

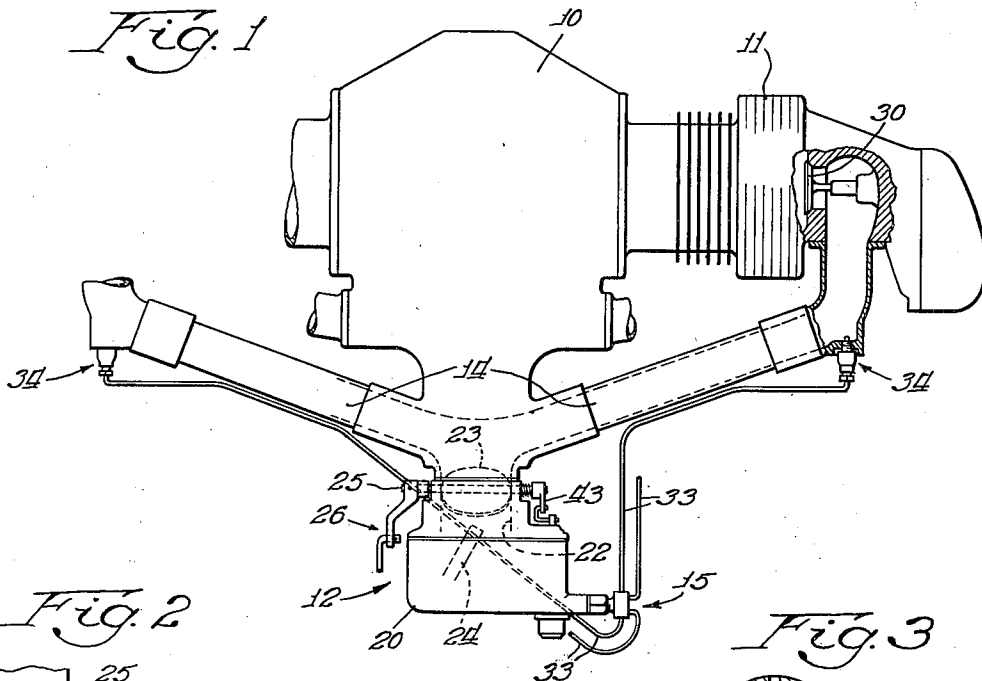
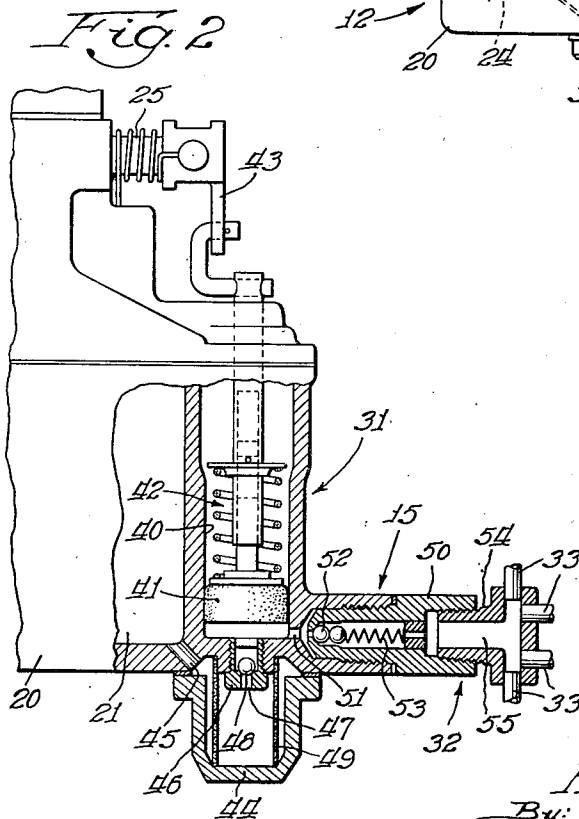
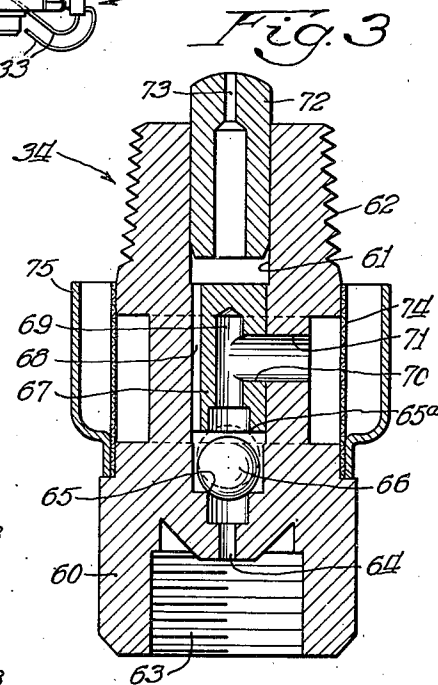
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ACCELERATOR DEVICE

