May 25, 1943. T. A. RIALL 2,320,012

CARBURETOR

Filed Sept. 17, 1941

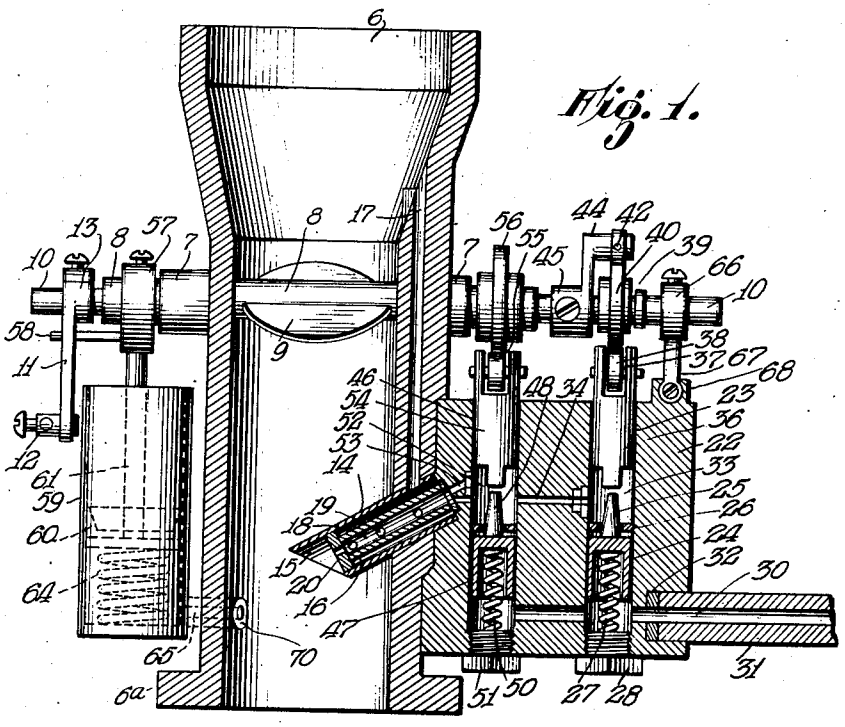


Fig. 1.

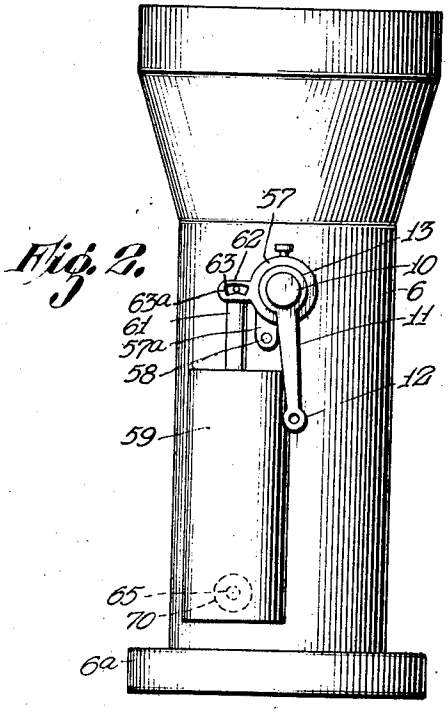


Fig. 2.

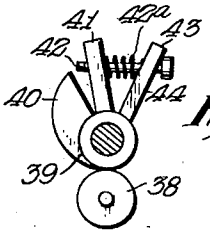


Fig. 3.

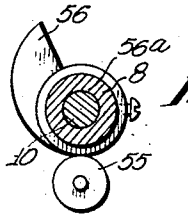


Fig. 4.

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CARBURETOR

Troy A. Riall, Silvis, Ill.

Application September 17, 1941, Serial No. 411,212

1 Claim. (Cl. 261—49)

My invention has reference to carburetors for internal combustion engines, and has for its purpose to increase the efficiency and economy of operation of such devices. Some of the parts as set forth herein are similar to those shown in a former application for Letters Patent of the United States, filed by myself on the twenty-fourth day of August, 1940, Serial No. 354,012. As in said former application the main object is for the regulation and control of the flow and mixture of the fuel oil and air where the fuel supply is taken directly from a fuel pump or similar source without any intervening mechanism of any kind, such as float devices, accelerating pumps, idling jets and the like.

The invention is designed chiefly to take care of conditions attendant on changes in the speed of the motor, especially in going from a low to a higher speed, in which the efficiency is liable to be affected by impoverishment of the fuel and a consequent temporary poor operation of the engine. Because of the great range of motor speeds required in modern engine design it is a difficult matter to maintain an economic and uniform mixture throughout the range of speeds, and as a result a mixture suitable for low speeds will be too impoverished for the higher speeds, and one that performs well at higher speeds would be too rich for the low speeds. To maintain a degree of uniformity between the idling mechanism and the running or service mechanism it has been usual to employ an accelerating device, known as an accelerating pump or well, to take care of what might be called the "flat spot." It has been the practice largely to have the service jets anterior to the throttle valve, in which arrangement a large part of the mixture contacts the surface of the throttle valve and is again condensed, feeding off from the edge of said valve into the air stream in a more or less liquid form. This off-sets any attempts to produce a special vaporization at or near the nozzle opening.

