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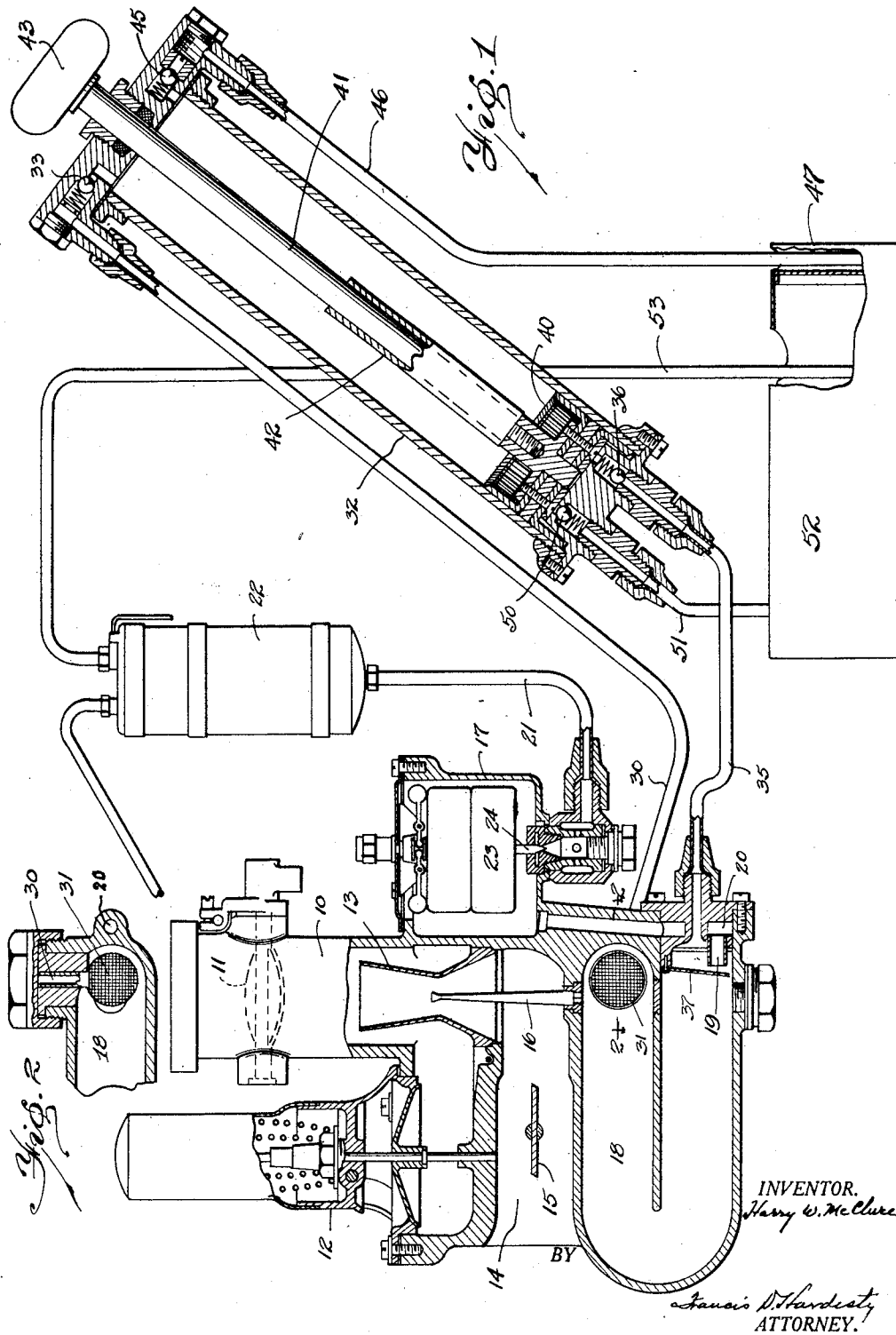
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MEANS FOR OPERATING INTERNAL COMBUSTION ENGINES

