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2,032,902

APPARATUS FOR FEEDING A COMBUSTIBLE FLUID TO INTERNAL COMBUSTION ENGINES

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2 Sheets-Sheet 1

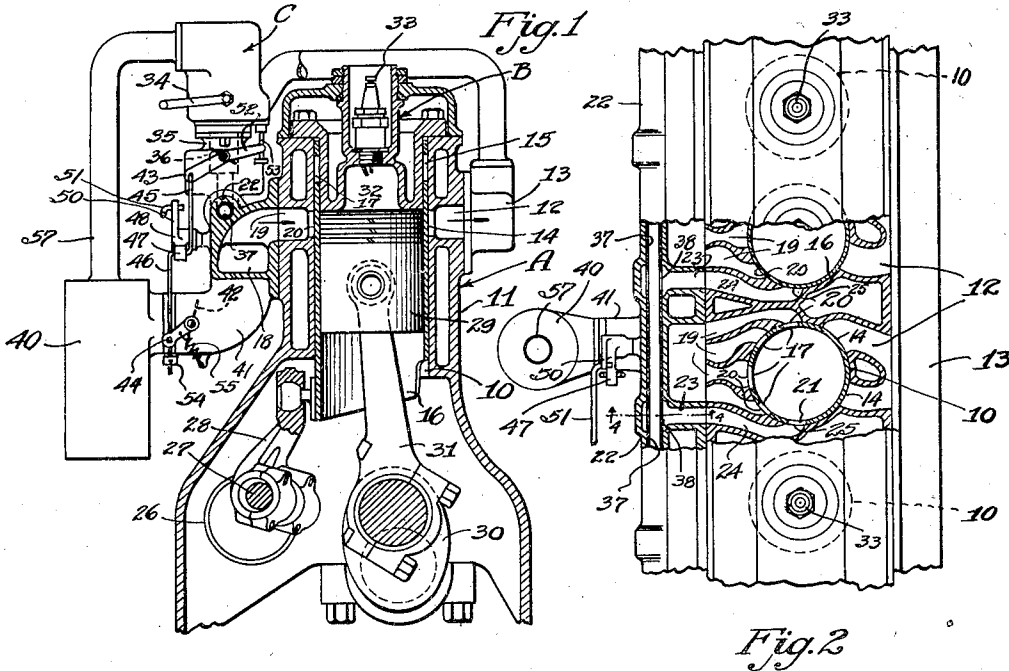
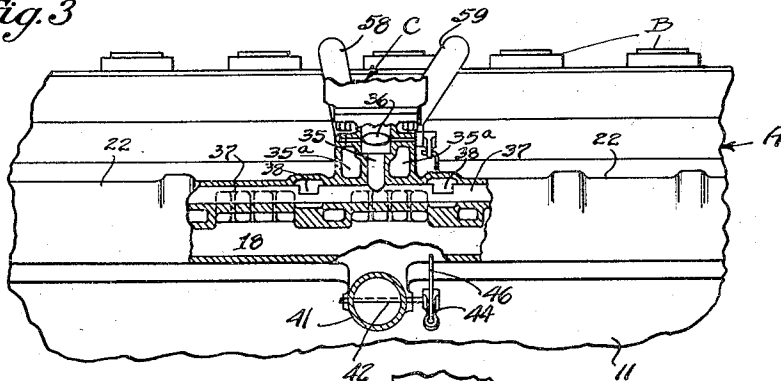
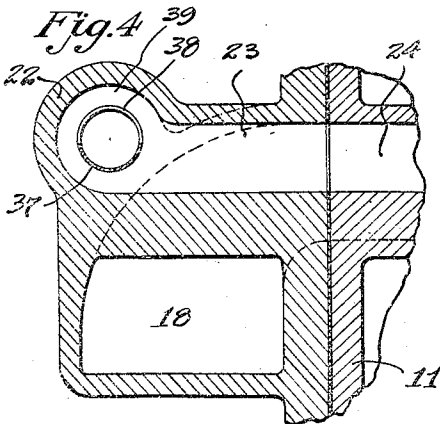
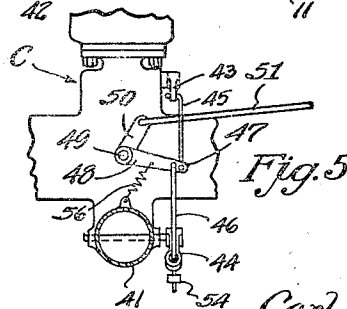


