Feb. 7, 1933. W. C. CARTER 1,896,390

CARBURETOR

Filed June 11, 1930 3 Sheets-Sheet 1

Fig. 1.

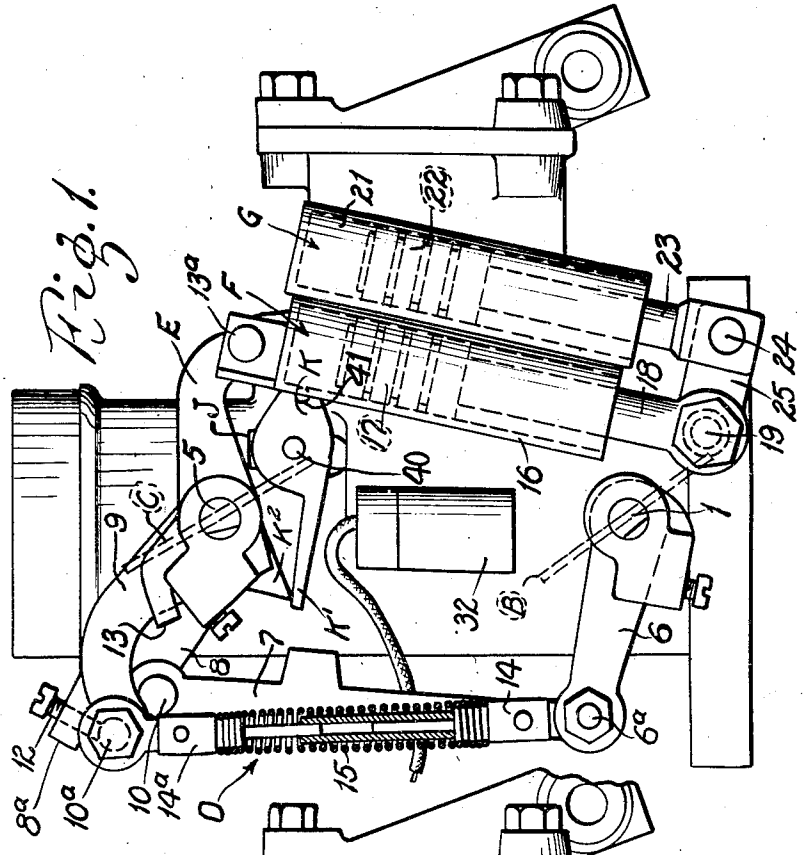
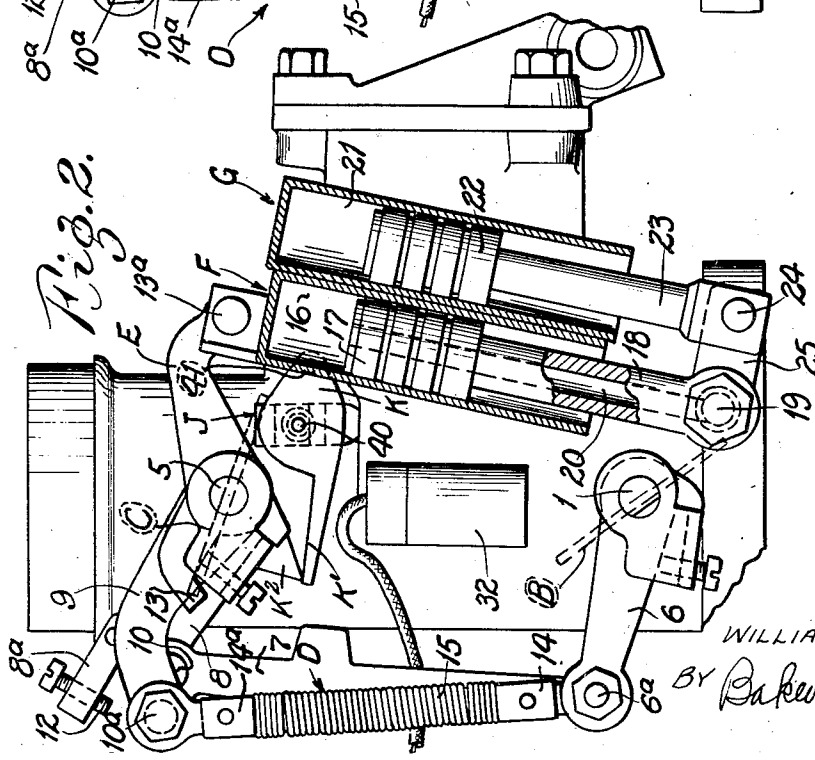


Fig. 2.



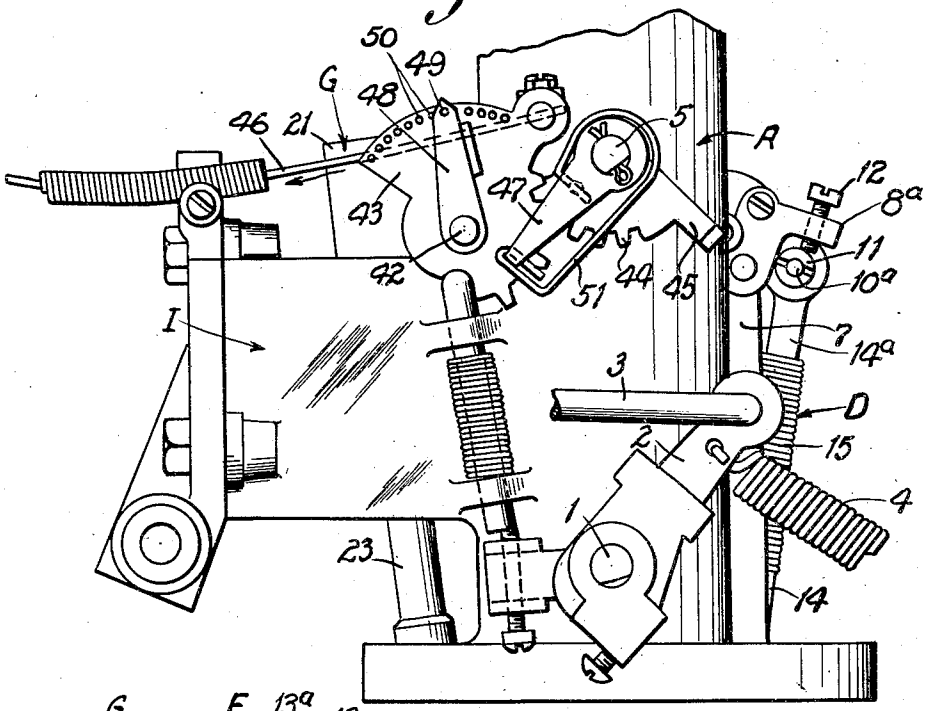
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CARBURETOR

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Fig. 3.