Filed Aug. 18, 1928

2 Sheets-Sheet 1



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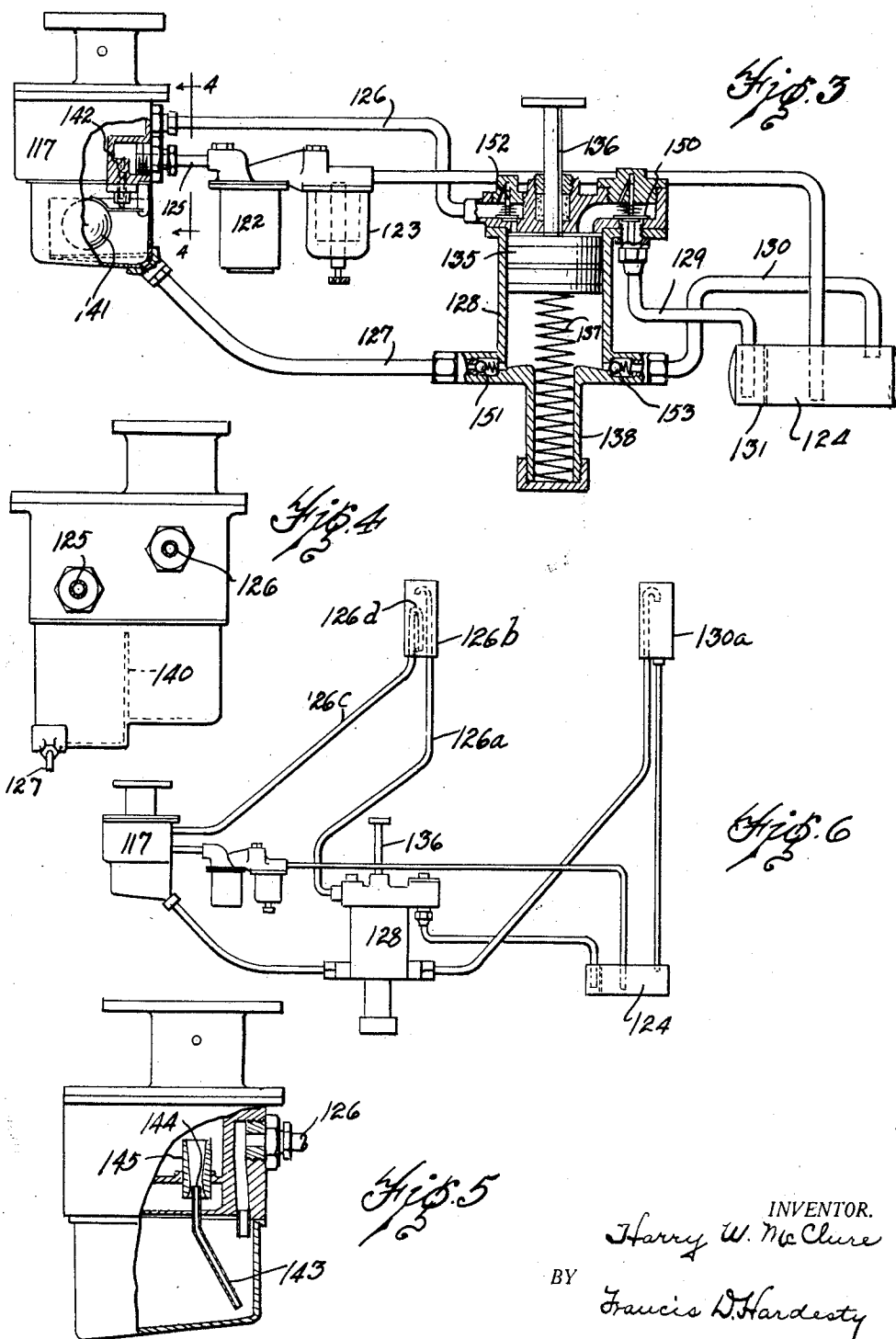
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

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MEANS FOR OPERATING INTERNAL COMBUSTION ENGINES

Application filed August 18, 1928. Serial No. 300,423.

The present invention relates to methods of and means for operating internal combustion engines.

Among the objects of the invention is improved means for starting internal combustion engines and for operating them during a warming-up period, preparatory to their usual subsequent efficient operation on the ordinary, commercial grade of fuel.

Another object is means for withdrawing from the fuel system a predetermined quantity of the fuel therein and ready to enter the engine manifold and for substituting therefor a substantially equal amount of a higher grade or more volatile fuel.

Another object is to substitute such high grade or more volatile fuel in such position in the fuel supply line that this high grade fuel will be largely consumed before any considerable amount of the ordinary fuel enters the engine.

Still other objects will occur to those skilled in the art upon reference to the following description and accompanying drawings in which:—

Figure 1 is a more or less diagrammatic view of the device, which, were the pump shown therein replaced by the form of pump shown in Figure 3 and were it slightly modified in compliance with the annexed description, would show the preferred form.

Figure 2 is a partial section identified by a horizontal plane through the center of the screen 31 in Figure 1.

Figure 3 is a more or less diagrammatic view of another form of the device, with parts in section.

Figure 4 is a view of the carburetor of Figure 3, taken on line 4—4 of Figure 3.

Figure 5 is a side elevation of the carburetor with parts in section to show the location of some of the internal elements, and

Figure 6 is a diagrammatic view of a modified form of the structure shown in Figure 3.

