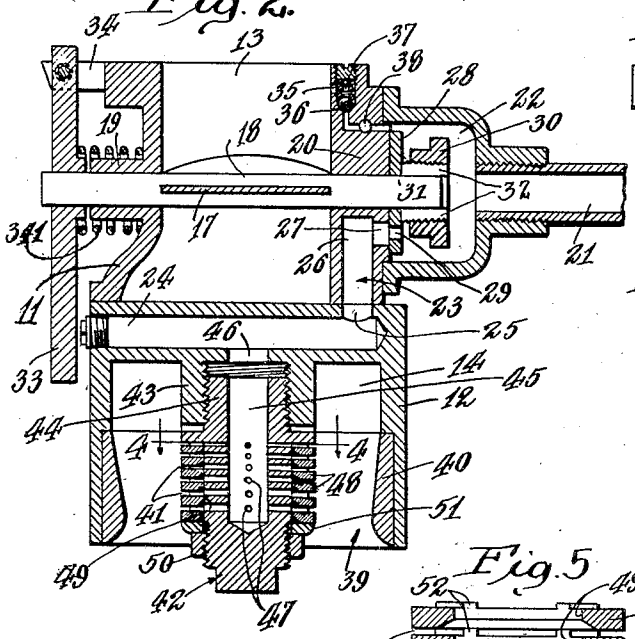


Fig. 1.

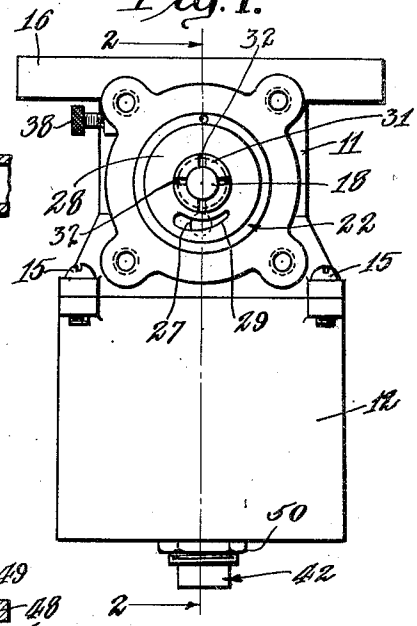


Fig. 5

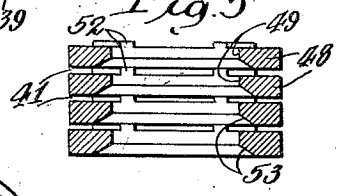
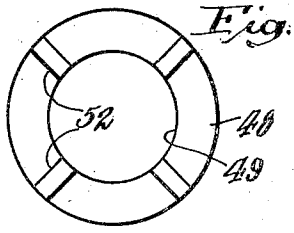


Fig. 6



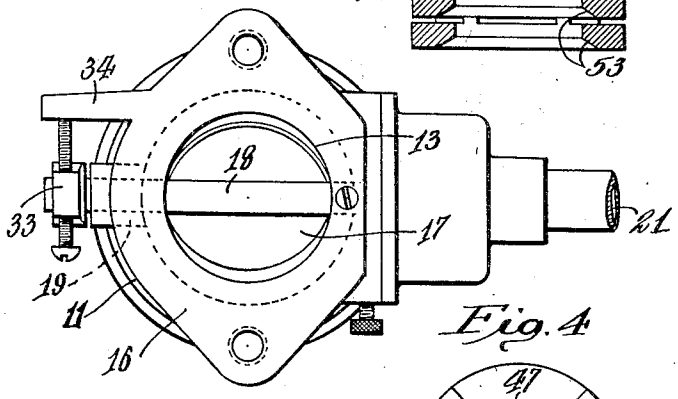


Fig. 3

Fig. 4

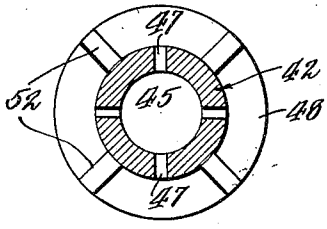
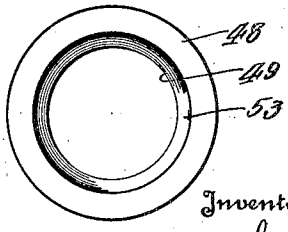


Fig. 7



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UNITED STATES PATENT OFFICE

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GAS CARBURETOR AND METHOD OF CARBURATION

Application filed August 26, 1929. Serial No. 388,397.