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ACCELERATOR DEVICE

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3 Claims. (Cl. 123—119)

This invention relates to fuel feeding systems for internal combustion engines and particularly to a system incorporating a separate arrangement for delivering an enriching charge of fuel to the engine fuel inlet valve under conditions demanding high acceleration.

It is recognized that many previous attempts have been made to solve the problem of properly supplying accelerating charges of fuel to the cylinders of internal combustion engines. However, it is believed that the herein disclosed arrangement presents novel features of operation and structural distinction not heretofore contemplated.

It is an object of the present invention to provide a more effective arrangement for supplying enriching charges of fuel to the cylinders of an internal combustion engine, and particularly to furnish such an arrangement wherein the enriching charge is not subject to the inefficiency and limitations present under accelerating conditions in the conventional carburetor mixing passage and manifold supply system.

A more particular object is the provision of separate means including separate conduits for delivering individual accelerating charges of fuel to points closely adjacent the cylinder fuel inlet valves, which separate arrangements are not subject to the limiting conditions present in the usual manifold conduit system.

Still another particular object is the provision of an arrangement which is operable in response to the movement of the throttle valve assembly to open position and is not influenced by the effect of manifold vacuum particularly when the throttle is in closed or near closed position.

Other and more particular objects, advantages and uses of my invention will become apparent from a reading of the following specification taken in connection with the appended drawing forming a part thereof, and wherein:

Fig. 1 is an elevation of a plural cylinder engine assembly with certain parts broken away for simplification and showing one preferred embodiment of my invention;

Fig. 2 is an enlarged broken-away view of the special carburetor construction showing the accelerator pump and distributor manifold to advantage; and

Fig. 3 is an enlarged cross-section view of one of the accelerating nozzle assemblies.

Referring in greater detail to the figures of the drawing, there is indicated at 10 an internal combustion engine assembly with certain parts thereof broken away for the purpose of simplifi-

cation, this assembly including generally a plurality of cylinders 11 (only one of which is indicated), and my novel fuel feeding system indicated generally at 12 for supplying fuel to the several cylinders 11.

Fuel feeding system 12 includes essentially a carburetor assembly 13, a manifold assembly 14, and an accelerating fuel supply assembly indicated generally at 15, the latter functioning, under conditions to be pointed out in greater detail, to deliver accelerating charges of fuel at points in the manifold assembly closely adjacent the fuel inlet valves to the cylinders, this delivery being in effect independent of manifold assembly 14.

The carburetor assembly 13 includes the usual housing 20, fuel bowl 21, fuel and air mixing passage 22, butterfly valve 23 for controlling the flow through the carburetor and main fuel nozzle 24 for delivering fuel from the fuel bowl to the mixing passage in response to the conditions existing in passage 22 when butterfly throttle valve 23 is moved away from its closed position. Throttle valve 23 is mounted on a shaft 25 extending through the wall of housing 20 and provided with crank and connecting linkage mechanism indicated generally at 26 and adapted for manual operation as from a hand or foot controlled adjustment (not shown). In the event that engine 10 is associated with an aircraft for driving the same, then crank and linkage mechanism 26 will be operated from the cabin of the plane.