The starting of internal combustion engines, particularly as used in automotive vehicles and then especially under adverse temperature conditions, is generally difficult, and sometimes impossible, owing to the fact that ordinary fuel does not readily vaporize

at low, or even medium, temperatures. Various devices, such as primers, have been suggested for overcoming this difficulty, with but indifferent results. At best, they tend somewhat to lessen the difficulty in effecting initial firing, beyond which their usefulness is nil. There have been devised also systems which have the advantage of supplying a light, volatile fuel during the warming up period, but, because of their cost, complications, general impracticability of application, and, very especially, the time and attention required for their manipulation, they have failed to gain recognition.

Ordinary, commercially practical, fuel consists of a mixture of fuels of various degrees of volatility. Those fractions which are, at the assumed low temperature, sufficiently volatile to vaporize and so remain until fired are of relatively low content. Therefore, in order to realize at such temperatures a vapor mixture which may be satisfactorily fired and burned, an excessive quantity of the whole fuel must be drawn into the cylinders, the lower fractions being largely in the liquid form. It is current practise, even under moderate temperature conditions, to employ a carburetor choke to induce the heavy flow of fuel necessary to effect initial firing and thereafter to maintain firing during a considerable part of the warming up period.

Liquid fuel in the cylinders necessarily dilutes and washes the lubrication from the cylinder walls, pistons, and rings, which results in rapid and excessive wear of these parts. While part of this liquid fuel is ejected through the exhaust valves, once the engine operates under its own power, a portion of it passes the pistons and dilutes the lubrication oil supply, with obviously deleterious effects.

It is particularly during the cranking period, that interval preceding initial firing, that the cylinders are flooded with liquid fuel. During this period, while the starting motor is turning over the engine relatively slowly, the low velocity of the manifold air column, and its consequently negligible disruptive effect together with its low vapor carrying ability, necessitates excessive chok-

ing, especially at times of cold weather. It should be especially noted that, during continued cranking accompanied by the inevitable choking, the liquid fuel in the cylinders is cumulative, whereas the volatilized fractions are being ejected therefrom at every exhaust stroke. In any event, the flooding of the cylinders is excessive and extensive cranking operations consume battery current in large quantities, especially in season when such current is most needed for lighting. The general effect on the battery is low gravity which, in turn, results in sulphation, rapid battery depreciation accompanied by even further increased starting difficulties, probable removal of the battery for re-charging or replacement. From the above, not to mention other facts which might be adduced, it is apparent that the practise of initiating operation and subsequently warming up of internal combustion engines with an economically and operatively practical grade of fuel is responsible for a very large portion of motor car ills, not to mention great expense and exasperating inconvenience to the owner.

In order to overcome such difficulties, the present device and methods have been devised to enable the starting and operation of the engine for some time on a highly volatile fuel so that the use of the conventional choke with its disadvantages may be greatly lessened, if not entirely eliminated.

The process consists in initiating and continuing for some time the operation of the engine on higher volatile fuel and then after a short time gradually changing from the higher volatile fuel to the ordinary grade of fuel. It also consists in drawing out of the fuel line a measured quantity of the ordinary fuel therein and simultaneously substituting therefor a substantially like quantity of a higher grade or more volatile fuel sufficient to operate the engine for a desirable period of time.

Referring now to the drawings, a carburetor mixing chamber is indicated at 10 in Figure 1 with the throttle valve at 11. The particular carburetor shown is supplied with an automatic auxiliary air inlet and valve mechanism therefor, indicated as a whole at 12. Leading into the mixing chamber 10 is the conventional Venturi tube 13 and air is supplied thereto through the passage 14 controlled by a butterfly choke valve 15.

Extending into the Venturi tube in the usual manner is the fuel nozzle 16 which, in ordinary construction, is connected directly to a float bowl 17 but which in the present construction is connected to a chamber 18 sufficiently large to hold a considerable quantity of fuel. This chamber 18 is shown as a large U-shaped tube mounted horizontally and having the nozzle 16 opening from the upper part thereof.

At the lower part, the tube connects

through a short nipple 19 to a passage 20 leading to the float bowl 17. The float bowl 17 is shown as connected through a pipe 21 to vacuum tank 22 and the flow of fuel through this pipe is controlled in the usual manner by a float 23 controlling the valve 24.

Leading to the upper part of chamber 18 is a pipe 30 connected to the chamber through a screen 31, shown also in Fig. 2.

The other end of pipe 30 is connected at one end of a pump cylinder 32 through a valve 33 opening towards the chamber 18. A second pipe 35 leads from the lower part of chamber 18 to the opposite end of pump cylinder 32, through a valve 36 opening toward the pump cylinder. The end of the pipe 35 is connected to the chamber 18 adjacent to the nipple 19 above mentioned and the latter is provided with a flapper valve 37 which will close readily upon movement of the fluid in the chamber 18 towards and into pipe 35, as will later on be explained more fully.