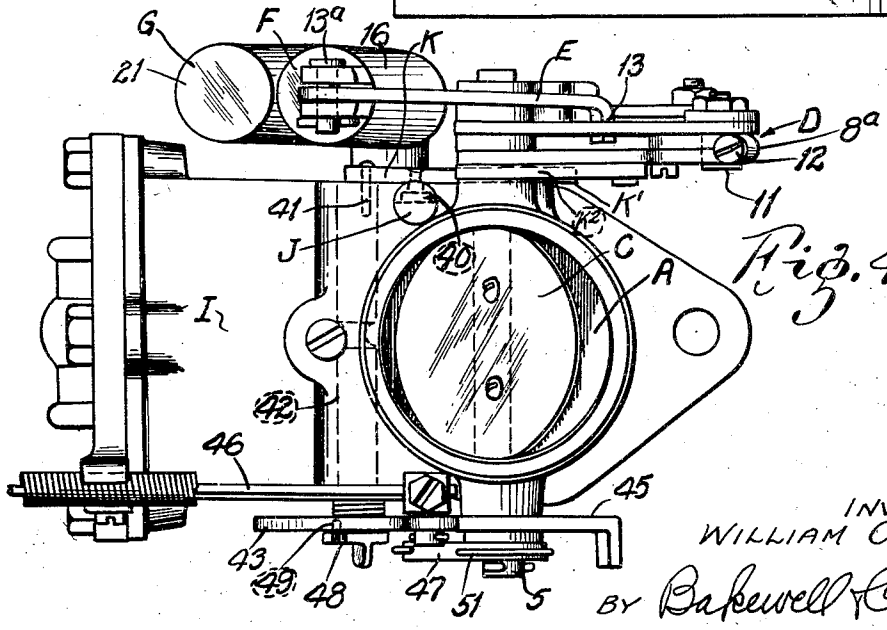


Fig. 4.

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Fig. 5.

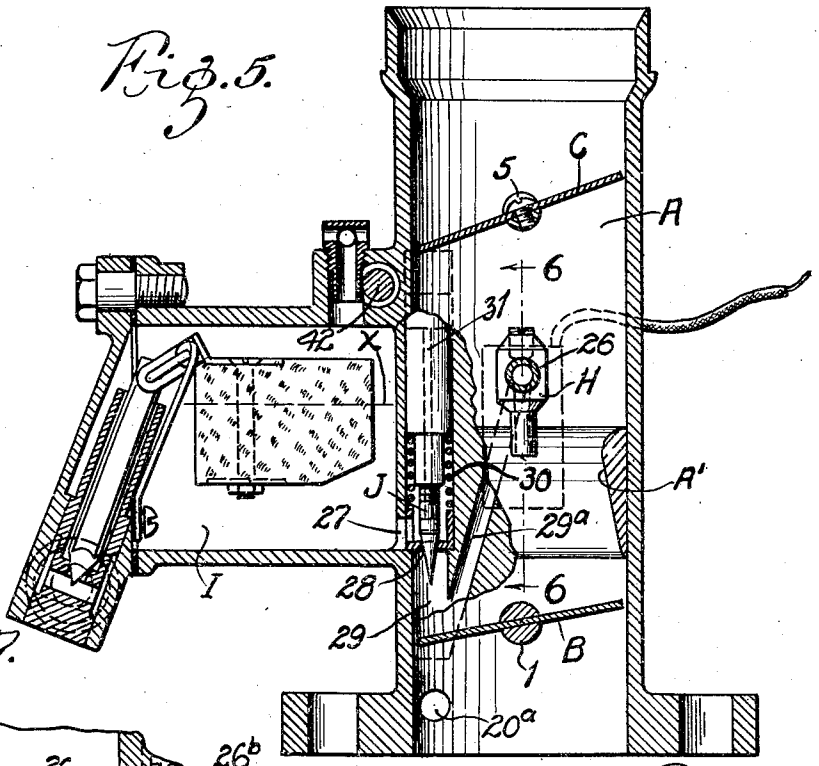


Fig. 7.

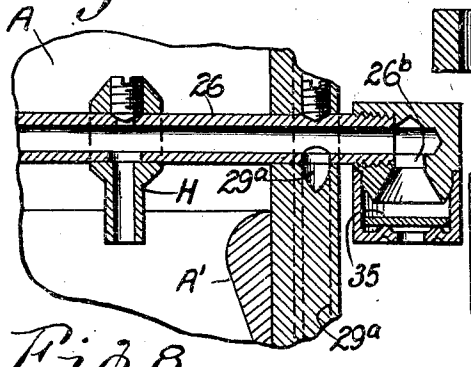


Fig. 6.

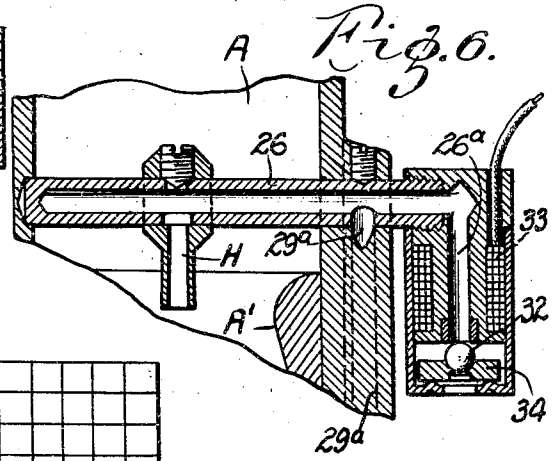
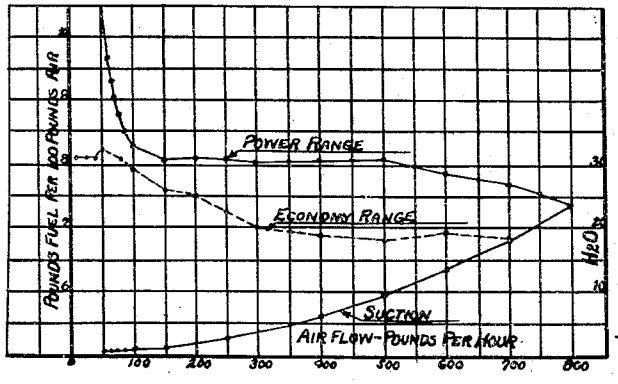


Fig. 8.



