Oct. 7, 1930. F. C. MOCK ET AL 1,777,472

CARBURETION APPARATUS

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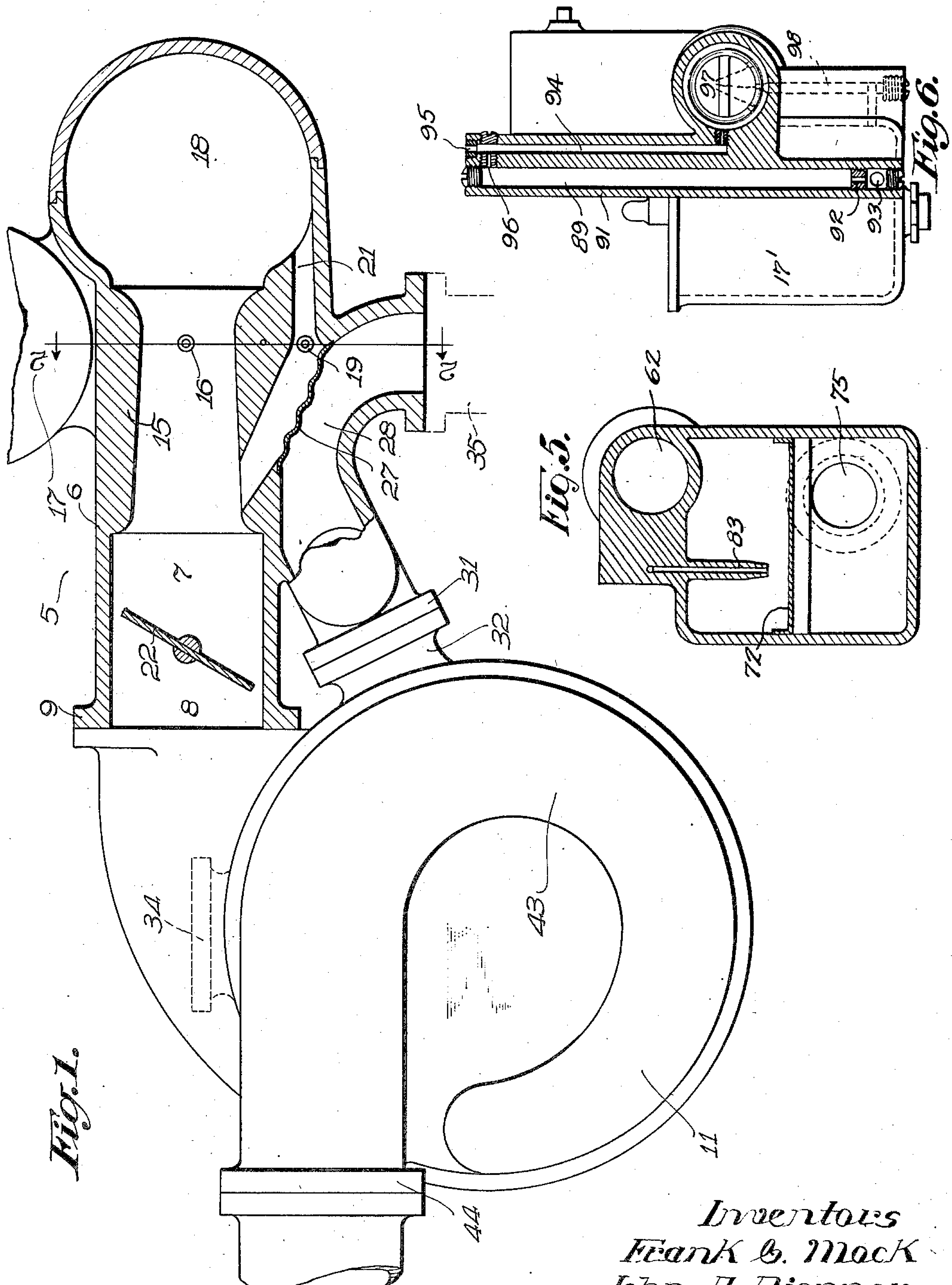

Fig. 6.

Fig. 5.

Fig. 1.