The present invention includes a nozzle opening into the main air passage at a point posterior to the throttle valve, with a constant and uniform suction on the nozzle, to which the fuel is fed by primary and secondary taper valves the taper in which is calibrated to conform to the various openings of the throttle valve, and with a control mechanism for the secondary valve which operates automatically from the suction of the main cylinder. It is obvious that the opening of the primary feed valve must be much slower in relation to the opening of the throttle valve than that of the secondary or high speed valve. As will be later explained, the degree of opening of both of said valves, and the relative amount of opening thereof is such as to secure substantially uniform suction commensurate for the fuel valve openings, combining the throttle valve with the choke valve by the combined action of the accelerator rod and suction generated by the motor.

Another feature of the invention consists of a means for idling purposes having an independent adjustment on the primary mixing valve actuating cam which can impart micrometric movement of the cam without moving the throttle control shaft.

In the drawing:

Fig. 1 is a sectional elevational view of the invention.

Fig. 2 is an elevation looking at one end of the machine, showing arrangement of the cylinder 59.

Fig. 3 is a detail of the cam devices for actuating the primary fuel feed valve.

Fig. 4 is a detail of the cam devices for actuating the secondary fuel feed valve, partly in section.

The reference number 6 indicates a main air cylinder, shown for a down-draft operation, at the sides of which are bearings 7, in which is rockingly mounted a hollow shaft 8, on which is fixed a throttle valve 9, near the throat portion of the cylinder 6. Rockingly supported in the shaft 8 is a shaft 10, fixed to one end of which is an arm 11, provided with connections at 12 for a wire or rod by means of which the arm may be operated, and not shown in the drawing.

In one side of the cylinder 6 is an opening in which is held a tubular casing 14, projected downwardly into the air channel, and ending in an atomizer hood 15 which is in the form of a hood or shield, preventing the down current from sweeping the liquid from the discharge opening and carrying it downwardly, without atomizing properly. Said casing contains an outer chamber 16, connected by an air duct 17 with the air passage in the cylinder 6 at a point above the valve 9. An inner passage 18 communicates with the chamber 16 through perforations 19, and at the inner end of the casing is a metering orifice 20.

Attached to the cylinder 6 at one side is a block 22, containing a primary valve control apparatus, embracing a vertical bore 23, in the lower end of which is a valve casing 24, from which is projected upwardly a taper valve 25, for engagement in a valve-seat 26, having a central

opening corresponding with the shape of the valve 25. In the casing 24 is a coiled spring 27, held at its lower end by a plug 28, closing the lower end of the bore 23. Above the plug 28 is a space 29, into which fuel oil can be introduced through a passage 30, extended into a pipe 31, connected with a source of fuel liquid fuel supply under pressure, such as an oil pump, and not shown in the drawing. At 32 the liquid fuel passes through a metering orifice. Above the valve seat 26 is a space 33, connected by a duct 34 with the passage 18, in which a supply of fuel is mixed with a quantity of air coming through the duct 17, and drawn into the main air passage, where the atomizing operation is carried on and completed.

Slidable in the upper end of the bore 23 is a plunger 36, containing a recess 37 in which is an anti-friction roller 38. Mounted loosely on the shaft 10 just above the roller 38 is a collar 39, on which collar is a cam 40, movable by means of an arm 41 fixed to the collar 39. The free end of the arm is perforated and threaded to receive the threaded end of an adjustment bolt 42, the other end of which has play in a slot 43 in an arm 44*a* projected from a collar 44, fixed to the shaft 10. The arms 41 and 44*a* are held in spread relation with each other by means of a spring 42*a* on the bolt 42. A rocking movement of the shaft 10 is imparted through the arms 41 and 44*a* to the cam 40, causing a downward movement of the plunger 36, and opening of the valve 25, which is pressed downwardly against the tension of the spring 27. The movement of the cam can be hastened or retarded, as desired, by suitable adjustment of the bolt 42.

The invention is also provided with a secondary valve mechanism, as follows:

Parallel with the bore 23 in the block 22 is a similar bore 46, in which is slidable a valve casing 47, from which is projected upwardly a taper valve 48, similar to the valve 25, but of more acute taper, and speedier response. The valve 48 is normally positioned in a seat 49 fixed in the bore 46 above the casing 47, and is held yieldably in place by a coiled spring 50 in said casing, and supported by a plug 51 in the lower end of the bore. Above the valve-seat 49 is a space 52, connected by a duct 53 with the nozzle member 14, and adapted to conduct the liquid fuel into the central passage of said member. In the upper end of the bore 46 is a plunger 54, in the upper end of which is a roller 55, for engagement by a cam 56 fixed on the end of the hollow-shaft 8. By the rocking action of said hollow-shaft the cam is caused to force the plunger downwardly, opening the valve 48.

The valves 25 and 48 are entirely independent of each other, the first-named being manually operated, and the latter one automatically controlled by devices of a special character actuated by the suction force in the main air passage.