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Patented Feb. 7, 1933 1,896,390

UNITED STATES PATENT OFFICE

WILLIAM C. CARTER, OF FLINT, MICHIGAN

CARBURETOR

Application filed June 11, 1930. Serial No. 460,371.

This invention relates to carburetors of the kind that are used on internal combustion engines.

One object of the invention is to provide a carburetor of improved design that has two separate and distinct fuel ranges, i. e., a power range in which the proportion or ratio of fuel to air is relatively high and great enough to produce adequate power for a heavy load, and an economy range in which the ratio or proportion of fuel to air is considerably lower, but is sufficient to take care of the requirements at idle speeds or when the engine is operating under a normal load or maximum load.

Another object is to provide a multi-fuel range carburetor of the kind above described, which is of such design that there is no "flat spot" or perceptible variation in the ratio of fuel to air when the change from one range to the other occurs.

Another object is to provide a carburetor that embodies the desirable features and characteristics of a plain tube carburetor and a mechanical carburetor, and which is of such design that when the engine is operating under a heavy load with a wide open throttle, the carburetor will act as a plain tube carburetor whose fuel ratio is high enough to produce great power, and when the engine is idling or is operating under a normal load, with the throttle valve in an intermediate position or nearly closed, the carburetor will act as a mechanical carburetor whose fuel ratio is considerably lower than the fuel ratio which prevails when the carburetor is acting as a plain tube carburetor.

Another object is to provide a carburetor which is of such design that when the throttle valve is in its wide open position, the supply of fuel to the main passageway is not dependent entirely upon the suction that exists in said main passageway at such times, thereby making it possible to construct the carburetor so that sufficient fuel will be supplied to the main passageway to take care of a heavy load that is imposed on the engine when the throttle valve is in its wide open position, even though the air is flowing through the main passageway at such a low velocity as to produce a very slight suction on the fuel supplying device in said passageway.

And still another object is to provide a carburetor of the kind previously described, that will supply the correct ratio or proportion of fuel to air at all speeds and varying loads, and which is of such design that the engine can be easily started in cold weather. Other objects and desirable features of my invention will be hereinafter pointed out.

Figure 1 of the drawings is a side elevational view of a carburetor embodying my present invention, partly broken away to illustrate the construction of the extensible link that forms part of the mechanism for transmitting movement from the throttle valve to the air admission valve.

Figure 2 is a side elevational view of said carburetor, partly broken away to illustrate the construction of the vacuum pot and the dash pot that are combined with the air admission valve.

Figure 3 is a side elevational view of the opposite side of the carburetor, illustrating the choking mechanism.

Figure 4 is a top plan view of the carburetor.

Figure 5 is a vertical longitudinal sectional view of the carburetor.

Figure 6 is a fragmentary vertical transverse sectional view, taken on the line 6—6 of Figure 5, looking in the direction indicated by the arrows.

Figure 7 is a view similar to Figure 6, illustrating another means that may be used to interrupt the action of the fuel siphon when the engine is stopped; and

Figure 8 is a facsimile of an indicator card produced on a flow bench on which my improved carburetor was tested.

In the accompanying drawings I have illustrated my invention embodied in a downdraft carburetor, but I wish it to be understood that the invention is applicable to an updraft carburetor. The carburetor is provided with a main passageway A equipped with a throttle valve B attached to a rock shaft 1 that has an arm 2 to which an operating rod 3 and return spring 4 are attached, as shown in Figure 3, said return spring be-

ing of such tension that it tends to hold the throttle valve in its closed position. The main passageway A is also provided with an air admission valve C, which, in the form of my invention herein illustrated, consists of an oscillating valve rigidly connected to a rock shaft 5, that extends transversely of the main passageway A. The air admission valve is connected with the throttle valve in such a manner that said air admission valve will move with the throttle valve, but said air admission valve is also capable of moving independently of and relatively to the throttle valve.

Connecting mechanism for throttle valve and air admission valve

The connection between the valves B and C, or the mechanism that is used for transmitting movement from the throttle valve to the air admission valve, consists of a fixed or rigid arm 6 on one end of the throttle valve shaft 1 (see Figures 1 and 2), a rigid link 7 and an extensible link D pivotally connected by a pivot 6^a to the free end of the arm 6 and leading upwardly from same, two rock arms 8 and 9 loosely mounted on one end of the shaft 5 of the air admission valve and pivotally connected to the upper ends of the links 7 and D, respectively, by pivots 10 and 10^a, a laterally-projecting pin or device 11 on the free end of the rock arm 9 arranged so as to engage or bear against a stop screw 12 mounted in an extension 8^a on the rock arm 8 that projects beyond the pivotal connection 10 between the rigid link 7 and the rock arm 8, a rigid or fixed lever E on the air admission valve shaft 5 provided with a laterally-projecting lip or extension 13 that laps over and bears against the underside of the rock arm 9, and a vacuum pot designed as an entirety by the reference character F whose cylinder is pivotally connected by a pivot 13^a to the outer end of the lever E. The said mechanism also comprises a dash pot, designated as an entirety by the reference character G, that is used to retard or check the opening movement of the air admission valve.