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CARBURETION APPARATUS

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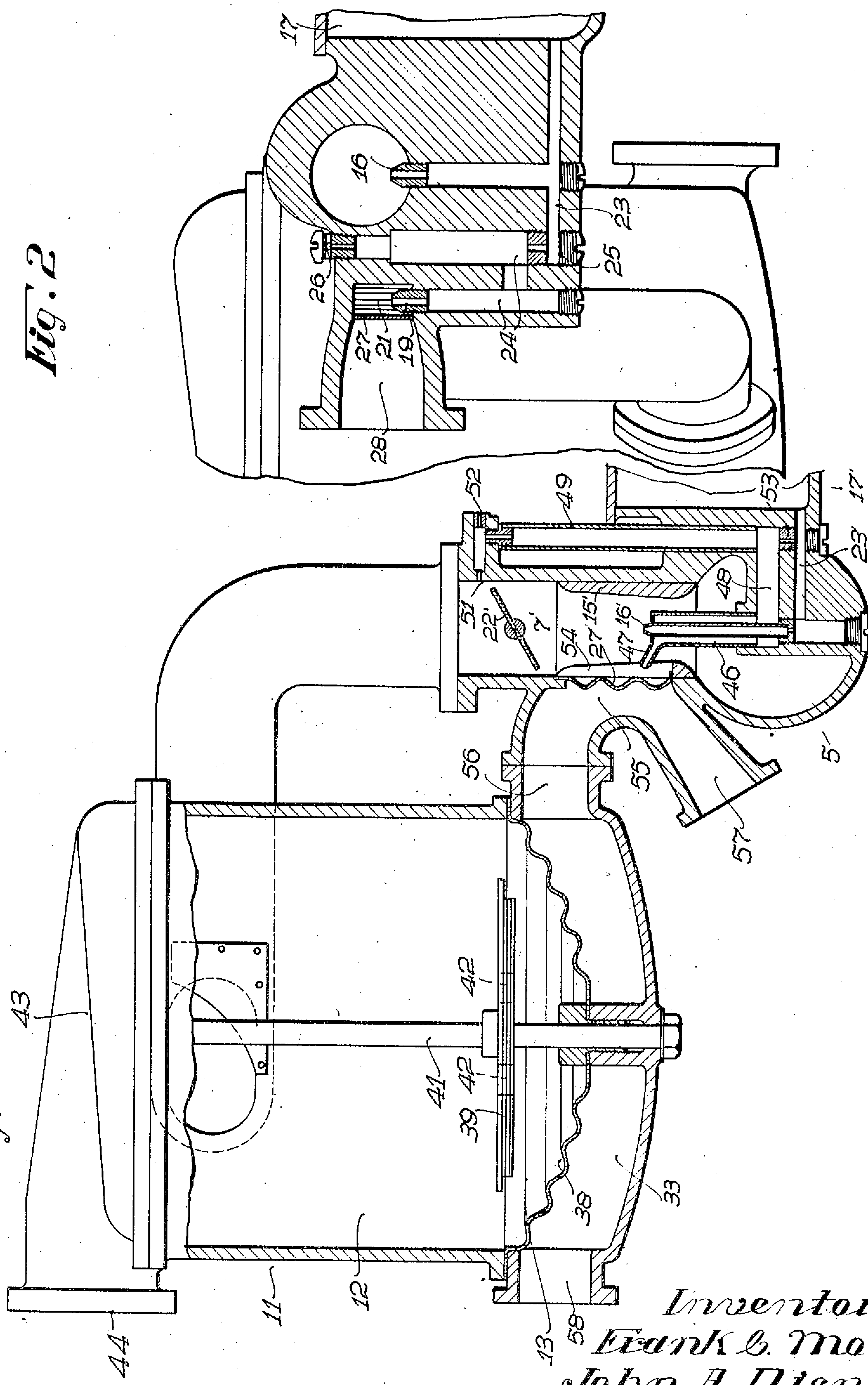