The pump cylinder 32 is closed liquid tight at both ends and is provided with a suitable piston 40 which is connected to the operating knob or handle 43 by the piston rod 41. Tubular piece 42 shown mounted on piston rod 41 suggests a stop to limit travel of piston 40.

The piston 40 divides the pump chamber 32 into two chambers, the upper of which connects through outlet valve 33 and pipe 30 to the upper part of chamber 18 and also through inlet valve 45 and pipe 46 to a small reservoir 47 adapted to contain a supply of high grade or highly volatile fuel. The lower chamber of the pump, which is connected to the lower part of chamber 18 through inlet valve 36 and pipe 35, is connected also to the conventional fuel tank 52 through outlet valve 50 and pipe 51. The inlet of vacuum tank 22 is connected to the ordinary fuel tank 52 by pipe 53.

In the operation of the device, assuming the vacuum tank 22 to have been operated and the carburetor bowl and fuel line therefrom, including chamber 18 and nozzle 16, to be full of the customary fuel, and assuming the upper chamber of pump cylinder 32 to be charged with high grade fuel as a result of the preceding operating of the device, in order to start and warm up a cold engine to the best advantage, handle 43 is withdrawn and returned before the ignition switch or starting motor are operated. This pump operation may be performed once or more times, depending upon the relative capacities of cylinder 32 and chamber 18 and upon other considerations of design, but an arrangement adapted to a single pump operation would result in a more elegant performance. Even under seemingly favorable temperature conditions, worthwhile benefits are to be realized by preceding the starting of a cold engine by at least a partial operation of the pump.

When the piston 40 is moved upwards in the cylinder 32 by the handle 43, fuel in the chamber 18 is withdrawn through pipe 35 and inlet valve 36 into the lower chamber of cylinder 32 and at the same time a substantially equal amount of high grade fuel in the upper chamber of cylinder 32 is forced through outlet valve 33 and pipe 30 and into the chamber 18 at the end thereof adjacent to nozzle 16, whereas the fuel being withdrawn from the chamber exits therefrom at its opposite end. A minor amount of mixing of the two fuels takes place at their plane of contact and this plane moves in chamber 18 until it arrives finally at or near the end thereof distant from fuel nozzle 16.

Thereupon, chamber 18 has been filled with the high grade fuel which now has a small ordinary fuel content at its end distant from nozzle 16 and little or no such content at its end adjacent to nozzle 16. This ordinary fuel content may be even further minimized by replacing chamber 18 with one having a duct of smaller transverse cross section, as, say, a worm having several turns about a vertical axis.

During the above described operation, more fuel is withdrawn from chamber 18, through pipe 35, than is introduced thereinto through pipe 30, the difference being equal to the volume of the piston rod 41 withdrawn from cylinder 32. Since the movement of liquid in chamber 18 toward pipe 35 seats flapper valve 37 on opening 19, no flow will take place from float chamber 17 into chamber 18. Therefore, a diminution of fuel results in chamber 18 and atmospheric pressure acting at the tip of nozzle 16 causes the liquid therein to empty against capilarity into chamber 18 to be carried away in the current. Upon cessation of the liquid flow in chamber 18, flapper valve 37 moves from its seat 19 and the hydrostatic level between float chamber 17 and nozzle 16 is reestablished. Thereupon, valve 24 being slightly open, vacuum tank 22 replenishes the system. Thus, the proper levels are re-established and nozzle 16, as well as chamber 18, is filled with high grade fuel.

Valve 37 and its immediate accessories have been shown in Figure 1 and described in operation largely by way of showing the extraordinary possibilities of the device as a whole. However, insofar as the emptying and refilling of nozzle 16 is an entirely unnecessary refinement and not justified in the face of practical considerations, the system happily may be, and preferably should be, operated with the valve arrangement comprising parts 19, 37, and their immediate supports deleted from the system. In this case there is a tendency to maintain the hydrostatic level between nozzle 16 and float chamber 17. In general, the diminution of fuel heretofore mentioned as developing in chamber 18 results in a drop of this level, slight because of the relatively large horizontal cross section of float chamber 17. This drop of level results in a slight opening of float valve 24 whereupon vacuum tank 22 replenishes the system. In the meantime, pipe 30, chamber 18, and pipe 35 constitute a simple circulating system for the interchange of fuels.

However, in actual experiment the system with flapper valve 37 deleted may not operate precisely in accordance with the last paragraph, for, especially when the pump is operated impulsively, the effects of inertia, friction, and eddy currents may produce a lowering of the fuel level in nozzle 16, even to the extent of emptying it. Also, a permissible constriction in passage 20 or the configuration in the region of the latter's lower end may be made contributory. In any event, these effects are of, or may be turned to, favorable account.