The extensible link D previously referred to is composed of two telescoped or relatively movable sections 14 and 14^a combined with a contractile spring 15 in such a way that said spring tends to hold the link D in its contracted condition. The vacuum pot F is composed of an inverted cylinder 16 whose upper end is provided with a lug for receiving the pivot 13^a, and a piston 17 is reciprocatingly mounted in said cylinder. Said piston is provided with a rigid piston rod 18 that is rockably mounted on the body of the carburetor in such a way that the vacuum pot F as an entirety is capable of rocking about an axis 19. A suction duct or passageway 20 is formed in the piston 17 and piston rod 18 for exerting a downward pull on the cylinder 16, the upper end of the said suction passageway 20 terminating in the top face of the piston 17, and the lower end of said duct, designated by the reference character 20^a in Figure 5, terminating in the main passageway A at a point between the throttle valve B and the intake of the engine on which the carburetor is used. The dash pot G, previously referred to, can be constructed and arranged in various ways without departing from the spirit of my invention, but it is herein illustrated as being composed of a cylinder 21, rigidly attached to the cylinder 16 of the vacuum pot and a piston 22 reciprocatingly mounted in the cylinder 21 and provided with a rigid piston rod 23 whose lower end is pivotally connected at 24 to a rigid arm 25 on the lower end of the piston rod 18 of the vacuum pot.

When the throttle valve B is moved from its closed position, shown in Figure 5, towards its open position, as indicated by broken lines in Figure 1, the air admission valve C will move simultaneously towards its open position, as indicated in broken lines in Figure 1, due to the fact that the suction which exists in the intake of the engine is exerted on the cylinder 16 of the vacuum pot (through the duct 20) in a direction tending to move said cylinder downwardly and cause the lateral extension 13 on the lever E to remain in engagement with and follow the rock arm 9 which swings upwardly with the rock arm 8 that is joined by the rigid link 7 to the arm 6 on the throttle valve shaft. When a certain approximate suction exists in the intake of the engine, the downward pull which the vacuum pot exerts on the outer end of the lever E holds the spring 15 stretched and causes the laterally-projecting pin 11 on the arm 9 to remain in engagement with the stop screw 12 in the extension at the end of the rock arm 8. Hereafter I will explain how the mechanism just described governs the relative position of the throttle valve and air admission valve and permits or causes said valves to assume different positions relatively to each other at different periods in the cycle of operations of the carburetor.

Fuel supply means

Liquid fuel is introduced into the main passageway A at a point intermediate the throttle valve B and air admission valve C by a fuel nozzle H, or other suitable type of fuel supplying device, arranged so that fuel will be discharged from same in the direction of travel of the air that is flowing through the main passageway A. In a downdraft carburetor, as herein illustrated, the nozzle H will discharge downwardly, as shown in Figures 5 and 6. The nozzle H is carried by a tubular member 26 disposed

transversely of the passageway A, and the discharge end or outlet of said nozzle H is located at a point below the fuel level x of the float chamber I of the carburetor. Preferably, a suction amplifier herein illustrated as a venturi A′ is arranged inside of the main passageway A at such a point that the discharge end of the nozzle H terminates in the contracted portion of said venturi. Due to the fact that the suction in the main passageway A is not relied upon entirely to supply fuel to said passageway, it is possible to make the venturi A′ much larger than is the usual practice, thus increasing the volume of the air flowing through the passageway A when the throttle valve is wide open.

Fuel escapes from the float chamber I of the carburetor through an outlet 27, and then passes through a fuel orifice 28 into a fuel passageway 29 formed in the side wall of the main passageway A and located at a point considerably below the discharge opening of the nozzle H, said fuel passageway 29 having a branch 29^a which leads upwardly, as shown in Figure 5, and communicates at its upper end with the interior of the tubular member 26 that carries the fuel nozzle H. By referring to Figure 5, it will be noted that the upper end of the fuel passageway 29^a terminates at a point above or higher than the fuel level of the float chamber, and it will also be noted that the discharge opening of the nozzle H is located at a point below the fuel level x of the float chamber. Under certain conditions, hereinafter described, the fuel orifice 28 is unobstructed, thus permitting a relatively great quantity of fuel to pass through said orifice and enter the passageway 29^a that leads to the fuel nozzle, and under different conditions the flow of fuel through the orifice 28 is restricted by a fuel valve J, preferably a needle valve, combined with a spring 30 that exerts pressure on same in a direction tending to hold the valve J open, or in such a position as to not restrict the flow of fuel through the orifice 28. The fuel valve J is moved in the opposite direction, i. e., towards its seat, by a rocked lever K pivotally connected with the upper end portion of said valve and provided with a track K′ (see Figures 1 and 2) that co-acts with a cam K^2 on the rock arm 8 previously referred to, which is attached by the rigid link 7 with the arm 6 on the throttle valve shaft. Movement of the throttle valve B towards its closed position causes the cam K^2 to rock the lever K downwardly, with the result that the fuel valve J will move towards its closed position, and thus cut down or restrict the flow of fuel through the fuel orifice 28. When the throttle valve moves towards its open position, the cam K^2 travels over the track K′ in a direction to permit the lever K to rock upwardly, due to the upward pressure which the spring-pressed fuel valve J is constantly exerting on the lever K. During the economy range the supply of fuel to the main passageway A is varied automatically, according to the position of the throttle valve by a change in the position of the fuel valve J whose position at such times is governed by a mechanism controlled or operated by the throttle valve, and during the power range an entirely different means, hereinafter described, is used to govern the admission of the fuel to the main passageway A.

The mechanism that transmits movement from the throttle valve to the air admission valve is so designed that when the carburetor is acting as a mechanical carburetor, the air admission valve C will be held in substantially parallel relationship with the throttle valve B, so as to produce a high suction zone between said valves that is exerted on the fuel orifice 28, which, at such times is restricted by the fuel valve J. The cam k^2 and the lever K that are combined with the throttle valve and fuel valve form a very reliable means of simple design for varying the ratio of fuel to air supplied to the main passageway A during the economy range. The suction that exists in the intake of the engine when the throttle valve is in a closed or intermediate position is also utilized to vary the supply of fuel to the nozzle H during the economy range. If the throttle valve B is in a closed or partly closed position, the high suction in the intake that is exerted on the suction passageway 20 draws the cylinder of the vacuum pot downwardly, and thus causes the laterally-projecting stop 11 on the long arm 9 to be held in engagement with the stop screw 12 in the extension on the end of the short arm 8, the spring 15 of the extensible link D being held stretched or under tension at such times. If a heavy load is imposed on the engine, the suction in the intake diminishes, and immediately the cylinder of the vacuum pot will move upwardly under the influence of the spring 15 of the extensible link D which contracts and draws the long arm 9 downwardly, thereby causing the air admission valve C to move independently of and relatively to the throttle valve D into such a position as to diminish or cut down the supply of air to the main passageway A. The downward movement of the arm 9 is transmitted to the air admission valve by the lever E whose laterally-projecting lug 13 engages the underside of the arm 9. As soon as the air admission valve C moves in this manner, i. e., towards its closed position, the suction in the passageway A between the valves B and C increases, with the result that a greater quantity of fuel will be drawn from the fuel orifice 28, notwithstanding the fact that the positions of the throttle valve and fuel valve J have not been changed. The increase in the supply of fuel takes care of the extra load imposed on the