Fig. 2

Fig. 3

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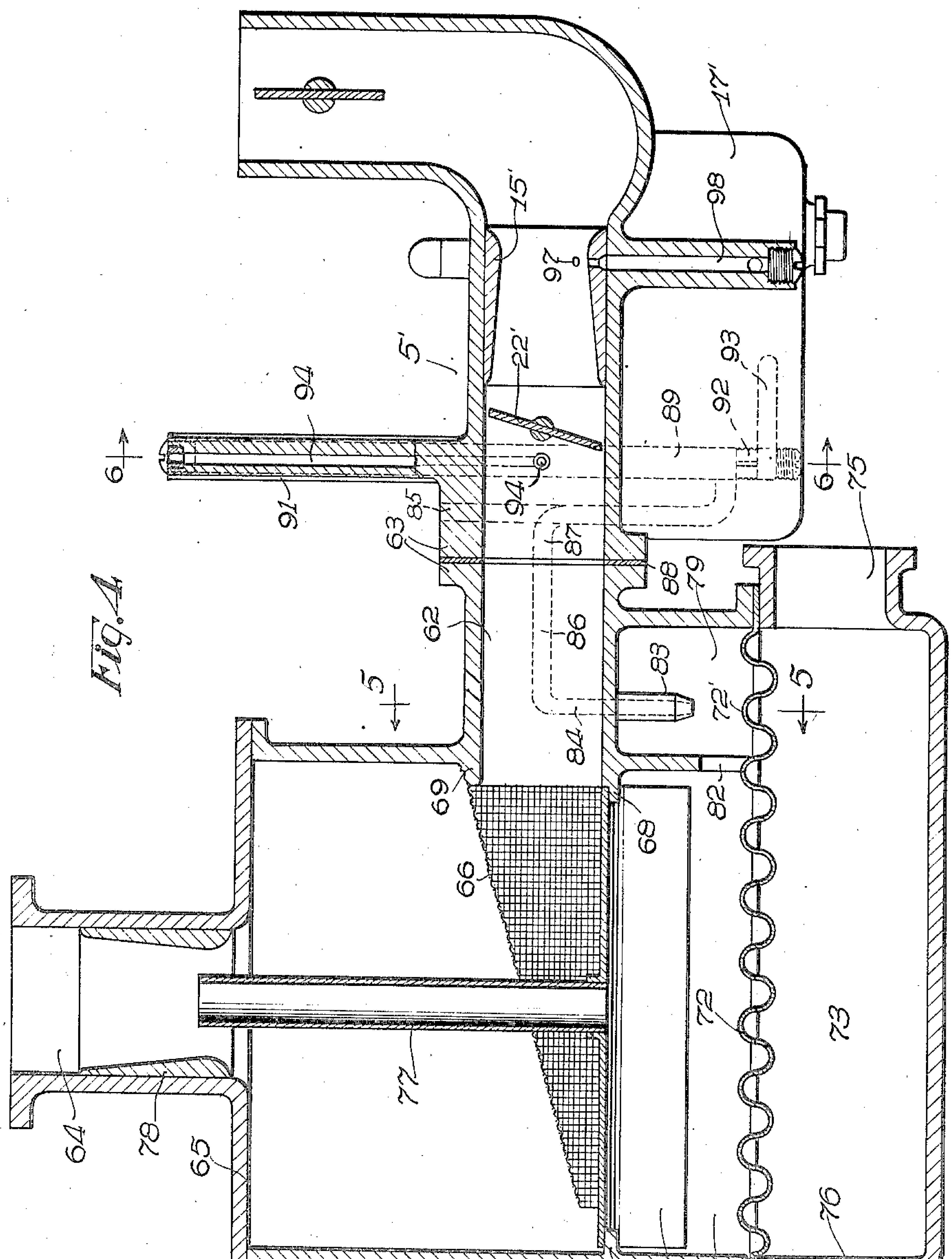

Fig. 4

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Patented Oct. 7, 1930 **1,777,472**

UNITED STATES PATENT OFFICE

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CARBURETION APPARATUS

Application filed July 5, 1921. Serial No. 482,318.

The present invention relates to carburetion apparatus, and has particular reference to a method of and means for vaporizing the liquid fuel, or rendering the same easier to vaporize by the application of heat thereto. This is for the purpose of increasing the combustibility and power of the mixture and its responsiveness to acceleration.

It has heretofore been proposed to vaporize the liquid fuel particles in the mixture by directing the entire volume of mixture against a hot spot in the intake manifold, or by separating the unvaporized particles of fuel out of the mixture stream and retaining them in continued subjection to heat until vaporized. The first of these methods has the undesirable effect of heating the air undesirably and thereby reducing the volumetric efficiency of the engine and causing excessive heating of the engine and impairment of its lubricating function. The second method is deficient in that it is necessary to provide for delaying the passage of the unvaporized particles of fuel to the cylinder in order to supply sufficient heat for their vaporization, and thus the flow of fuel to the engine is not sufficiently responsive for quick acceleration. There are numerous factors which cause this delay in the passage of the unvaporized fuel to the engine. The heavy ends of the fuel frequently have boiling temperatures approximately 450° F. or more. The proportion of unvaporized fuel in the average mixture requires a fairly large vaporizing area, while the exhaust temperatures which may be employed to heat this vaporizing area are limited. Moreover, the time interval of one cycle of the mixture is very short, the average interval embracing the vaporization, compression and expansion of one charge at intermediate engine speeds being approximately 1/25th second. In view of these conditions it has been found to be desirable, if not necessary, to delay the passage of these unvaporized particles of fuel by separating them out of the mixture stream and retaining them in subjection to the vaporizing means until completely vaporized.

But, as before stated, during acceleration this method of vaporizing the fuel particles is not adequate for the vaporization of the fuel particles of the accelerating charge because of the delay in the vaporization and the lack of quick responsiveness. To overcome this difficulty the present invention has as its primary object to provide means which will heat or vaporize the accelerating charge of fuel separately from the main air stream or from the unvaporized particles of the main charge of fuel. The advantages of this practice are numerous: First, it avoids undue heating of the air component of the mixture with the consequent disadvantages pointed out above; second, it accommodates any preferred manner of treating the main body of fuel in the mixture independently of the accelerating charge and permits of any desired time delay in the vaporization of the "heavy ends" of the main charge of fuel; third, it insures instantaneous response of fuel for acceleration.