A prime object of this invention is to locate the replacing high grade or more volatile fuel in position for immediate use, an end which is, in no practical sense, defeated by the presence of that very small quantity of ordinary fuel which, after the substitution of the high grade fuel, may, in accordance with the two preceding paragraphs and also in case of modifications of the present design, notably that modification to be hereafter described in connection with Figures 3-6, remain in the nozzle, or nozzles, or any small duct leading thereto, for such volume of ordinary fuel will be almost instantaneously removed by manifold suction and its presence and effects are entirely beneath practical consideration. Though it antecedes the high grade fuel, it is, in the relations and conditions understood, a pseudo antecedent and is to be regarded as non-existent. Therefore, in all the description of the apparatus and operation thereof and in claims relative thereto the expression, "in position for immediate use," and its equivalents, if any, is regarded and used as applicable both literally and within the meaning intended by the within paragraph and it should be so regarded and interpreted by all and sundry.

The fuel replacing or substituting operation takes place, as heretofore described, when the handle 43 in Figure 1 is withdrawn to move the piston 40 upwardly in its cylinder. When the handle is thereafter returned to move piston 40 downwardly in its cylinder 32, the ordinary fuel, heretofore shown to have been drawn thereinto, is ejected through outlet valve 50, through pipe 51, and into the main or ordinary fuel tank 52, as drawn, or preferably, for the reasons assigned later, into the outer chamber of the vacuum tank. And at the same time, a charge of the high grade fuel is drawn from tank 47, through pipe 46, through inlet valve

45, and into the upper chamber of cylinder 32, preparatory to a future interchange of fuels between pump 32 and chamber 18 as heretofore described.

5 For reasons hereafter assigned, pipe 51, referred to above as preferably entering the outer vacuum tank chamber, should have its effective outlet above the liquid level therein. A still further advantage would be gained by
10 utilizing the energy of the entering jet to blow open the vacuum tank flapper valve to establish communication between the outer and inner chambers of the vacuum tank. By this device, the inner, as well as the outer,
15 chamber may be used to store the ordinary fuel withdrawn from the carburetor and no considerable increase in the vacuum tank dimensions will be necessary. If the entering pipe be carried below the fuel level, say to reach the flapper valve, said pipe should be
20 vented within the vacuum tank and at a point above the highest liquid level therein. Such an arrangement will conserve material, simplify assembly, and at the same time avoid
25 drainage of the carburetor, as past imperfect or dirty valves, into the main tank, which might occur if Figure 1 were here followed. Insofar as the outer chamber of the vacuum tank is always open to the atmosphere, vent-
30 ing the entering discharge pipe above the liquid level therein, or terminating the pipe above such level, will break the air seal and prevent syphoning from vacuum tank to carburetor.

35 A somewhat modified form of the apparatus heretofore described is shown in Figures 3-6.

40 Figure 3 shows at 117 a carburetor which is now standard on several cars. Several details not essential to our presentation have been omitted to simplify the drawings. While the bowl in carburetors of this general type is ordinarily of unusually generous proportions, it would in general be desirable to in-
45 crease the capacity of such bowl, for it is proposed to utilize it as a storage for the high grade fuel similarly as in chamber 18 in Figure 1.

50 The ordinary fuel supply device is here represented by the conventional fuel pump 122, preceded by filter 123, drawing fuel from the main or ordinary fuel tank 124 through a pipe, shown but not numbered, and discharging into carburetor 117 through pipe 125 and
55 float valve 142, which last is governed by float 141.

60 The bowl, that chamber not numbered but shown at the bottom of the carburetor in Figures 3-6, is drawn, for the sake of clarity, like that of an existing carburetor, except in that the bottom has been moulded and a partition, shown at 140 in Figure 4, has been added.

65 This partition, an end view of which is shown as just indicated above, and a side

view of which is shown, but not numbered, within the float bowl and beyond the float 141 in Figure 3, extends along a median line of the bowl between the float valve 142 shown in Figure 3 and the nozzle uptake 143 shown in Figure 5, and from the end or side of the bowl adjacent to the float valve towards, but short of, the opposite side.

70 This partition contacts at its one end throughout its height with the wall of the bowl and throughout its length with the bottom of the bowl, preferably liquid tight. The height of the partition should extend at least above the liquid level, or, preferably, it should contact throughout its upper edge
75 with the carburetor body.

80 If a horizontal cross section of the bowl modified as described above be taken, it will reveal a duct of rectangular transverse section, formed into a U-shaped chamber into
85 one end of which enters ordinary fuel through the float valve 142 in Figure 3 and from the other end of which nozzle intake 143 in Figure 5 leads to nozzle 144 within the usual Venturi tube 145.

90 Hereafter, the above mentioned U-shaped carburetor bowl chamber will be so designated and the first of the above mentioned ends thereof will be referred to as its float valve and in contradistinction to its oppo-
95 site, or last above mentioned, end hereinafter referred to as its nozzle end.