engine, and as soon as said extra load ceases, the high suction that is re-established in the intake below the throttle valve again draws the cylinder of the vacuum pot E downwardly, thus causing the air admission valve C to move in the opposite direction, i. e., towards its open position, with the result that the supply of air to the main passageway A will be increased. From the foregoing it will be understood that during the economy range the link D that forms part of the mechanism that transmits movement from the throttle valve to the air admission valve is extended, thereby causing the air admission valve to remain in parallel relationship with the throttle valve, and when a load comes on the engine, said link D contracts and causes the air admission valve to move relatively to the throttle valve into such a position as to automatically increase the ratio of fuel to air, and thus supply sufficient fuel to take care of the extra load. While the ratio of fuel to air will, of course, vary with different engines, I have found that the carburetor is entirely satisfactory if it is designed in such a way that under a normal load with a wide open throttle the fuel and air will be supplied in a ratio of about 8½ lbs. of fuel per 100 lbs. of air, and under a normal load with the throttle valve in an intermediate position, the fuel and air will be supplied in a ratio of about 7 lbs. of fuel per 100 lbs. of air.

When the carburetor is operating as a plain tube carburetor with the throttle valve B and air admission valve C both wide open, the fuel valve J is inactive and is held in its wide open position by the spring 30 with which it is combined. Due to the fact that the venturi A′ only slightly restricts the flow of air through the passageway A when the throttle valve is wide open, there is not sufficient suction exerted on the fuel nozzle H when the engine is subjected to a heavy load with a wide open throttle to cause fuel to be drawn into the passageway A from the fuel nozzle. Accordingly, I have designed the carburetor so that fuel will be supplied to the nozzle H at such times, either by a siphoning action or by gravity. In the carburetor herein shown a siphon is used to deliver fuel from the float chamber I to the nozzle H when the air entering through the main passageway A is traveling at the lowest velocity, and it is for this reason that I arrange the discharge end of the fuel nozzle H at a point below the fuel level *x* of the float chamber and arrange the upper end of the fuel passageway 29^a so that it extends to a point above the level of the fuel of the float chamber. The fuel orifice 28 is calibrated so that said orifice will supply the correct quantity of fuel to produce the proper ratio of fuel to air under a normal load with a wide open throttle, i. e., at the intermediate velocity of air flowing through the main passageway A. After the flow of fuel upwardly through the fuel passageway 29^a has been established, fuel will continue to flow upwardly through said passageway, even though the suction in the main passageway A diminishes considerably, due to an extra heavy load imposed on the engine when the throttle valve is wide open. Consequently, when the velocity of the air flowing through the passageway A is at minimum, sufficient fuel is supplied to said passageway by the action of the siphon, previously mentioned, to produce a rich mixture that will successfully take care of the extra load on the engine. In view of the fact that the fuel orifice 28 is calibrated so as to supply the proper quantity of fuel under a normal load with a wide open throttle, said orifice 28 would supply too much fuel when the velocity of the air flowing through the passageway A is at maximum, i. e., when the engine is operating under a light load with a wide open throttle. Accordingly, I provide the fuel valve J with an air vent 31, shown in broken lines in Figure 5, whose upper end communicates with the atmosphere at a point outside of the main passageway A. This air vent 31 is subject to the same suction that the fuel outlet 27 of the float chamber is subject to, but the size of the outlet 27 is considerably greater than the size of the air vent 31. Accordingly, air will not start to break in through the air vent 31 until the suction exerted on the port 27 is equal to the weight of the fuel standing in the air vent 31. By increasing the size of the outlet port 27, the time at which air starts to break in through the vent 31 will be delayed. This will be clear from the chart shown in Figure 8, which illustrates that when five hundred pounds of air per hour is drawn through the main passage, sufficient suction is exerted on the outlet 27 to equal the weight of fuel standing in the air vent 31, and at this time air begins to flow through the port 28 controlled by a needle valve, the ratio of fuel to air continuing to drop until the maximum is reached. When air is traveling through the passageway A at the highest velocity, air enters the fuel passageway 29^a through the air vent 31 in the fuel valve, and thus diminishes the suction in said fuel passageway 29^a sufficiently to prevent an excessive quantity of fuel being supplied by the nozzle H.

Unless some means were provided for breaking the siphon that causes fuel to be delivered to the main passageway A when the engine is operating under a heavy load with a wide open throttle, fuel would continue to escape from the nozzle H after the engine had been stopped, thus causing considerable waste of fuel and also causing the engine to become flooded. In order to prevent this from occurring, I provide the carburetor with a means which breaks or interrupts the siphon automatically as soon as the engine is stopped. One means that

may be used for this purpose consists of a valve 32 arranged to close a vent 26^a leading from the interior of the tubular member 26 that carries the fuel nozzle H, and combined with a solenoid or similar electrically-operated device 33 that is connected with the ignition system of the engine. As shown in Figure 6, the valve 32 is mounted on a member 34 constructed of magnetic material and arranged below the coil of the solenoid. As soon as the ignition circuit of the engine is closed, the solenoid moves the member 34 upwardly into a position to close the air vent 26^a. So long as the engine continues in operation, the valve 32 will remain seated, but as soon as the engine is stopped by opening the ignition circuit, the member 34 drops downwardly, due to gravity, with the result that the interior of the tubular member 26 will be vented, thus causing air to be admitted to the fuel passageway 29^a so as to break the siphon. Another means that may be used for this purpose consists of a disk valve 35 that controls an air vent 26^b leading from the interior of the tubular member 26 that carries the fuel nozzle H, as shown in Figure 7. As soon as the engine is started the suction that is created in the main passageway A of the carburetor causes the valve 35 to move upwardly into engagement with its seat 36 and remain seated so long as the engine continues in operation. As soon as the engine stops the suction in the main passageway A will cease and the valve 35, due to its weight, will drop downwardly into position to open the air vent 26^b and cause air to be supplied to the siphon to interrupt the action of same.