Secured on the opposite end of the hollow shaft 8 is a collar 57, with which is connected an arm 57*a* in which is supported a rod 58, adapted to come in contact with the arm 11, upon a limited rocking movement of the shaft 8, forming a stop therefor. Just beneath the arm 57 is supported from the side of the cylinder 6 an air cylinder 59, in which is a piston 60, provided with an upwardly extending arm or rod 61, the upper end of which has a pin connection with an arcuate slot 63*a* in an extension 63 on the sleeve 57. Beneath the piston 60 is an expansive coiled spring 64, which holds the piston normally at a given position in the cylinder 59, as shown in the drawing. The cylinder 59 is held rockingly in position by a pivot 70 near the bottom of said cylinder, held in an opening in the lower part of the cylinder 6, and communicating with said cylinder through a duct 65. The connection of the pivot with the cylinder 6 is preferably a threaded one. Upon the suction in the main air passage exceeding a given amount the tendency thereof is to draw the piston 60 downwardly against the force of the spring 64, rocking the hollow shaft 8, and opening the valve 48. This results in the entry of additional fuel into the mixing nozzle at 14, and as the need is multiplied through an increase of the suction in the main cylinder, the supply of relief fuel is increased in proportion thereto, through a greater opening of the valve 48. This is in addition to the supply of fuel through the primary apparatus in bore 22, and independent thereof.

The rod 58 not only provides a detent, or stop for the shaft 8, by coming in contact with the arm 11, but by the manual operation of the arm 11 the movement of the detent can be reversed, rocking the shaft 8 in the opposite direction, and aiding the spring 64 in raising the piston. This will result in a closing of the valve 48 to a greater or less extent, and the combined actions of the arms 11 and 57*a* will result in a great degree of flexibility in the movements of the valves 25 and 48, and in the relative opening and closing thereof to meet the requirements of the motor as to speed.

Movement of the shaft 10 in a direction to close the throttle valve is limited by a collar 66 fixed on said shaft near one of its ends, and provided with an arm 67 carrying an adjustment screw 68 for contact with a stop 69 on the block 22. When fully stopped a slight movement of air is permitted past the throttle.

When it is desired to operate the engine, the motor is started in the usual manner, following which the accelerating lever 11 is actuated, rocking the shaft 10, the rocking movement of which is imparted to the cam 40, depressing the plunger 36, and opening the primary valve 25. Fuel oil coming through the channel 30 passes into the space 33, and through the orifice at 35 into the duct 34, through which it enters the mixing nozzle at 14, and passes out at the end thereof into the main channel 6. The fuel oil coming through the passage 18 is mixed with air drawn downwardly through the duct 17, and the fuel oil and air are at least partially mixed and atomized before being discharged into the channel 6, where the atomization continues.

After the engine has started the ensuing high suction in the channel in cylinder 6 is imparted to the cylinder 59 through the passage 65, which in turn draws the piston 60 downwardly, compressing the spring 64. As the piston is drawn downwardly it causes the throttle valve to open by actuating the arm 57. At the same time the cam 56 is operated to open the secondary valve 48.

So long as the suction is strong enough to hold the detent on the operating arm in line with the travel of the accelerating arm, the throttle valve works in unison with the accelerating arm, and the accelerating rod spring holds the rod normally closed regardless of the suction in the cylinder 59, therefore so long as the motor is operating the throttle valve the cam only opens as far as the accelerating arm travels because of the detent, but the accelerating arm can be in wide open position without causing the throttle to

open, as it opens only by vacuum suction, but can close by loss of suction or by movement imparted by the accelerating arm.

It has been determined that the best results can be secured by the use of a slow taper valve in the primary feed apparatus, with the actuating cam designed to open but substantially one-fourth its capacity in one-half of the cam's travel. The secondary or high speed valve, also of taper type, and whose actuating cam does not operate until one-half of the rotary movement has been completed, then opens to the full extent.

It is obvious that in carburetors where the nozzle is posterior to the throttle valve such valve controls not only the flow of air through the carburetor but also the suction that is exerted upon the mixing nozzle. In this device when the suction falls below a predetermined degree the valve will automatically close to a position commensurate with the suction force in the motor, whereby a uniform mixture will be maintained at all times and under all conditions.

What I claim, and desire to secure, is:

In a carburetor, a cylinder adapted for attachment to the intake manifold of an internal combustion engine, having a central down draft passage, a mixing nozzle in the wall of said cylinder near the lower end thereof, a throttle valve in said passage at a point above said nozzle, an air duct leading from the main air passage to said nozzle, for a continuous supply, a manually operable hollow throttle shaft rockingly mounted in said cylinder, a liquid fuel system connected with said nozzle, for supplying fuel under pressure to said nozzle, a primary taper valve in said feed system, a manually operable shaft rockingly supported in said hollow shaft, cam controls on said last named shaft for actuating said valve, a secondary taper valve control in said system, cam devices on the hollow shaft for actuating the secondary valve, an air cylinder communicating with the main air passage downstream of the throttle valve, and provided with controlling means operatively connected with the hollow shaft, and means limiting the movement of the hollow shaft with respect to the inner shaft and rendering the same subject to movement from the action of the manual operating devices.

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