Fig. 3



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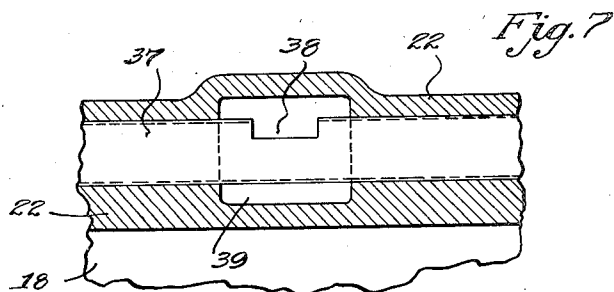
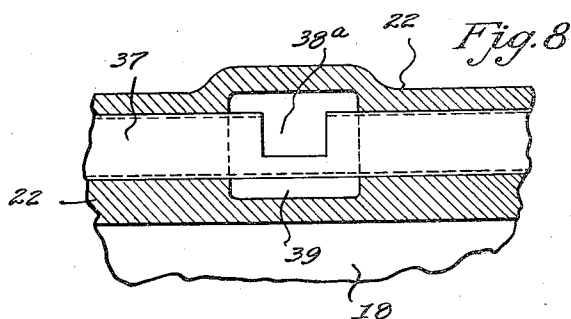
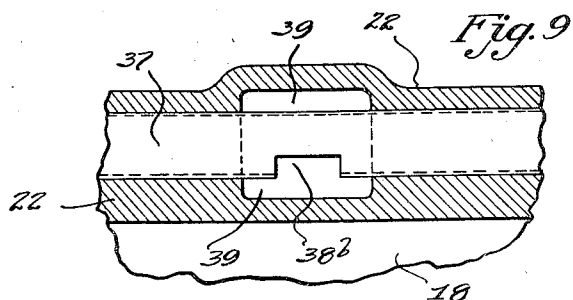
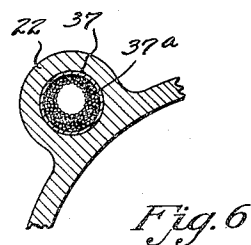
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APPARATUS FOR FEEDING A COMBUSTIBLE FLUID TO INTERNAL COMBUSTION ENGINES

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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APPARATUS FOR FEEDING A COMBUSTIBLE
FLUID TO INTERNAL COMBUSTION EN-
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3 Claims. (Cl. 123—75)

This invention relates to improvements in internal combustion engines and also to an improved method and apparatus for feeding combustible fluid to an internal combustion engine.

One important phase of my invention relates to improvements in so-called cold carburetion systems. Considerable difficulty has been experienced in connection with such systems although it is generally recognized that inherent benefits may be realized provided that the difficulties experienced heretofore can be satisfactorily overcome. In connection with this phase of my invention I have provided an apparatus and method for carbureting an engine wherein, at relatively high engine loads, a relatively rich mixture of air and a suitable hydro-carbon such as gasoline is supplied directly to the engine cylinder or combustion chamber and such combustion chamber is independently supplied with a quantity of air. I therefore, do not mix the fuel with all of the air prior to introduction to the combustion chamber of the engine over the load range of the engine and in this way many of the difficulties experienced heretofore are overcome. At relatively low engine loads I preferably supply a substantially normal fuel mixture to the engine without additional air, such normal mixture for gasoline being approximately fifteen parts air to one part of gasoline.

It is an object of my invention to provide an improved carburetion system and method whereby I materially increase the volumetric efficiency of the engine. It is a further object of my invention to obtain improved fuel mixture distribution characteristics for the various cylinders of the engine, increased fuel economy, obtain improved conditions of engine idling, and generally improve the overall engine performance. I preferably maintain an approximately constant cross-sectional area of the fuel mixture conduit system right up to the cylinder intake port and hence maintain the velocity of the fuel mixture up to the cylinder port whereby the fuel does not drop out or puddle. This is especially beneficial at light engine loads. At heavy engine loads it is not so important since, then, the velocity is much increased and the chance for puddling or bad distribution is greatly diminished.

It is a further object of my invention in its more limited characteristics to provide an improved carburetion system and method, particularly adapted to engines of the sleeve valve type as distinguished from the poppet valve types of engines. I have thus provided a common valve means in the form of one or more sleeve valves or

the like for controlling the introduction of the fuel mixture and air separately to the engine cylinder and combustion chamber.