Choking mechanism

The carburetor is equipped with a choking mechanism for facilitating starting of the engine. Said mechanism is so constructed that when it is actuated by the operator in charge of the engine, the air admission valve C will be moved into its closed position and the fuel valve J will be raised slightly from its seat. The lever K, previously referred to, is pivotally connected at 40 to the upper end portion of the fuel valve J, and said lever is mounted in such a way that it can be adjusted to vary the initial setting of the fuel valve and also to raise said valve slightly from its seat during the operation of choking the engine. In the carburetor herein shown the lever K is provided at one end with a laterally-projecting pin 41 (see Figure 4), that projects into an eccentrically-disposed hole in a horizontal shaft 42 that is rockably mounted in a bearing on the top wall of the float chamber I. The choking mechanism comprises a manually-operable segmental rack 43 (see Figure 3) mounted on one end of the shaft 42 and arranged in mesh with a segmental rack 44 on a rock arm 45 that is used to move the air admission valve C towards its closed position. When the operator in charge of the engine shifts the operating rod 46 attached to the rack 43 in the direction indicated by the arrow in Figure 3, such movement of the operating rod 46 causes the arm 45 to rock clockwise and co-operate with a rigid arm 47 on the air admission valve shaft 5 to move the valve C into its closed position, so as to choke or cut down the supply of air to the main passageway A while the engine is being cranked to start the same. As the segmental rack 43 is connected with the shaft 42 in which the pivot 41 of the fuel valve control lever K is eccentrically mounted, the movement of the operating rod 46 in a direction to choke the engine causes the shaft 42 to rock in a direction to bodily raise the lever K and raise the fuel valve J slightly off its seat, thereby insuring a sufficient supply of fuel to start the engine, even in excessively cold weather, when the lubricating oil is stiff or congealed.

In order that the fuel valve J may be initially adjusted or set closer to or farther away from its seat when the air admission valve is in its fully closed position, means is provided for adjustably connecting the segmental rack 43 to the rock shaft 42 that serves as a shiftable bearing for the lever K. In the form of my invention herein illustrated the means that is used for this purpose consists of a rigid arm 48 on the shaft 42 (see Figure 3) provided with a pin 49 that is adapted to be inserted in any one of a row of arc-shaped holes 50 in the segmental rack 43. The rack 43 is loosely mounted on the shaft 42, but when the pin 49 is inserted in one of the holes 50, the rack 43 will be rigidly connected with the shaft 42. By changing the relationship between the segmental rack 43 and the rigid arm 48, the location of the supporting pivot 41 of the lever K will be changed, thereby enabling the degree of the opening movement of the fuel valve J to be changed to adapt the carburetor to the particular engine on which it is used.

The carburetor is so designed that in the operation of starting the engine the air admission valve C will automatically open a slight degree and admit air to the passageway A as soon as the engine starts firing. Accordingly, I interpose a spring 51, or some other yielding or resilient buffer, between the arm 47 on the air admission valve shaft 5 and the arm 45 on the segmental rack 44, so as to permit the air admission valve C to open slightly, even though the operator fails to restore the operating rod 46 to its former position as soon as the motor starts firing. The spring or buffer 51 is of such tension that when the arm 45 engages said spring during the choking operation, said spring will transmit the movement of the arm 45 to the rigid

arm 47 on the shaft 5, but when the arm 47 rocks slightly in the reverse direction, due to the air admission valve C opening automatically when the engine starts firing, the spring 51 will yield, and thus not interfere with the movement of the arm 47.

Operation

Assuming that the engine is in operation and that the throttle valve B is in its closed or slightly cracked position, as shown in Figure 5, the air admission valve C will be maintained in parallel relationship with the throttle valve, and the relatively high suction that exists in the main passageway A between said valves will cause fuel to be drawn through the fuel orifice 28, and thence upwardly through the fuel passageway 29^a and fuel nozzle H into the main passageway, the fuel duct 28 being restricted by the fuel valve J which is held in its nearly closed position by the lever K which co-operates with the cam 31. At such times the suction in the intake of the engine that is exerted on the suction passageway 20 causes the vacuum pot F to exert a downward pull on the free end of the lever E, with the result that the spring 15 of the extensible link D will be maintained under tension or in a stretched condition, and the laterally-projecting pin 11 on the long arm 9 will be held in engagement with the stop screw 12 on the short arm 8. Movement of the throttle valve towards its open position causes the air admission valve C to move towards its open position, and also causes the cam 31 to travel over the track K′ in a direction to permit the fuel valve J to move away from its seat, and thus increase the supply of fuel to the fuel passageway 29^a. An idle engine speeds, or when the engine is operating under a normal load with the throttle valve in an intermediate position, the throttle valve and the air admission valve will move in unison and will be maintained in approximately parallel relationship, and the fuel valve J will be moved towards or away from its seat, depending upon the direction of movement and degree of movement of the throttle valve. During this range of operation of the carburetor, which, for convenience, I have referred to as the economy range, the quantity of fuel supplied to the fuel passageway 29^a will be such as to produce the correct or approximately correct ratio of fuel to air, which, as previously stated, is about 7 lbs. of fuel per 100 lbs. of air. The previously mentioned ratio of fuel to air will stay constant or substantially so when the engine is operating under a normal load with the throttle valve in an intermediate position. When the load on the engine increases above normal the suction in the intake of the engine will diminish and the spring 15 of the extensible link D will immediately contract and cause the long arm 9 to exert pressure on the lateral extension 13 of the lever E in a direction to move the air admission valve C towards its closed position. The fuel valve J, however, remains in its former position, due to the fact that the cam 31 which co-acts with the lever K that controls the position of the fuel valve, is carried by the short rock arm 8 which remains in its former position, due to the fact that said arm 8 is joined by the rigid link 7 to the arm 6 on the throttle valve shaft. The fuel supply, however, is instantly increased because movement of the air admission valve towards its closed position creates a higher suction in the main passageway A, and this higher suction draws more fuel out of the fuel orifice 28, with the result that the fuel range is changed automatically from the economy range to the power range, wherein the fuel is supplied at an increased ratio, for example, 8 lbs. of fuel per 100 lbs. of air. As soon as the extra load on the engine ceases, the suction in the intake increases sufficiently to draw the cylinder of the vacuum pot F downwardly, thereby restoring the air admission valve C to its former position and causing the quantity of fuel supplied to the fuel passageway 29^a to be diminished or restored to the ratio that prevails during the economy range. Under the conditions just described the carburetor may be properly said to be operating as a mechanical carburetor, because the air supply is varied by the valve C and the fuel supply is varied by changing the position of a fuel valve J that moves towards and away from its seat as the position of the throttle valve is varied.