This invention relates to carburetors of the type in which carburation of air with a fuel gas, at different speeds of the air as required for internal combustion engines, is accomplished by a method and structure that will produce, at the different air speeds, a combustible mixture that is either uniform as regards the proportions of air and fuel or that varies in said proportions in a ratio that may be predetermined for producing, preferably, a leaner mixture at higher air speeds than at lower air speeds.

The invention relates also to methods of carburation.

When a fluid, such as gasoline, is supplied through a nozzle or jet placed in the bore of a Venturi tube and air is drawn through said tube, the fluid discharged into the tube varies approximately as the square of the velocity of the air. Thus, if the velocity of the air varies, for example, between 100 ft. and 500 ft. per second and the nozzle orifice supplying fuel is of a size to obtain a correct mixture for combustion when the air velocity is 250 ft. per second, it follows that if the air flow is reduced to 100 ft. per second the mixture will contain too little fuel and that, if the air velocity be increased to 500 ft. per second, the mixture will contain too great a quantity of fuel.

When gas flows through a sufficiently small orifice, the resistance to its flow varies approximately, as the square of the velocity of the gas through said orifice. This invention takes advantage of the above stated facts and an important object of the invention is to provide a construction that, preferably, secures viscous flow of a gas issuing from a nozzle into a Venturi tube so as to obtain a correctly proportioned combustible mixture at all velocities of the air, since the speed of flow of gas into the air stream varies, approximately, directly as the speed of the air.

Another important object is to facilitate alteration in the size of the orifice in the nozzle or jet, so as to alter the degree of compression of the fuel gas in the nozzle orifices and thus to alter the viscous flow of said fuel gas.

Another very important object is to provide a construction in which one or more nozzle orifices are subject to a different degree of suction or partial vacuum than another or other nozzle orifices.

Other objects and advantages will appear in the subjoined detailed description.

The accompanying drawing illustrates the invention.

Figure 1 is an end elevation of a carburetor constructed in accordance with the provisions of this invention, the end chamber and pipe connected therewith being omitted.

Figure 2 is a vertical section on the line indicated by 2—2 Figure 1.

Figure 3 is a plan view of the carburetor positioned as in Figure 2.

Figure 4 is an enlarged horizontal view, partly in section, from the line indicated by 4—4 Figure 2.

Figure 5 is an enlarged vertical section of a number of the nozzle discs.

Figure 6 is an enlarged plan view of one of the nozzle discs.

Figure 7 is an inverted plan view of the nozzle disc shown in Figure 6.

The carburetor body, in this instance, comprises an upper section 11 and lower section 12 provided with communicating bores 13, 14, respectively, said sections being secured together by fastening means or screws 15. The upper section 11 is provided with a flange 16 by which it may be secured by bolts to the intake manifold of an internal combustion engine, not shown.

Within the bore 13 is mounted a butterfly throttle valve 17 of the usual or any preferred construction, said valve, in this instance, being mounted on a spindle 18 which turns in bearings 19, 20 in the section 13.

A combustible gas is supplied to the carburetor through a pipe 21 which has its inner end in communication with a chamber 22 that encloses one end of the spindle 18. The chamber 22 is adapted to communicate with the nozzle bore 45 through a port which is indicated in general by the character 23, said port comprising a horizontal portion 24 in the section 12. a vertical portion 25 connected with the portion 24 and opening to the upper end of the section 12, a vertical portion 26

communicating at its lower end with the portion 25 and formed in the section 11, and a horizontal portion 27 communicating at one end with the portion 26 and having its opposite end open to the chamber 22. The port portion 27 is controlled by a disc valve 28 which is mounted to rotate with the spindle 18 and is provided with a port 29 adapted, as the spindle is turned, to be brought into more or less perfect registration with the port 23. In this instance, the valve 28 is adjustably held on the spindle 18 by a clamping nut 30 which is screwed onto the hub 31 of the valve 28. The valve hub is provided with slots 32 which allow the nut 30 to clamp the valve 28 in any desired position on the throttle spindle 18.