This accelerating charge is preferably vaporized by contact with a "hot spot" or vaporizing surface which is individual to that particular function. This vaporizing surface is designed to maintain an intense heat and owing to the fact that a full accelerating charge only contacts with the vaporizing surface intermittently a large reserve accumulation of heat can be stored in this surface for instantaneous vaporization of the accelerating charge.

Referring to the accompanying drawings wherein we have illustrated a preferred embodiment of our invention:

Figure 1 is a plan view of our improved carburetion apparatus, showing the main fuel separating chamber in elevation and the carbureter in horizontal section;

Figure 2 is a transverse sectional view taken approximately on the line 2—2 of Figure 1;

Figure 3 is a vertical sectional view of another form of our invention;

Figure 4 is a complete sectional view of another form of our invention;

Figure 5 is a detail section taken on the line 5—5 of Figure 4; and

Figure 6 is a similar view taken on the line 6—6 of Figure 4.

The carbureter, which is designated 5 in its entirety, comprises a casing 6 forming a carbureting chamber 7 and a mixture outlet 8.

The mixture outlet 8 connects through the usual flange 9 with the intake passageway of a centrifugal fuel separating and vaporizing device of any preferred construction. As illustrative of an efficient form of device of this character, we have shown a centrifugal fuel separating and vaporizing chamber similar to that disclosed in the co-pending application of Frank C. Mock, Serial No. 478,929, filed June 20, 1921 now Patent No. 1,567,806, of Dec. 29, 1925. This separating device is designated 11 and comprises a centrifugal chamber 12 in which the heavy, unvaporized particles of fuel are separated out of the mixture stream and are precipitated into a vaporizing chamber 13 in the lower part of the device where they are retained in continued subjection to heat until vaporized. We shall hereinafter describe this action in detail in referring to the vaporization of the unvaporized fuel particles in the main body of mixture.

Carbureter 5 is preferably provided with the usual Venturi tube 15 into which opens a main fuel nozzle 16 which is supplied in the usual manner from a constant level chamber 17. The air supply enters through an upturned air intake 18 which may be provided with any suitable choke valve if desired. For producing the desired enrichment of the mixture for acceleration, there is provided an accelerating nozzle 19 which discharges into a restricted air passageway 21. The air intake to this restricted passageway 21 is at any suitable location, preferably opening into the air intake horn 18, and the outlet of this passageway discharges into the carbureting chamber 7 through the wall of the Venturi tube 15 or at any point in back of the throttle 22. The passageway 21 is properly proportioned relative to the Venturi tube 15 to insure that the greater portion of the air will flow through the Venturi tube with only sufficient quantity flowing through the passageway 21 to insure effective atomization of the fuel discharged from the accelerating nozzle 19.

As shown in Figure 2, the main fuel jet 16 and the accelerating nozzle 19 are both fed from the float chamber 17 through a fuel passageway 23. It will be obvious that any desired arrangement of accelerating apparatus may be employed for discharging the added increment of fuel from the accelerating nozzle 19 during accelerations in suction. As illustrative of a simple embodiment of accelerating mechanism, I have shown the accelerating nozzle 19 communicating with one leg of a U tube or passageway 24 which is supplied with fuel at its lower end through a restricted port 25 from the fuel passageway 23. The upper end of the other leg of the U tube has communication with atmosphere through a port 26.

The fuel discharged from the accelerating nozzle 19 impinges directly against a heated surface 27, which is so positioned in the bend of the passageway 21 as to be in the line of travel of the fuel particles discharging from the accelerating nozzle. This heated surface is preferably heated by the exhaust gases from the engine by forming an exhaust passageway 28 immediately in back of the heating surface 27. The heating surface 27 may consist of a thin wall interposed between the passageways 21 and 28, or a corrugated sheet metal membrane for obtaining a rapid transmission of heat to the fuel particles impinging thereon. One end of the exhaust passageway 28 has a suitable connection 31 with an exhaust port 32 opening into the exhaust chamber 33 (Figure 3) of the fuel separator and vaporizer 11. A port 34 communicating with the chamber 33 is adapted for connection with the exhaust manifold of the engine, and the discharge end of the exhaust passageway 28 is adapted for connection with an exhaust pipe 35 leading back to the muffler. This arrangement produces a circulation of the exhaust gases into the exhaust chamber 33 and thence up through the exhaust passageway 28, but this may obviously be reversed if desired by connecting the engine manifold to discharge first into the exhaust passageway 28 for concentrating the highest temperature upon the vaporizing surface 27. It is desirable that the vaporizing surface 27 be maintained at an intense heat, higher than that of the vaporizing surface in the unit 11. It will be noted that this will naturally follow from the action of concentrating the entire volume of exhaust gases upon the relatively small area of the vaporizing surface 27, the constriction and bend in the exhaust passageway 28 at this point also assisting in this function by producing a high velocity impingement of the exhaust gases upon the rear of the vaporizing wall. The location of this vaporizing surface in the shunt passageway 21 minimizes the heating effect by conduction or radiation upon the main supply of air. Owing to the relatively small volume of air flowing through the passageway 21 this air, even though highly heated, does not objectionably heat the main body of air flowing through the Venturi tube 15.