Air gets under way faster than liquid fuel, and accordingly, if the throttle valve of a carburetor is positively connected with an air valve that controls the supply of air to the main passageway of the carburetor, a sudden movement of the throttle valve towards its open position so as to accelerate the engine is apt to result in too much air being supplied to the main passageway, or, in other words, supplied at a rate far in excess of the ratio that should be maintained between the fuel supply and air supply. In my improved carburetor the dash pot G, previously referred to, prevents the air admission valve C from opening at the same rate of speed as the throttle valve B when said throttle valve is kicked open to accelerate the engine. If the throttle valve is opened suddenly, the air admission valve C will lag or travel towards its open position at a slower speed than the speed of movement of the throttle valve, thus holding back the air and causing it to be admitted to the passageway A in approximately correct ratio to the fuel.

When the throttle valve is moved into its wide open position, the air admission valve C will also move into its wide open position, so as to not retard the flow of air through the

main passageway A. At such times the fuel valve J is maintained in its fully open position, and hence, the carburetor may be said to act as a plain tube carburetor at such times, due to the fact that the air supplied to the main passageway is constant and unvaried. While it is true that the fuel valve J is inactive or in its wide open position at such times, i. e., when the throttle valve and air admission valve are wide open, nevertheless, the fuel is supplied to the passageway A in varying quantities, but in such a ratio of fuel to air as to produce a mixture that is correct for the particular load or varying loads to which the engine is subjected under a wide open throttle. At intermediate velocity of the air flowing through the passageway A, when the throttle valve and air admission valve are wide open, the suction that is exerted on the nozzle H causes the correct quantity of fuel to be drawn through the fuel orifice 28 to produce a ratio of about 8 lbs. of fuel per 100 lbs. of air. If a heavy load is imposed on the engine the fuel ratio is increased automatically to, say, 9 or 10 lbs. per 100 lbs. of air, as indicated by the indicator card in Figure 8. This highly desirable result is attained by constructing the carburetor in such a way as to produce a siphon which supplies fuel to the main passageway A under a heavy load with a wide open throttle, and one of the outstanding advantages of such a design is that it permits the main passageway A to be equipped with a venturi A′ which is so large or of such great diameter that it does not materially restrict the flow of air through the passageway A when the throttle valve of the carburetor is wide open. When the air is traveling through the passageway A at maximum velocity, sufficient air is admitted to the fuel passageway 29^a by the air vent 31 in the fuel valve J to diminish the fuel supplied to the nozzle H and prevent the carburetor from being wasteful. Subsequently, when the throttle valve is moved towards its closed position, the air admission valve C comes into service so as to regulate the supply of air to the passageway A, and the fuel valve J comes into service to regulate the supply of fuel to the nozzle H and change the proportion or ratio that is required to produce an economical mixture. This change or switch from the power range to the economy range, and vice versa, is effected automatically and without producing a "flat spot" or perceptible variation in the fuel supply. When the engine is stopped the vent valve of the fuel passageway 29^a opens automatically, and thus interrupts or breaks the siphon that was used to supply fuel to the passageway A when the engine was operating under a heavy load with a wide open throttle.

In starting the engine the operator in charge of same pulls the operating rod 46 in the direction indicated by the arrow in Figure 3, so as to move the air admission valve C into its closed position. The speed at which the pistons of the engine travel when it is being cranked, either by hand or by an electrical starter, is not sufficient to create a suction in the intake below the throttle valve that is of sufficient intensity to pull the cylinder of the vacuum pot downwardly. Hence, there is no tendency for the air admission valve C to open, after it has been closed by the choking mechanism, and before the engine starts firing. As soon as the engine starts firing, however, the high suction that exists in the intake is exerted on the cylinder of the vacuum pot F in a direction to slightly open the air admission valve C, thus causing sufficient air to be supplied to the passageway A to prevent the engine from stalling or dying, even though the operator fails to restore the operating rod 46 to its former position. This reverse movement or opening movement of the air admission valve C is made possible by interposing a spring or other suitable buffer 51 between the rigid arm 47 on the shaft 5 of the valve C, and the rock arm 45 of the choking mechanism that co-acts with the arm 47 to move the valve C into its closed position. In addition to closing the valve C so as to choke the engine, the movement of the segmental rack 43 causes the fuel valve J to be raised slightly from the seat, with the result that sufficient fuel will be supplied to the fuel passageway 29^a to insure the engine starting, even though the engine is cold and the lubricating oil of same is congealed.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A carburetor provided with a main passageway through which air travels to the intake of an engine, a throttle valve and an air admission valve for said passageway, a suction amplifier arranged in said main passageway between said valves, means for causing the position of said air admission valve to change when the position of the throttle valve is changed, means for closing said air admission valve without changing the position of said throttle valve, a fuel orifice for supplying fuel to said main passageway, a fuel valve for restricting said fuel orifice under certain conditions, and an operating mechanism for changing the position of said fuel valve, constructed so that said fuel valve will act as a variable restriction for said fuel orifice in the intermediate positions of the throttle valve and will be maintained in an inactive or wide open position when the throttle valve and air admission valve are wide open.

2. A carburetor of the kind described in claim 1, provided with means separate and distinct from the suction existing in the main passageway, for delivering fuel to said pas-

sageway when the engine is operating under a heavy load with a wide open throttle.