In carrying out my invention I preferably provide a carbureted fuel mixture having a relatively small diameter manifold for supplying the various combustion chambers of the engine, such manifold being adapted to supply a normal fuel mixture of substantially the most advantageous ratio of fuel and air for relatively low ranges of load on the engine and as the load on the engine is increased, I have provided a control device whereby air is supplied to the combustion chambers in increasing quantity as the fuel mixture is enriched to decrease the ratio of air to fuel in the carbureted mixture. Thus, assuming that the engine is mounted for propelling an ordinary motor vehicle, the normal carbureted fuel mixture would supply the engine through its relatively small distributing tube or manifold, without additional air, in the usual ratio of substantially fifteen parts air to one part gasoline until the vehicle speed reaches twenty miles per hour for example, under ordinary load for such speed, and as the speed of the vehicle is increased, with corresponding increase in engine load, the fuel mixture ratio passing through the fuel mixture tube is adapted to decrease and at the same time my system is adapted to supply air independently and directly to the engine combustion chambers in sufficient quantity to maintain in the combustion chambers approximately the aforesaid normal ratio of fifteen to one. Thus, when the engine is operating under substantially full load the fuel mixture ratio passing through the fuel mixture tube may approach approximately three parts air to one part gasoline or may vary therefrom depending on the degree to which my invention is carried out.

A further object of my invention resides in the provision of improved means for distributing the fuel mixture from the manifold runner to the branches leading to the engine cylinders.

Further objects and advantages of my invention will be apparent as this specification progresses, reference being had to the accompanying drawings in which:

Fig. 1 is a sectional elevation view through a typical cylinder of the engine and illustrating the fuel mixture and air supply,

Fig. 2 is a plan view of the engine with a portion thereof cut-away to illustrate the introduction of the carbureted mixture and air to the engine combustion chambers,

Fig. 3 is a side elevation view of a portion of the

engine block with a part thereof cut-away to illustrate the fuel mixture supply manifold.

Fig. 4 is a detail sectional view of the fuel mixture manifold along the line 4—4 of Fig. 2.

Fig. 5 is a detail elevation view illustrating the common control device for the fuel mixture and air throttle valves.

Fig. 6 is a sectional view through the fuel mixture distributing tube illustrating, in exaggerated manner, the formation of wet fuel travelling in the tube.

Fig. 7 is an enlarged detail view illustrating the outlet from the fuel mixture pipe to a branch passage leading to an engine cylinder, wherein a relatively small amount of wet fuel is passed to the branch passage.

Fig. 8 is a view corresponding to Fig. 7 illustrating the control for passing a medium amount of wet fuel to the associated branch, and

Fig. 9 is a view corresponding to Fig. 7 illustrating the control for passing a relatively large amount of wet fuel to the associated branch.

Referring to the drawings A represents the engine having a plurality of cylinders 10 and for the most part the description will be limited to one of the cylinders and associated parts, it being understood that the other cylinders are correspondingly constructed. For purpose of illustration I have shown my invention in connection with an engine of the sleeve valve type and more particularly the Burt-McCollum type of engine in which a single sleeve valve associated with each cylinder is moved in a combined reciprocating and oscillating movement for controlling the cyclical events of the engine. It will be understood, however, that my invention is not limited to any particular valving type of engine or specific sleeve valve means in its broader aspects.

The cylinder block 11, containing cylinders 10, is formed with cylinder block exhaust passages 12 for conducting exhaust gases from each cylinder to the exhaust manifold 13, the passages 12 communicating with cylinder exhaust ports 14 controlled by ports 15 of the sleeve valve 16, the latter being movably associated with cylinder 10. The sleeve 16 also has a series of intake ports 17 for controlling the admission of air from the air manifold 18, the air being supplied from this manifold to each cylinder by reason of the cylinder block air intake passages or conduits 19 opening inwardly at the cylinder block air intake ports 20. The sleeve valve also has one or more additional intake ports 21 adapted to control the admission of fuel mixture from the fuel mixture distributing pipe or manifold runner 22, which may be fitted with a pipe or tube 37 therein, this manifold supplying the fuel mixture to the various branches or conduits 23, preferably of substantially the same cross-sectional area as that of tube 37, whence the fuel mixture is conducted to cylinder block fuel mixture intake conduits or passages 24 terminating in fuel mixture cylinder intake ports 25. The passages 24 also by preference have substantially the same cross-sectional area as the pipe 37 and conduit branches 23.