100 In some applications, it is preferred to so mould the float bowl that the bottom of the U-shaped carburetor bowl chamber will slope continuously downward from its nozzle end to its float valve end, as is indicated in Figures 3-6.

105 It will now readily be seen that by further modifying the float chamber, as by moulding the U-shaped chamber into one having a cross section more desirable than that indicated by the drawings, which were drawn as is for the sake of simplicity, by streamlining, and by other obvious altera-
110 tions, the float chamber may be made to very acceptably serve the purpose of chamber 18 in Figure 1.

115 In Figure 3 is shown a form of pump designed to mount under the floor board and to be operated by foot and spring pressures. The pump barrel, shown at 128, contains piston 135 operatable downwardly by foot pressure communicated thereto through piston rod 136 and, upwardly by compression
120 spring 137 within the pump barrel and extending, if necessary, into extension 138.

125 Piston 135 divides cylinder 128 into two chambers, upper and lower, as drawn. The upper chamber is connected, through inlet valve 150 and pipe 129, with tank 131 here conveniently shown as a separate compartment in the main or ordinary fuel tank and designed to contain the high grade fuel. The upper chamber is connected also, through
130

outlet valve 152 and pipe 126, with the heretofore mentioned nozzle end of the U-shaped carburetor bowl chamber. The lower pump chamber is connected, through inlet valve 151 and pipe 127, with the float valve end of the U-shaped carburetor bowl chamber at the latter's lowest point, and also with the ordinary fuel tank 124, through outlet valve 153 and pipe 130.

In visualizing the operation of the device, first assume that it has been operated previously and that as a result thereof the lower pump chamber contains, as will appear later, ordinary fuel. Also, assume that the float chamber, that is, the U-shaped carburetor bowl chamber, is filled with ordinary fuel to the proper level. No account need here be taken of fuel pump 122 which operates only simultaneously with the engine.

Now, if piston 135 be depressed, the ordinary fuel, already said to be contained in the lower pump chamber, is forced through outlet valve 153 and pipe 130 into ordinary fuel tank 124 and at the same time suction in the upper pump chamber draws thereinto a charge of high grade fuel from tank 131, through pipe 129 and inlet valve 150. The subsequent upward movement of the piston, under compulsion of compression spring 137, forces the high grade fuel from the upper pump chamber, through outlet valve 152, through pipe 126, and into the nozzle end of the U-shaped carburetor bowl chamber, and at the same time suction in the lower pump chamber draws thereinto, through pipe 127 and inlet valve 151, the ordinary fuel in the U-shaped carburetor bowl chamber, withdrawing same at the float valve end thereof. The ordinary fuel thereupon in the lower pump chamber there remains until a subsequent operation of the pump ejects it.

And so, the ordinary fuel has been withdrawn and has been replaced with high grade fuel.

Note that more fuel has been withdrawn than has been substituted. Note, also, that there is here no automatic device, corresponding to the conventional vacuum tank heretofore mentioned in this connection in describing Figure 1, to rectify this situation prior to cranking. However, a couple of engine revolutions enables pump 122 to fill the need.

Figure 6 shows the device of Figure 3 slightly modified in that the small tank device 126b has been inserted in the pipe line joining the upper pump cylinder chamber outlet to the carburetor, and the tank device 130a has been inserted in the pipe line joining the lower pump cylinder chamber outlet valve to the ordinary fuel tank.

Tank 126b in Figure 6, open to the atmosphere through an air vent at its top, not shown, and elevated above the level of carbu-

retor 117, is of capacity greater than that of the upper pump cylinder chamber from which leads pipe 126a to a point within tank 126b and above the highest liquid level therein. Pipe 126c, leading from within and from near the bottom of tank 126b to the nozzle end of the U-shaped carburetor bowl chamber, is bent, as shown at 126d, into the form of a siphon tube. The height of the bend 126d above the bottom of the tank is such that a charge of high grade fuel from pump 128 will just nicely submerge it. Pipe 126c has a fuel vent, not shown, within the tank 126b, on a level with the adjacent inlet end of pipe 126c, and of effective area considerably less than the bore of pipe 126c.

When therefore, a charge of high grade fuel is forced by pump 128 through pipe 126a and into tank 126b, the air therein is displaced through the vent heretofore mentioned but no very considerable flow to the carburetor takes place until the bend at 126d is submerged, whereupon the rate of flow which has existed during the short interval indicated above, which flow takes place through the above mentioned fuel vent in pipe 126c, is greatly multiplied, in so far as the area of the pipe bore is now fully utilized, and this greater rate of flow thereafter continues until the contents of tank 126b are emptied into the carburetor, down to the level of the fuel vent or of the inlet end of pipe 126c. The fuel vent in pipe 126c is provided to assure flow to the carburetor, even though bend 126d be not completely submerged.