Only a brief description of the fuel separating and vaporizing device 11 is necessary as the present form of this device is merely illustrative and is fully disclosed in the above mentioned co-pending application of Frank C. Mock. The devices shown in Figures 1 and 3 are substantially the same, and it will be noted from Figure 3 that the mixture from the carbureter 5 enters the fuel separating and vaporizing unit through a tangential inlet passageway 37 which opens into a centrifugal fuel separating chamber 12. The heavier unvaporized fuel particles which are separated out of the mixture on the walls of the separating chamber 12 descend along the walls down into the vaporizing chamber 13 where they come into contact with a highly heated vaporizing surface 38 consisting of a corrugated sheet metal shell interposed between the exhaust chamber 33 and the vaporizing chamber 13. A heat insulating baffle 39 is mounted on a tie bolt 41 extending through the center of the device and is adapted to prevent the radiation of heat from the vaporizing surface 38 up into the fuel separating chamber 12. The periphery of this baffle 39 is spaced from the walls of the separating chamber, and adjacent its center is a plurality of circulating holes 42 for inducing a limited circulation of mixture from the separating chamber 12 down into the vaporizing chamber 13 and up through the holes 42 to the main volume of mixture for the purpose of picking up the gaseous products of the liquid fuel in the vaporizing chamber and returning the same to the main volume of mixture flowing to the engine. The mixture is drawn out of the separating chamber through a rising helical channel 43 in the upper end of the separating chamber, which channel terminates in a tangential outlet 44 having the usual flange for connecting with the engine or intake manifold.

In the operation of the above described embodiment, the main volume of mixture for constant speed running is created in the Venturi tube 15 and carburetor chamber 7 between the main supply of air flowing therethrough and the main supply of fuel discharged from the fuel nozzle 16. This volume of mixture entering the whirling chamber 12 tangentially produces a high velocity vortex motion which throws the heavier, unvaporized fuel particles out into contact with the walls of the chamber, from whence the accoumulation of fuel drains downwardly into the vaporizing chamber 13. The air with its vaporized fuel is then drawn upwardly to the helical channel 43 and out through the tangential outlet 44 to the engine. The liquid fuel precipitated into the vaporizing chamber 13 remains in contact with the vaporizing surface 38 until completely gasified, when the circulation of mixture down through the vaporizing chamber picks up this gasified fuel and returns the same to the ascending volume of mixture through the openings 42. The action of separating out the unvaporized particles of fuel and retaining them in subjection to a vaporizing temperature removed from the main volume of mixture involves a certain delay in the passage of this fuel to the engine, but it will be noted that during substantially constant speed running this causes no difficulty because the gaseous products of fuel particles previously collected in the vaporizing chamber rise to join the mixture and retain it at the proper fuel proportion.

During periods of acceleration, however, when it is desirable that the increased richness of mixture reach the engine in the shortest possible time, it will be apparent that the delay incident in separating out the unvaporized particles of this increased charge and vaporizing the same in the vaporizing chamber 13, would retard the responsiveness of the engine and be of considerable disadvantage. It is at this point that the vaporizing surface 27 comes into play. With an increase in the throttle opening a charge is drawn from the accelerating well or U tube 24 through the accelerating nozzle 19 under the aspirating effect of the high velocity flow of air through the air passageway 21. This fuel, or at least the unvaporized portion thereof, impinges immediately upon the heating surface 27, which is of such high temperature as to result in a substantially instantaneous vaporization of the fuel. The fuel which is instantly vaporized on this heating surface is held in suspension in the air stream flowing to the motor, little or no separation of this part of the mixture occurring in the fuel separating and vaporizing unit 11, whereby this increased charge of fuel is carried to the motor with substantially the same velocity as the air stream.

Figure 3 also illustrates another arrangement of accelerating well and vaporizing surface for vaporizing the accelerating charge. For illustrative purposes the carbureter in this instance is shown as being of the upright or vertical type having the usual carbureting chamber 7′, Venturi tube 15′ and main fuel nozzle 16′. The main fuel nozzle receives fuel from the float chamber 17′ through a main fuel supply passage 23′, any suitable restriction being interposed in this passageway if desired. Surrounding the primary nozzle 16′ is a sleeve or tube 46 having an inclined accelerating nozzle 47 extending from the upper end thereof. The bore of the tube 46 has communication through a cross channel 48 with a particular construction of vacuum controlled accelerating well 49 which is fully described in and which constitutes part of the subject matter of the patent to Mock, No. 1,395,233 of October 25, 1921. The tubes 46 and 49 and the cross channel 48 constitute a U tube, the outer leg 49 of which extends considerably above the fuel level for communication through a restricted vent 51 with the mixture passageway above the throttle valve 22′. A screw plug 52 having a calibrated orifice admits atmosphere in proper proportion to the suction acting through the tube 51 to insure that the fuel in the outer leg 49 will not rise above a predetermined level during positions of substantially closed throttle. This U tube accelerating well receives fuel from the float chamber through a plug restriction 53.