3. A carburetor provided with a throttle valve, an air admission valve, a mechanical connection between said valves, a variable fuel supplying means controlled by the throttle valve, and a means controlled by the suction in the intake of the engine for causing the air admission valve to move independently of the throttle valve into a position to diminish the air supply to the carburetor and thus increase the fuel supply proportionately to the amount of air passing the throttle valve when the engine is subjected to an increased load in an intermediate position of the throttle valve.

4. A carburetor provided with a main passageway, a throttle valve and an air admission valve, a governing mechanism for the air valve which maintains said valve in a certain approximate relationship with the throttle valve under normal loads, a variable fuel supplying means operatively connected with the throttle valve for producing a certain ratio of fuel to air in the intermediate positions of the throttle valve, and a means for increasing the ratio of fuel to air in the event the position of the throttle valve is not changed when the load on the engine is increased.

5. A carburetor provided with a main passageway, a throttle valve, a means governed by the throttle valve for admitting variable amounts of air to said passageway in the intermediate positions of the throttle valve and for permitting the air to flow freely through said passageway in the wide open position of the throttle valve, a fuel supplying device in said main passageway, a fuel orifice through which fuel is delivered to said fuel supplying device, calibrated so as to produce the correct ratio of fuel to air in the wide open position of the throttle valve when the engine is operating under a normal load, means for drawing fuel from said orifice into the main passageway by a siphoning action when the suction in said passageway drops to minimum, and means for automatically reducing the discharge of fuel from said orifice when the suction in the main passageway increases to maximum.

6. A carburetor of the kind described in claim 5, provided with a fuel valve governed by the throttle valve for restricting the flow of fuel through said orifice, more or less, according to the position of the throttle valve, in the intermediate positions of said throttle valve.

7. A carburetor of the kind described in claim 5, provided with means for causing the discharge of fuel from said orifice to vary automatically in the intermediate positions of the throttle valve, and a means governed by the suction in the intake beyond the throttle valve for automatically increasing the discharge of fuel from said orifice when the load on the engine is increased in an intermediate position of the throttle valve.

8. A carburetor provided with a main passageway, a throttle valve and an air admission valve for said passageway, a governing means for the air admission valve which permits it to move with the throttle valve, comprising a rigid arm on the throttle valve, two rock arms of different lengths associated with the air admission valve, a rigid link for joining the short arm to the throttle valve arm, an extensible link for joining the long rock arm to the throttle valve arm, a rigid lever attached to the air admission valve and provided with a part that is adapted to co-act with said long rock arm to govern the position of said air admission valve according to the position of said long rock arm when the engine is in operation, co-acting means on said long and short rock arms for determining the normal position of said arms relatively to each other, and a suction device operated by the suction in the intake of the engine beyond the throttle valve and operatively connected with the lever attached to the air admission valve for moving the long rock arm relatively to the short rock arm under certain conditions.

9. A carburetor of the kind described in claim 8, provided with a fuel valve for regulating the supply of fuel to the main passageway under certain conditions, and a means controlled by the short rock arm for changing the position of said fuel valve.

10. A carburetor provided with a main passageway, a throttle valve and an air admission valve for said passageway, a mechanism for transmitting movement from the throttle valve to the air admission valve when said valves are moving towards their closed position, constructed so that the air admission valve is capable of moving independently of and relatively to the throttle valve, a fuel supply valve governed by the throttle valve, a choking mechanism for moving the air admission valve into its closed position to facilitate starting the engine, and a device operated by the suction in the intake of the engine beyond the throttle valve for opening the air admission valve slightly when the engine starts firing.

11. A carburetor of the kind described in claim 10, provided with means for moving the fuel supply valve slightly away from its seat when said choking mechanism is actuated to close the air admission valve.

12. A carburetor provided with a main passageway, a throttle valve and an air admission valve for said passageway, a mechanism for transmitting movement from the throttle valve to the air admission valve when said valves are moving towards their closed positions, constructed so as to permit

the air admission valve to move independently of and relatively to the throttle valve, a rigid arm attached to the shaft of the air admission valve, a choking mechanism comprising a rock arm whose movement in one direction causes the air admission valve to close, a yielding buffer interposed between said rock arm and the arm on said valve shaft, and a means governed by the suction in the intake of the engine for causing said air admission valve to open slightly when the engine starts firing.

13. A carburetor provided with a main passageway, a throttle valve in said passageway, a fuel nozzle in said passageway, a fuel passageway leading to said nozzle from a source of supply of fuel, an air vent for said fuel passageway, and a valve for said air vent adapted to remain in its closed position when the engine is in operation and to open automatically when the engine is stopped.

14. A combined plain tube and mechanical type carburetor for internal combustion engines, comprising a main air passageway provided with a suction amplifier, a butterfly valve for said passageway adapted to be set in a wide open position to cause the carburetor to function as a plain tube carburetor or set in a throttling position to cause the carburetor to act as a mechanical carburetor, a fuel supplying means for delivering fuel uninterruptedly to said passageway, means for diminishing the proportion of fuel to air as the volume of air through the main passageway increases when the throttle valve is in its substantially wide open position, a fuel valve operatively connected with the throttle valve for varying the supply of fuel to the main passageway according to the position of the throttle valve and for maintaining a set ratio between the fuel and the air when the carburetor is functioning as a mechanical carburetor, and a manually-operated means for increasing the ratio of fuel to air to facilitate starting the engine.

15. A carburetor provided with a main passageway, a throttle valve, an air admission valve, a governing means for the air admission valve which permits it to move with the throttle valve, constructed so as to normally maintain said valves in a certain approximate relationship and permit the air admission valve to shift relatively to the throttle valve under certain conditions, a dash pot combined with the air admission valve for retarding the opening movement of said valve when the throttle valve is opened suddenly to accelerate the engine, a fuel supply device governed by the throttle valve for regulating the supply of fuel to said main passageway under certain operating conditions, and a suction device controlled by the suction produced by the engine for moving the air admission valve relatively to the throttle valve when the air admission valve is being used as a choking device, during the operation of starting the engine and also when the load on the engine is increased in an intermediate position of the throttle valve when the engine is in operation.

16. A carburetor of the kind described in claim 15, in which the fuel supplying device comprises a siphon which operates under a wide open throttle, and means for interrupting said siphon when the engine is stopped.

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