Under normal or cruising conditions of operation of engine 10 the fuel supply therefor is delivered by nozzle 24 under the control of throttle valve 23 and delivered through manifold assembly 14 to the several cylinders 11, this fuel being admitted thereto through fuel inlet valves 30 provided with the usual arrangement of means not shown for timing the operation thereof with the positions of the respective cylinders. I have found that under certain conditions this fuel delivery through manifold assembly 14 is sluggish and inefficient. For example, when there is a sudden demand for acceleration, as when taking off in the case of an airplane, the engine falters for lack of sufficient fuel charges being delivered to the respective cylinders 11.

As a solution to this and related problems, I have provided a novel arrangement indicated generally at 15 for delivering additional accelerating fuel charges to the respective cylinders at such times as the above conditions exist. Since the movement of the butterfly valve 23

toward open position is found to be a satisfactory index to the demand for such accelerating charges, I have made the operation of my accelerating assembly operable in response thereto.

Accelerating assembly 15 includes an accelerator pump unit indicated generally at 31, manifold 32, conduit 33 and accelerating nozzle unit indicated generally at 34 (there being one conduit and one nozzle corresponding to each cylinder, some of which are not shown for the purpose of simplification). Accelerator pump 31 preferably forms part of the carburetor 20, the pump cylinder 40 being formed in carburetor housing 20. Accelerator piston 41 is received in barrel 40 and may be operated through a lost motion spring connection indicated generally at 42 by means of a crank and link assembly 43 drivingly associated with butterfly valve supporting shaft 25. It is important to note that while I have indicated the preferred embodiment of my invention as incorporating this lost motion linkage, I nevertheless contemplate, as coming within the scope of my invention, an arrangement wherein there is a positive drive between the piston 41 and the operating shaft 25. For admitting fuel to the underside of piston 41 within cylinder 40 there is provided a sump or well 44 below the level of bowl 21 and communicating therewith through passage 45. The bottom wall of cylinder 40 is orificed for the reception of a threaded plug 46 in turn formed with a restricted metering port 47 providing at the upper terminal thereof a horizontal seat for the reception of a ball check valve 48. Received within the well 44 is a strainer 49 for removing foreign matter from the fuel passing there-through. It will thus appear that when throttle valve 23 is moved toward the closed position thereof, piston 41 will be raised, thus causing fuel to lift ball check valve 48 and pass into cylinder 40, filling the space left by the receding piston.

Manifold assembly 32 includes an adaptor 50 threaded into a protuberance extending from the side wall of housing 20 and communicating with cylinder 40 through outlet orifice 51. Tubular adaptor 50 is formed in the end thereof adjacent orifice 51 with a restricted outlet orifice providing a seat for a ball check valve 52 urged into engagement therewith by a compression spring 53. Received in the opposite end of tubular adaptor 50 is a plug member 54 having one inlet passage 55 and adapted to support the inlet end of each of the distributor conduits 33. It will thus appear that when the throttle valve 23 is moved in the direction of open position, the linkage 43 will cause a lowering of piston 41 with the result that ball check valve 52 is forced away from its seat and fuel is forced out to each of the distributor conduits 33.