The accelerating nozzle 47 projects into a longitudinal slot 54 cut in the Venturi tube 15′. The rear wall of this slot is defined by a thin sheet metal vaporizing wall 27′ against which the accelerating charge of fuel from the nozzle 47 is adapted to impinge. The rear of this vaporizing wall is heated from a curved exhaust channel 55 which is connected through the port 56 with the exhaust chamber 33 of the fuel separating and vaporizing device. The other end 57 of the exhaust channel is adapted for connection either with the exhaust manifold for direct concentration of the engine exhaust upon the vaporizing wall 27′ for intensely heating the same, or this end may be connected with the exhaust pipe leading back to the muffler, in which latter case, the exhaust port 58 would be connected to the engine manifold.

The general theory of operation of this embodiment is substantially the same as that previously described, the heavier unvolatilized particles of fuel from the m-in fuel supply being separated out of the mixture stream in the separating unit 11 and being returned to the mixture stream as gaseous products after vaporization in the chamber 13. It will be noted that by reason of its disposal at the base of the slot 54 the vaporizing surface 27′ for the accelerating charge has a minimum heating effect upon the air stream flowing through the Venturi tube, and at the same time this vaporizing surface is in an advantageous position for receiving the accelerating charge of fuel discharged by the accelerating nozzle, and for securing the immediate admixture of the gaseous products of this accelerating charge with the air stream. The action of the accelerating well 46—48—49 is responsive to the vacuum existing above the throttle 22′. During positions of closed or substantially closed throttle, the relatively high vacuum above the throttle will raise the fuel in the outer leg 49 of the accelerating well to a relatively high level much in excess of the normal fuel level maintained in the inner leg 46. When the throttle is suddenly opened for acceleration this relatively high vacuum is sharply diminished with the result that the fuel in the tube 49 drops considerably and causes a sudden discharge of fuel from the accelerating nozzle 47 against the vaporizing surface 27′, the plug restriction 53 preventing return flow of fuel into the float chamber. The extent to which the fuel drops in the outer leg 49 is controlled by the extent of opening of the throttle valve 22′, so that the degree of enrichment of the mixture is accurately proportioned by the degree of opening of the throttle.

The form of device illustrated in Figure 4 differs from the previous embodiment principally in the mode of separating the unvaporized particles of fuel from the mixture stream, and in the use of a common heating surface for both the fuel particles from the main volume of mixture and for the fuel particles from the accelerating charge. The fuel separating and vaporizing unit comprises a housing 61 of square, round or any other formation, having an intake passageway 62 entering the same centrally from the side. The intake passageway 62 has communication through the usual flanged connection 63 with the mixture outlet of the horizontal carburetor 5′. The outlet passageway 64 is arranged centrally in the cover plate 65, this outlet passageway having the usual flanged connection with the intake manifold of the engine. The fuel separating function is performed by passing the mixture through a wire gauze screen 66 which is interposed in the housing 61 between the intake passageway 62 and the outlet 64. In its preferred form, this wire gauze screen is shaped semicircular and is supported co-extensive with the intake passageway 62, the back of the screen 66 being tapered or inclined whereby the unvaporized particles of fuel impinge against the screen directly upon entering the separating chamber from the intake passageway 62. The separating zone defined below the screen 66 is closed at the bottom by an arched plate 67 which is supported on ribs or lugs 68 projecting inwardly from the housing 61. The raised back of the screen 66 is supported on a lug 69 and the side edges of the screen rest upon or are secured to the arched plate 67 adjacent its side edges. The edges of the plate 67 extend into close proximity to the walls of the housing 61 in order to minimize the transfer of heat by radiation or convection from the vaporizing chamber below the plate 67 to the upper part of the housing through which the mixture rises in passing out through the outlet passage 64. The bottom of the vaporizing chamber 71 is formed by a thin sheet metal corrugated plate 72. An exhaust chamber 73 is formed below the corrugated vaporizing surface 72 by a lower casing section 74 which is suitably secured to the lower end of the housing portion 61. This lower casing section has the usual flanged or screw threaded connections 75 and 76 for attachment to the exhaust manifold and to the pipe leading back to the muffler.