The sleeve valve 16 may be operated in any desired manner, that illustrated consisting of a valve shaft 26 adapted to actuate each sleeve with the aforesaid movement by reason of the wobble cranks 27 and sleeve connecting links 28. It will be understood that the valve shaft 26 is operated at half crankshaft speed for the four-stroke cycle engine illustrated.

Within each sleeve valve 16 is the usual piston 29 adapted to actuate crankshaft 30 through the

intermediary of a connecting rod 31. Each cylinder 10 has one end thereof closed by a cylinder head structure B, that illustrated being of the re-entrant type so as to receive the upper end of the associated sleeve valve, and also forming a combustion chamber 32 wherein the fuel mixture is ignited by the usual spark plug 33.

C represents a carburetor in which the hydrocarbon, such as gasoline supplied by pipe 34 is mixed with the air and the mixture conducted through the riser 35 containing the throttle valve 36 and thence to the header of manifold 22 which extends longitudinally of the engine. The fuel mixture may or may not be subjected to the application of a moderate amount of heat, near carburetor C. I have illustrated an exhaust heater jacket 35^a surrounding riser 35 whereby the carburetion of the gasoline is facilitated. In any event the heat is not applied to the air in manifold 18 so that where a certain amount of heating is desired for the fuel mixture, it does not seriously affect the improved volumetric efficiency of my engine since only a small proportion of the air would be heated at relatively heavy engine loads. A part of the exhaust from manifold 13 is circulated to jacket 35^a by the supply pipe 58 and the return pipe 59. The tube 37 is shown as having slots 38 formed therein at each cylinder for conducting the fuel mixture from tube 37 to the associated branch 23 aforesaid. The tube 37 provides a convenient means for controlling the amount of wet fuel passed to any branch 23 depending on the fuel mixture requirements for equal distribution to the various cylinders. One element entering into the varying requirements of the cylinders is the proximity of the cylinders to the carburetor and hence to the source of the wet fuel passing through tube 37. Thus in Fig. 6 the wet fuel film 37^a is shown having its greatest thickness at the bottom walls of the tube and tapering toward the top. In Fig. 7 the opening 38 is shown in the top of tube 37 whereby a relatively small amount of the wet fuel 37^a will pass to its branch 23. In Fig. 8 the opening 38^a is deeper to provide for passage of a medium amount of wet fuel 37^a to the associated branch 23. In Fig. 9 the opening 38^b is shown in the bottom wall of tube 37 for passage of a relatively large amount of the wet fuel 37^a to the associated branch 23. Thus I am enabled to conveniently determine and control the proper distribution of the fuel from tube 37 to the various cylinders. At each opening such as the opening 38, the manifold 22 is provided with an annular chamber 39 surrounding the tube and opening into branch 23 as shown in Fig. 4 permitting ready flow of the fuel mixture from tube 37 to the various cylinders and combustion chambers of the engine.

The air manifold 18 is supplied with air through an air cleaner 40 to the riser 41, and air throttle valve 42 controlling the quantity of air admitted to manifold 18. The air cleaner 40 may also supply air to carburetor C by the air pipe 57.

The fuel mixture throttle valve 36 is controlled by an arm 43 and the air throttle valve 42 is controlled by an arm 44, these arms being connected by links 45 and 46 to a common arm 47 of a bell crank lever 48 pivoted at 49, the other arm 50 thereof being adapted for controlling actuation by a rod 51 to a convenient point of manual control such as the usual accelerator where the engine is mounted for propelling a motor vehicle. The arm 43 has an extension 52 adapted to actuate the fuel controlling nozzle

53 of carburetor C so that as the throttle valve 36 is opened, fuel in increasing amounts is supplied to the fuel mixture manifold 22.

The link 46 is provided with an actuating collar 54 shown in Fig. 1 as being spaced from arm 44, the collar 54 being adapted to actuate arm 44 and throttle valve 42 after a predetermined load has been placed on the engine. Thus the collar 54 provides a sort of lost motion connection for arm 44 whereby air through manifold 18 is not supplied to the engine during the relatively low ranges of load on the engine, but as the load increases, air in increasing amounts is admitted to the engine. A spring 55 acts on arm 44 tending to close valve 42 and a second spring 56 acting on bell crank lever 48 tends to restore arms 43 and 44 to their positions of engine idling as will be readily understood.