For delivering the accelerating charges at points within the manifold assembly 14 closely adjacent the inlet valve 30, I have provided a special discharge nozzle unit indicated generally at 34. Each of these units 34 comprises a tubular nozzle housing 60 formed with a central bore 61 there-through and being threaded on the forward end at 62 for mounting in the wall of the associated manifold and threaded at 63 for connection with the associated discharge end of supply conduit 33. The inlet end of nozzle housing 60 is formed with a port 64 and a coaxial seat 65 for the reception of a ball check valve 66. Received in bore 61 beyond the normal position of ball check 66 when in engagement with

seat 65 is a cylindrical plug insert 67. Plug 67 is formed in the periphery thereof with a coaxially extending channel 68 serving alternatively to allow the passage of accelerating fuel or air thereby under conditions to be pointed out. Plug 67 is formed centrally with a coaxial bore 69 extending from one end to a point short of the other end thereof, this bore providing a second vertically spaced seat 65a for ball check 66 and communicating with the atmosphere through a transverse passage 70 in the side wall thereof, which in turn communicates with a second passage 71 in the wall of housing 60.

Received in the outer end of bore 61 is a tubular nozzle tip 72 formed with a restricted discharge orifice 73. Formed about the mid-periphery of nozzle housing 60 is an annular recess channel communicating with passage 71 and having a screen 74 embracing the same, the screen in turn being surrounded by an inverted protecting skirt 75.

It will thus appear that when piston 41 of accelerator pump 31 is being moved downwardly, as when the throttle is being opened, accelerating fuel will be forced through conduits 33, inlet ports 64 of the respective nozzle assemblies 34, raising ball check valves 66 out of contact with the lower seats 65 and into contact with the upper seat 65a, thence passing upwardly along channel 68 and out through nozzle 73 into the area adjacent the associated inlet valve 30.

From the above description it will now be apparent that unless ball 66 has been forced away from its seat 65 by the flow of fuel therepast, then this ball check valve will remain seated. The vacuum in the manifold is not effective to lift the ball check valve 66 from its seat 65, since nozzle 34 is in communication with the atmosphere through channel 68 and passages 69, 70 and 71 at such times as ball 66 is in engagement with the lower seat 65. As a result of this arrangement, the vacuum in the manifold is never effective to inadvertently draw charges of fuel from the nozzle. On the contrary, the only time that fluid flows through lines 33 and the respective nozzles 34 is in response to the operation of the accelerator.

It is important to note, while I have indicated that a nozzle assembly 34 will be provided for each cylinder in my preferred embodiment, I nevertheless contemplate as coming within the scope of my invention, an arrangement wherein only certain of the cylinders are provided with an accelerating nozzle 34.

While I have disclosed and described the details of the preferred embodiment of my invention in the form in which they are being manufactured and sold, it is to be understood that this is by way of example rather than by way of limitation, and that I desire the following claims to be construed in a manner as broad as permitted by the prior art.

I claim:

1. In a fuel feeding system adapted for a plural cylinder internal combustion engine of the type having fuel inlet valves means associated with each cylinder, said fuel system including a carburetor assembly comprising means therein defining a fuel and air mixing passage, main nozzle means for delivering fuel into said mixing passage, a throttle valve assembly including a valve for controlling the flow through said passage, manifold conduit means leading from said mixing passage to the respective ones of said engine in-

let valves, means separate from said main nozzle adapted for introducing enrichening charges of fuel into said manifold at a plurality of points adjacent at least certain of said inlet valves, said enrichening charge supply means comprising a fuel pump assembly, and means including auxiliary fuel nozzles adapted to be mounted in the wall of said manifold at said plurality of points adjacent said engine inlet valves, separate conduits leading from said pump to each of said auxiliary fuel nozzles, said pump being operable in response to the opening movement of said throttle valve assembly and means between said pump and each of said auxiliary nozzles including a vent valve assembly responsive to the stoppage of fuel flow thereby to effect venting of said nozzles to the atmosphere to thus prevent manifold suction from drawing fuel through said conduits when said fuel pump is not being operated, said valve assembly being responsive to fuel flow thereby when said pump is operating to shut off communication with the atmosphere thus preventing both the discharge of fuel therefrom and the inlet of air therethrough.