The wire screen 66 is of the proper mesh to intercept the larger unvaporized particles of fuel, and to guide these fuel particles down along the sides of the screen onto the arched plate 67, the surface tension of the globules of fuel preventing the volume of air rushing through the screen from carrying these globules through and off from the back of the screen up with the ascending mixture stream. The fuel draining down upon the arched plate 67 runs down to the lower side edges and drops onto the vaporizing plate 72 where it is vaporized. For returning the vaporized products to the ascending body of air there is provided an induction tube or stack 77 extending upwardly from the peak of the arched plate 67 into the outlet passageway 64. In order to stimulate the induced suction up through the induction tube 77 a Venturi tube 78 is mounted in the mixture outlet 64 and the upper end of the induction tube 77 is terminated slightly above the point of maximum constriction for producing a relatively high suction in the induction tube. This acts to draw the gasified fuel from the upper part of the vaporizing chamber 71 up through the induction tube 77 and to inject the fuel into the ascending stream of mixture discharging through the passage way 64.

The foregoing description is concerned solely with the vaporization of the fuel particles from the main volume of mixture. Vaporization of the fuel particles in the accelerating charge is preferably performed on a separate portion of the vaporizing surface 72, which portion is normally not influenced by the fuel particles intercepted from the main volume of mixture. We have shown this as being accomplished by forming an extension chamber 79 projecting from the main housing 61, the bottom of this chamber extension consisting of a portion 72′ of the plate 72. The adjacent wall of the housing 61 is cut away as indicated at 82 to form an intermediate passageway between the extension chamber 79 and the vaporizing chamber 71. An accelerating nozzle 83 extends downwardly into the extension chamber 79 and discharges upon the vaporizing surface 72′. The upper part of the bore 84 of this accelerating nozzle is formed in an enlargement on the side of the intake passageway 62, this same enlargement being extended along the length of the intake passageway to accommodate a horizontal bore 86 which extends from the flanged end of the intake passageway and intersects the vertical bore 84. The flanged connection 63 is sealed by a suitable gasket 88, and registering with the bore 86 through a hole in this gasket is the short leg 87 of a U tube vacuum controlled accelerating well similar to the one previously described. An atmospheric vent 85 opens into the upper end of this leg 87 for preventing the drawing of fuel to the accelerating nozzle except upon a rise of fuel in the leg 87. The long leg 89 of this accelerating well is formed in a vertical extension 91 which is cast integral with the carbureter barrel and float chamber. The lower end of the short leg 87 is extended horizontally to intersect the lower end of the long leg 89, fuel being fed to this accelerating well through a plug restriction 92 communicating with a passageway 93 leading to the float chamber. The upper end of the long leg 89 has vacuum communication with the carbureting chamber posterior to the throttle 22′ through an air passageway 94 which extends downwardly alongside of the leg 89 and opens laterally into the carbureting chamber on the back side of the throttle. The upper end of the air passageway 94 communicating with the fuel passageway has an atmospheric vent 95 and a restricted vent 96 to control the effectiveness of the suction on the leg of fuel in the passageway 89. As before described of the previous embodiment, the vacuum created during restricted or closed throttle operates to elevate the leg of fuel in the passageway 89 to a point considerably above the fuel level, and upon opening of the throttle for acceleration this vacuum is diminished with the result that the elevated fuel drops and discharges fuel through the passageways 87 and 86 into the bore 84 where the fuel mixes with a restricted volume of air and is thence injected upon the vaporizing surface 72′. It will be noted that fuel is only projected upon the vaporizing surface 72′ during periods of acceleration, and hence, during the intervening periods of substantially constant speed running, this inactive vaporizing surface has opportunity to become highly heated, much in excess of that of the larger vaporizing surface 72. The result is that when the accelerating charge is projected upon this hotter vaporizing surface 72′, it is vaporized almost instantaneously, so that the increased charge of fuel will flow almost immediately through the opening 82 and up through the induction tube 77 for admixture with the ascending steam of air in gaseous form.

The main fuel supply is arranged to occur from one or more main fuel nozzles 97 opening into the constricted part of the Venturi tube 15′. These main fuel supply nozzles receive fuel through a passageway 98 communicating with the lower end of the float chamber 17′.

Although all the forms herein illustrated show the vaporized accelerating charge as being introduced into the air stream anterior to the main fuel separating and vaporizing device 11 it will be understood that this charge might be introduced into the air stream posterior to the unit 11. The present concept of previously vaporizing the accelerating charge and then introducing it into the air stream constitutes a part of the invention which may be used independently of the use of the main fuel separating and vaporizing device.

The term "accelerating charge" employed in the specification and claims refers to the fuel which is purposely added to the incoming air in addition to that which is supplied by a suction controlled jet for the specific purpose of enriching the mixture when the throttle is moved relatively rapidly to admit a greater quantity of mixture to the engine for the purpose of speeding up the engine or for causing it to exert a greater effort. It is well known to those skilled in the art that when the throttle is opened quickly there is a tendency for the mixture to grow lean, that is the ratio of gasoline to air often termed the "gas ratio" decreases. This is due to the fact that air flows more readily than does the liquid fuel, and the sudden inrush of air does not aspirate a proportionate amount of fuel resulting in a disturbance of the gas ratio of the normal running mixture.