The other end of the spindle 18 projects outside of the body and is provided with a lever 33 to effect turning of the spindle. A suitable stop 34 is provided on the section 11 for engagement by the lever 33 when the butterfly valve is in the closed position.

The valve 28 is held tightly on its seat by a coil spring 341 which is positioned between the lever 33 and the section 11 so that the expansive force of said spring acting against the lever 33 pulls the spindle 18 to the left in Figure 2, thus holding the valve 28 on its seating.

The gaseous fuel admitted through the port 23 may be in sufficient quantities to properly operate the engine at all different speeds, but sufficient gas for idling purposes is preferably admitted to the bore portion 13 through a port 35 which is controlled by a check valve 36 that is yieldingly held closed, by a coil spring 37, when the engine is not operating, thus avoiding waste of gas. The suction of the engine opens the valve 36, whereupon small quantities of gaseous fuel are drawn from the chamber 22 through the port 35 into the bore portion 13.

The port 35 is further controlled by a needle valve 38 which may be manually operated into different positions to regulate the flow of fuel through the port 35.

The bore portion 14 constitutes a venturi so that as the air flows upwardly through the open mouth 39 of the carburetor the velocity of said air increases to a maximum at the throat of the venturi. The Venturi tube, proper, is indicated at 40 and, preferably, is of separate construction so that it may be readily removed and replaced by another of different proportions, in order that the velocity of the air may be readily regulated and, especially, so that a Venturi tube may be utilized having its throat at a lower level or another may be utilized having its throat at a higher level, with reference to the orifices 41 of the fuel nozzle or jet which is indicated, in general, by the character 42.

The nozzle 42 is constructed as follows:

Projecting downwardly from the port portion 24 is an internally threaded boss 43 into which is screwed a hollow nozzle member 44 which is closed at its lower end and the bore 45 of which communicates at its upper end through a passage 46 with the port portion 24. The nozzle member 44 is provided with any desired number of horizontally projecting holes 47 which open from the periphery of the member 44 to the bore 45. In the present instance the holes 47 are arranged in four vertical series.

Mounted on the member 44 are nozzle discs 48, the bores 49 of which fit the periphery of the member 44 closely but not so close as to prevent removal of the discs therefrom. Any desired number of discs may be employed and, in the present instance, six are illustrated as constituting the series, which series is held assembled on the member 44 by a nut 50 which is threaded onto the lower end of the member 44. Between the nut 50 and the lowermost disc there is preferably placed a washer 51.

The discs 48 are separated from one another so that the spaces therebetween constitute the nozzle orifices 41, hereinbefore referred to. Thus the orifices 41 are annular so that the fuel gas discharges laterally in thin sheets into the air stream. In this instance, the separation of the discs is effected by upwardly extending projections 52. The discs, preferably, are sufficiently close to one another to produce viscous flow of the gas, or, in other words, such compression of the gas, as it enters the inter-disc spaces, as to produce internal friction in the gas. The orifices 41 are horizontally aligned with the outer ends of the holes 47 and it is to be understood that the projections 52 of the various discs may be of the same height, so that the nozzle orifices may be alike in size, or that the projections on some of the discs may be of different height than on others so that some of the nozzle orifices may be of different size than others. Preferably each disc has a chamfer 53 to more freely permit gas to flow from the holes 47 to the spaces between the discs. It will now be readily understood that the viscous flow of the gas issuing from the nozzle can be regulated by varying the number of discs and/or substituting discs that have higher or lower projections 52.

It is to be clearly understood that the orifices 41 between the discs 48 are very narrow, as compared to the diameter of the openings 47, so that the flow of fluid through the nozzle is determined largely by the resistance it encounters while flowing between the discs 48, rather than through the holes 47.

The invention operates as follows:

Assuming that the carburetor is connected with the intake manifold of an internal combustion engine and that the engine is already in operation, at idling speed, the gas will be supplied through the port 35 in sufficient quantity to maintain the engine in idling op-

eration, it also being assumed that the throttle valve 17 is closed but that sufficient air escapes past it to produce the combustible mixture.