2. In a fuel feeding system adapted for a plural cylinder internal combustion engine of the type having fuel inlet valve means associated with each cylinder, said fuel system including a carburetor assembly comprising means therein defining a fuel and air mixing passage, main nozzle means for delivering fuel into said mixing passage, a throttle valve assembly including a valve for controlling the flow through said passage, manifold conduit means leading from said mixing passage to the respective ones of said engine inlet valves, means separate from said main nozzle for introducing enrichening charges of fuel into said manifold at a plurality of points adjacent at least certain of said inlet valves, said enrichening charge introducing means comprising a fuel pump the barrel of which is formed as part of said carburetor assembly, auxiliary fuel introducing nozzles mounted in the wall of said manifold at said plurality of points adjacent said engine inlet valves, separate conduit means for conducting fuel from said pump to each of said auxiliary nozzles, a check valve assembly adjacent the outlet of said pump for preventing the return flow thereto, and means interposed between said pump and each of said auxiliary nozzles including a vent valve assembly responsive to the stoppage of fuel flow thereby to effect the venting of said nozzles to the atmosphere to thus prevent manifold suction from drawing fuel through said conduits when said fuel pump is not being operated, said valve assembly being responsive to the flow of fuel thereby when said pump is operating to shut off communication with the atmosphere thus preventing both discharge of fuel therefrom and the inlet of air therethrough, said valve assembly comprising a spherical ball, means defining a pair of opposed vertically spaced seats receiving said ball therebetween, the lower one of said seats being in communication on the under side thereof with the corresponding conduit for supplying fuel thereto from said pump, means placing said upper seat in communication with the atmosphere on the remote

side thereof from said first seat and means placing the opposed sides of said valve seats both in communication with the corresponding nozzle.

3. In a fuel feeding system adapted for a plural cylinder internal combustion engine of the type having fuel inlet valve means associated with each cylinder, said fuel system including a carburetor assembly comprising means therein defining a fuel and air mixing passage, main nozzle means for delivering fuel into said mixing passage, a throttle valve assembly including a valve for controlling the flow through said mixing passage, manifold conduit means leading from said mixing passage to the respective ones of said engine inlet valves, means separate from said main nozzle adapted for introducing enrichening charges of fuel into said manifold at a plurality of points adjacent at least certain of said inlet valves, said enrichening charge supply means comprising a fuel pump assembly, means including auxiliary fuel nozzles adapted to be mounted in the wall of said manifold at said plurality of points adjacent said engine inlet valves, separate conduits leading from said pump to each of said auxiliary fuel nozzles, said pump being operable in response to the opening movement of said throttle valve assembly, said last named means comprising a cylindrical housing having a generally coaxial bore therethrough, a first terminal portion of said housing communicating with one end of said bore being threaded to adapt the same for connection to one of said conduits leading from said pump, a second terminal portion communicating with the other end, said bore being threaded to adapt the same for connection in a complementary opening in a manifold wall, means in said bore adjacent said first terminal portion defining a ball valve seat facing the direction of fuel flow, a spherical ball valve normally received against said seat, a generally cylindrical plug received in said bore with one end thereof in spaced relation to said ball when the same is in engagement with said seat, a coaxially extending groove formed in the periphery of said plug for placing said first terminal portion of said housing in communication with the space occupied by said ball, a second valve seat formed in the end portion of said plug in opposed relation to said first named valve seat, a vent orifice formed in the side peripheral wall of said housing, a passage formed in said plug placing said second valve seat in communication with said vent orifice, whereby the passage of fuel delivered by said pump past said ball valve effects the raising of the same from said first seat into engagement with said second seat thus shutting off the discharge of fuel past said second seat and shutting off the admission of air therethrough while fuel is transmitted freely to said first terminal portion of said housing through said coaxial groove in said plug, the stoppage of fuel delivery by said pump resulting in said ball valve settling into contact with said first seat thus placing said atmospheric vent in the side wall of said housing in communication with said first terminal portion of said housing through said coaxial groove.

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