In operation let us assume that the engine is idling so that the parts are in the positions substantially as shown in Fig. 1. Under such conditions the valve 42 is closed or substantially so, so that the engine is operated on a fuel mixture supplied by carburetor C, manifold 22, cylinder ports 20 and sleeve port 17. Such fuel mixture is preferably of a favorable normal ratio of fuel and air such as that commonly provided for in internal combustion engines and generally accepted as fifteen parts of air to one of gasoline. Under such conditions the idling and starting of the engine are greatly improved over common practice by reason of the high velocity provided by the relatively small cross-sectional area of manifold 22, branches 23, passages 24, and the attendant advantages incident to the relatively low wall surface area of the fuel mixture intake manifold and conduits associated therewith.

As the rod 51 is moved to open the fuel mixture throttle valve 36, the engine will be placed under increased load and the carburetor C is preferably adapted to supply the fuel mixture requirements for the engine in approximately the aforesaid normal ratio of fuel and air up to substantially an engine load corresponding to approximately a speed of twenty miles per hour of vehicle travel with ordinary load for such speed, after which the collar 56 engages arm 44. As the load is then increased on the engine, the throttle valve 42 is correspondingly opened and the fuel mixture supplied by carburetor C is rapidly enriched relative to a normal mixture so as to reduce the aforesaid ratio, the amount of air supplied through air manifold 41 preferably compensating for the enriched fuel mixture so that in any combustion chamber the aforesaid normal ratio of fifteen to one is substantially maintained.

It will be apparent that various modifications may be made in my disclosure without deviating from the principles of my invention and it is not my intention to limit my invention to the particular constructions and methods described and shown for purposes of illustration.

What I claim as my invention is:

1. In an internal combustion engine, a cylinder having a plurality of intake ports located substantially adjacent the cylinder outer end, sleeve valve means movable axially within the cylinder for controlling said intake ports, a carburetor associated with said engine, and a fluid conducting system for said engine including a rela-

tively small conduit connecting said carburetor with one of said intake ports and conducting a fuel mixture to the engine of a predetermined ratio of fuel and air for relatively low load engine operation, a relatively large conduit for conducting air to said other cylinder intake ports, and control means for regulating the fluid flow through said conduits, said control means being operable to maintain the ratio of fuel and air introduced into the engine cylinder substantially constant for substantially the entire range of engine load operation.

2. In an internal combustion engine, a cylinder having a plurality of intake ports located substantially adjacent the cylinder outer end, sleeve valve means movable axially within the cylinder for controlling said intake ports, a carburetor associated with said engine, and a fluid conducting system for said engine including a relatively small conduit connecting said carburetor with one of said intake ports and conducting a fuel mixture to the engine of a predetermined ratio of fuel and air for relatively low load engine operation, a relatively large conduit for conducting air to said other cylinder intake ports, and control means for regulating the fluid flow through said conduits, said control means closing off the flow of air through said large conduit for relatively low load engine operation and acting, to vary the ratio of fuel and air supplied to said small conduit for progressively enriching the fuel mixture as the engine load operation is relatively increased and to simultaneously open said large conduit to progressively increase the volume of air supplied to the engine through said large conduit, whereby to maintain the ratio of fuel and air in the engine cylinder substantially constant for substantially the entire range of engine operation.

3. In an internal combustion engine, a cylinder having a plurality of intake ports located substantially adjacent the cylinder outer end, sleeve valve means movable axially within the cylinder for controlling said intake ports, a carburetor associated with said engine, and a fluid conducting system for said engine including a relatively small conduit connecting said carburetor with one of said intake ports and conducting a fuel mixture to the engine of a predetermined ratio of fuel and air for relatively low load engine operation, a relatively large conduit for conducting air to said other cylinder intake ports, and control means for regulating the fluid flow through said conduits, said control means closing off the flow of air through said large conduit for relatively low load engine operation and acting, to vary the ratio of fuel and air supplied to said small conduit for progressively enriching the fuel mixture as the engine load operation is relatively increased and to simultaneously open said large conduit to progressively increase the volume of air supplied to the engine through said large conduit, whereby to maintain the ratio of fuel and air in the engine cylinder substantially constant for substantially the entire range of engine operation, said control means including a lost motion device to delay the opening of said large conduit until a predetermined degree of engine load operation has been attained.

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