To obtain higher speed or more power of the engine, the operator will open the throttle valve 17, thereby registering the ports 23, 29 so as to permit the gaseous fuel to pass into the nozzle bore 45. This opening of the throttle valve, as is well known, increases the velocity of the air through the Venturi tube 40, thus tending to draw from the nozzle an amount of fuel far in excess of the amount required for producing a proper combustible mixture. However, owing to the relatively small size of the inter-disc spaces of the nozzle, the ratio of fuel to air will not increase but will remain approximately constant so that an ideally proportioned mixture will result at all air speeds, since the velocity of the gas will be held down by internal friction that the fuel gas is subjected to as it flows between the discs. The suction effect on the nozzle increases approximately as the square of the velocity of the air through the Venturi tube and this is offset by the increase of internal friction of the gas in the nozzle orifices, which friction also increases substantially as the square of the velocity of the fuel gas through the inter-disc spaces.

It will be seen that different nozzle orifices are subjected to different degrees of suction, as said orifices are at different levels in respect to the throat of the Venturi tube. In this particular instance, the air velocity is greatest adjacent to the lowermost orifice and decreases upwardly.

I claim:

1. A gas carburetor comprising a body provided with a vertical bore, a Venturi tube in said bore, and a nozzle in said tube provided with horizontally opening annular orifices at different levels in said tube.

2. A gas carburetor comprising a body provided with a bore, a nozzle mounted in said bore, the body provided with a gas passage communicating with the nozzle, a spindle mounted in the body, a throttle valve mounted on said spindle and positioned in said bore, a rotary valve on the spindle to control the flow of gas into the gas passage to said nozzle, and means to simultaneously operate said valves.

3. A gas carburetor comprising a body provided with a bore, a nozzle mounted in said bore, the body provided with a gas passage including a port communicating with the nozzle, a spindle rotatably mounted in the body, a control valve in the bore mounted on the spindle, and a disc valve mounted on the spindle and provided with a port adapted to be moved into and out of registration with the first mentioned port by turning of the disc valve.

4. A gas carburetor comprising a body provided with a bore and with a gas passage having a port opening into the bore, a check valve in said port, a nozzle mounted in the bore, the body provided with a second gas passage communicating with the nozzle, and a throttle valve in the bore between the first mentioned port and the nozzle.

5. A gas carburetor comprising a body provided with a bore and with a gas passage having a port opening into the bore, a check valve in said port, a nozzle mounted in the bore, the body provided with a second gas passage communicating with the nozzle, a throttle valve in the bore between the first mentioned port and the nozzle, a valve to control the flow of gas into the second passage, and means to simultaneously operate the two last mentioned valves.

6. A gas carburetor comprising a body provided with a bore, a nozzle mounted in said bore, the body provided with a gas chamber and with a gas port in the chamber communicating with the nozzle, a valve in the chamber controlling said port, a gas passage connecting the chamber with the bore, a throttle valve in the bore between the nozzle and the point of entry of said last mentioned gas passage, a check valve in the last mentioned passage, and means to simultaneously operate the first and second mentioned valves.

7. A gas carburetor comprising a body provided with a bore and with a gas conduit, the gas conduit having a portion extending transversely within the bore, a boss projecting from said transverse portion of the conduit, and a nozzle member secured to the boss and having a bore communicating with said transverse portion.

8. A gas carburetor comprising a body provided with a bore and with a gas conduit having a portion extending transversely of the bore, a boss projecting from said transverse portion, a nozzle member secured to the boss and having a bore communicating with said transverse portion and provided with holes, and spaced nozzle discs provided with bores fitting the periphery of the nozzle member, the inter-disc spaces communicating with said holes.

9. A gas carburetor comprising a body provided with a bore and with a gas conduit, a nozzle member mounted in the bore and provided with holes, spaced nozzle discs provided with bores fitting the periphery of the nozzle member, the inter-disc spaces communicating with said holes, the bore of the body having a Venturi-shaped portion and the discs being approximately in the throat of the venturi.

10. A gas carburetor comprising a body provided with a bore and with a gas conduit, a nozzle member mounted in the bore and provided with holes, spaced nozzle discs provided with bores fitting the periphery of the nozzle member, the inter-disc spaces com-

municating with said holes, the bore of the body having a Venturi-shaped portion and the discs being approximately in the throat of the venturi, and a throttle valve in the bore of the body.

In testimony whereof I affix my signature.

GEORGE L. HOLZAPFEL.