But, in the meantime, that is, prior to the beginning of the greater flow, through pipe 126c, to the carburetor, and therefore before any considerable quantity of the high grade fuel has been delivered to the carburetor, the suction originating in the lower chamber of pump 128 has withdrawn the ordinary fuel from the carburetor.

This tank device, 126b in Figure 6, is designed primarily to delay the delivery of the high grade fuel to the carburetor, relative to the withdrawal therefrom of the ordinary fuel, to the end that diffusion may be prevented, or minimized, during the fuel interchanging interval, especially in cases where little or no other provision has been made therefor in the carburetor design.

At 130a in Figure 6 is shown a tank of capacity greater than that of the lower cylinder chamber in pump 128, elevated above the carburetor 117, and open to the atmosphere at its top through a vent not shown. The pipe, not numbered, shown leading thereto from the lower cylinder chamber outlet valve in pump 128, terminates therein and above the highest liquid level therein. A pipe, not numbered, is shown connected to drain tank 130a into ordinary fuel tank 124. Obviously, no drainage of the carburetor into the relatively lower main fuel tank 124, as

seepage past, imperfect or dirty valves in pump 123, can take place in the face of such a device. The same results may be had by completing the piping loop within tank 130a, by eliminating said tank, by extending the pipe below level of the liquid within main tank 124, and by venting the top of the loop through a small tube extending just within tank 124 and short of the liquid level therein.

It should be noted that no such leakage as just mentioned can take place through the upper pump chamber in the type of pump shown in Figure 3, for such seepage must pass not only valves 152 and 150, but also the ends of the ducts leading therefrom and into the pump chamber and effectively sealed by the piston 135 crowned by a yielding material, not shown, and firmly held against the duct openings by strong spring 137. Furthermore, there can be no seepage between the upper pump chamber and lower pump chamber, as past the piston or by osmosis, for the upper pump chamber does not exist in repose.

Assume the type of pump shown in Figure 3 as connected in replacement of the pump shown in Figure 1, but located below the levels of both the carburetor and the high grade fuel tank 47, which latter should be a small individual tank into which pipe 46, sloping continuously upward from the pump, should enter at the bottom. Then, any air or developed vapor in pipe 46 could escape to atmosphere, rather than enter the pump and, consequently, the carburetor.

Further, immediately the apparatus last described is operated, pipe 30 in Figure 1, here assumed to slope upwardly to the carburetor, is filled with volatile, high grade fuel which thereafter, due to heat from the warmed-up engine, may, in certain assemblies, develop small quantities of vapor, which, rising in tube 30, may temporarily tend to adversely affect the operation of the carburetor. If then a small circumferential groove or depression subtending, say, forty-five degrees of arc, be made in the upper part of chamber 18 between the nozzle 16 and the point of entrance of pipe 30 and if chamber 18 be vented at the highest point of said circumferential groove through a small duct whose upper end, preferably within float chamber 17, is open to the atmosphere, then any vapor entering chamber 18 will be trapped and conducted without.

Additional valves, screens, or baffles may be placed in the lines at desirable points to control surging and for the removal of dirt. Any or all of the valves shown may be located otherwise.

It will be seen from the above description that there has been devised means whereby a desirable quantity of the ordinary fuel may be withdrawn from the fuel line and a substantially like quantity of a higher grade or more volatile fuel substituted therefor in such

location that the high grade fuel is in position to be used immediately and must all be consumed before any of the low grade fuel again reaches the point of use. Of course, where the two bodies of fuel meet there will be no sharply defined line of division and there will be some blending of the fuels, so that when it is said that all of the high grade fuel must be consumed before any of the ordinary or low grade fuel reaches the point of use such blending must be taken into consideration.

In any event, the substituting of the high grade fuel in position for initial use, in lieu of the ordinary fuel normally in such position, is accomplished by a single, simple operation, and the subsequent return into use of the ordinary fuel results without further attention from the operator and, happily for best results, more or less gradually, depending on the design of, and therefore on the diffusion in, the carburetor portion of the device.

In the foregoing description, the device has been shown to be applicable when a suitable storage chamber is located between the nozzle and the float chamber, and, also, when the existing float chamber, modified or not modified, serves the purpose of such storage chamber. The device is equally applicable in case the carburetor be of the floatless type, if a suitable storage chamber, suitably located, be available or provided. In any event, such chamber must be close to the nozzle, or nozzles, or must at least communicate therewith in such manner as to fulfill the practical requirements of the invention.

Now, having described the invention and the preferred forms of embodiment thereof, it is to be understood that the said invention is to be limited, not to the specific details herein set forth, but only by the scope of the claims which follow.

I claim:—

1. In a carburetor for an internal combustion engine, a float bowl and a fuel nozzle, a reservoir having a relatively large capacity located between said float bowl and nozzle and communicating therewith, said reservoir being normally completely filled with fuel, and means connected with said reservoir for withdrawing the major portion of the fuel normally contained therein and substituting therefor another and more volatile fuel.

2. In a carburetor for an internal combustion engine, a float bowl and a fuel nozzle, a reservoir having a relatively large capacity located between said float bowl and nozzle and communicating therewith, said reservoir being normally filled with fuel, a pump connected with said reservoir and with a source of supply of another fuel and adapted to withdraw from said reservoir the fuel normally contained therein and to substitute therefor a similar quantity of said other fuel.

3. In a carburetor for an internal combustion engine, a float bowl and a fuel nozzle, a reservoir having a relatively large capacity located between said float bowl and nozzle and communicating therewith, said reservoir being normally filled with fuel, a pump connected with said reservoir and with a source of supply of another fuel and adapted to withdraw from said reservoir the fuel normally contained therein and simultaneously to substitute therefor a similar quantity of said other fuel.

4. In an internal combustion engine having a carburetor, a pair of fuel tanks adapted to contain respectively ordinary fuel and more volatile fuel, means for supplying ordinary fuel from its tank to said carburetor, and means for withdrawing the ordinary fuel from the carburetor and substituting therefor a previously measured quantity of the more volatile fuel and discharging the withdrawn ordinary fuel back into the fuel supply ahead of the carburetor.

5. A fuel supply device for internal combustion engines comprising a carburetor having a comparatively large chamber between the float bowl thereof and the discharge nozzle and communicating therewith, a tube leading into said chamber near said nozzle and a second tube leading from said chamber at a point remote from said nozzle, a fuel pump, said tubes being connected to said pump at opposite ends thereof, a piston in said pump dividing the latter into two pump chambers into one of which each of said tubes is connected, tubes leading from said pump to a source of supply of high grade fuel and a point of discharge of low grade fuel respectively, the first of said latter tubes connected to said pump at the end to which is connected the first of the first mentioned tubes, and the second of the last mentioned tubes being connected to that end of the pump to which is connected the second of the first mentioned tubes, valves controlling said tubes whereby actuation of the pump causes supply of fuel to one end of said first mentioned chamber close to said nozzle and withdrawal of fuel from said chamber at a point remote from said nozzle.

6. A fuel supply device for internal combustion engines comprising a carburetor having a comparatively large chamber between the float bowl thereof and the discharge nozzle and communicating therewith, a tube leading into said chamber near said nozzle and a second tube leading from said chamber at a point remote from said nozzle, a fuel pump, said tubes being connected to said pump at opposite ends thereof, a piston in said pump dividing the latter into two chambers, into one of which each of said tubes is connected, tubes leading from said pump to a source of supply of high grade fuel and a point of discharge of low grade fuel respectively, the

first of said latter tubes connected to said pump at the end to which is connected the first of the first mentioned tubes, and the second of the last mentioned tubes being connected to that end of the pump to which is connected the second of the first mentioned tubes, valves controlling said tubes whereby actuation of the pump causes supply of fuel to one end of said chamber close to said nozzle and withdrawal of the fuel from said chamber at a point remote from said nozzle, and means for closing communication between said chamber and float bowl during the operation of the pump producing the substitution.

7. In a carburetor for an internal combustion engine a fuel nozzle, a reservoir having a relatively large capacity communicating therewith, said reservoir being normally completely filled with fuel, and means connected with said reservoir for withdrawing the major portion of the fuel normally contained therein and substituting therefor another and more volatile fuel.

8. In a carburetor for an internal combustion engine a fuel nozzle, a reservoir having a relatively large capacity communicating therewith, said reservoir being normally filled with fuel, a double acting pump connected with said reservoir and with a source of supply of another fuel and adapted to withdraw from said reservoir the fuel normally contained therein and to substitute therefor a similar quantity of said other fuel.

9. In an internal combustion engine having a carburetor, a pair of fuel tanks adapted to contain respectively ordinary fuel and more volatile fuel, means for supplying ordinary fuel from its tank to said carburetor, and means for withdrawing the ordinary fuel from the carburetor and simultaneously substituting therefor a substantially like quantity of said more volatile fuel and for discharging the withdrawn ordinary fuel back into the fuel supply ahead of the carburetor.

10. In an internal combustion engine, a carburetor containing a supply of low volatility fuel, a reservoir containing a supply of high volatility fuel, means to empty said carburetor of the low volatility fuel and simultaneously to fill it with the high volatility fuel, said means being operated by and upon movement of a reciprocating piston of a double acting pump.

Signed at the city of Ann Arbor, county of Washtenaw, State of Michigan, this 11th day of August, 1928.

HARRY W. McCLURE.