To counteract this difficulty the art has provided means for releasing and discharging into the mixture an additional "accelerating charge" over and above what the mere aspiration of the additional air will draw from the suction jet and which accelerating charge has the function of first counteracting the tendency to grow leaner and second to cause the mixture to become for a short period of time abnormally rich. The abnormally rich mixture is desired temporarily for suddenly speeding up the automobile, as it is well known that a mixture to give maximum power should have a higher gas ratio than the mixture which is normally employed for running. The mixture which is normally employed for running should be of a gas ratio which will give high economy. The reference in the specification and in the following claims to the accelerating charge or the means for supplying the same or broadly to the function of supplying the additional fuel for accelerating purposes is intended to exclude mere secondary fuel inlets such as are common in the art for increasing the range of a relatively small primary jet and its air inlet and to include only such devices as introduce accelerating fuel in addition to that which is supplied solely by aspiration from a suction controlled nozzle.

As above intimated, it will be obvious that various changes may be made in the general embodiment hereinbefore described without departing from the essence of the invention.

We claim:

1. In carburetion apparatus, the combination of a mixture passageway, means for producing a main body of mixture therein, means including an accelerating well for injecting an accelerating charge of fuel into said main body of mixture, and means for contacting with and heating said accelerating charge independently of the main body of mixture.

2. In carburetion apparatus, means for producing a combustible mixture for normal running, a vaporizing surface removed from the path of the main volume of mixture for vaporizing the raw liquid fuel in said mixture, means for increasing the charge of fuel in said mixture upon acceleration, and additional means removed from the path of the main volume of mixture for vaporizing the raw liquid fuel in the accelerating charge of fuel.

3. The method of delivering fuel to an internal combustion engine which comprises forming a main unheated mixture of fuel and air, during acceleration delivering additional fuel to said mixture in a strongly heated condition, and at all times subjecting the mixture at a point beyond the point of addition of the accelerating charge to centrifugal stratification and selective heating of the denser portions separated.

4. The method of delivering fuel to an internal combustion engine which comprises forming a main charge, adding an enriching and accelerating charge of fuel upon sudden increase in load, and invariably heating the accelerating charge to greater degree than the main charge.

5. In a carbureter, the combination of a ful supply chamber, a fuel nozzle connected therewith, a mixture discharge passageway, a throttle controlling the same, air supply means for conducting a stream of air past the main fuel nozzle and into the mixture passageway, accelerating fuel supply means leading from the supply chamber to enrich the mixture in the mixture discharge passageway for accelerating the engine, said latter means being controlled by the rate of opening of the throttle, and a heating surface for contacting with the fuel supplied to the mixture by the accelerating supply means independently of the main fuel supply to the mixture.

6. In a carburetor, a main air and fuel mixture passage, a supplemental passage extending in the direction of the main passage and opening at its ends into said main passage, means for ejecting fuel into the supplemental passage upon acceleration, and means in the supplemental passage for vaporizing the fuel ejected thereinto.

7. In a carburetion apparatus, the combination of a normal charge forming device comprising a passageway, one end of which is a mixture outlet, the other end of which is an air inlet, and a suction responsive fuel nozzle for discharging liquid fuel into the passageway, with means for enriching the mixture supplied by said charge forming device comprising a separate supplemental passageway extending in the direction of the main passageway and opening at its ends into said first passageway and having fuel supply means responsive upon opening of the throttle to enrich the mixture for accelerating the engine, and having heating means in said separate passageway and substantially out of thermal contact with the normal mixture for heating the liquid fuel supplied by said separate fuel supply means for accelerating the engine.

8. In a carburetion device for an internal combustion engine, the combination of charge

forming means for producing under the suction of the engine a mixture stream of air and entrained liquid fuel of a quality suitable for operating the engine continuously at a given speed, said mixture when produced, requiring vaporization of the entrained liquid, a separator for separating out the entrained unvaporized liquid fuel, said separator having heating means for vaporizing said separated liquid and throwing it back into the charge in the form of vapor, means for introducing additional fuel into the stream of mixture for enriching the mixture for accelerating purposes, and heating means for vaporizing the unvaporized portion of the additional fuel prior to passage of said additional fuel into the main stream of mixture to permit said enrichment to pass through said separator without delay to secure prompt response of the engine.

9. In carburetion apparatus for an internal combustion engine, the combination of means for forming a running mixture for the engine, a throttle controlling the rate of mixture delivery to the engine, means for adding an enriching and accelerating charge of fuel upon sudden increase in the rate of mixture delivery to the engine, and means for invariably heating the accelerating charge to greater degree than the main charge.

10. In carburetion apparatus, the combination of a mixture passageway, a throttle valve therefor, a main fuel supply chamber, a main fuel inlet from the chamber to said mixture passageway, an accelerating fuel supply chamber fed from the main fuel supply chamber, a supplementary fuel inlet from said auxiliary fuel supply chamber to said passageway operable upon further opening of the throttle to supply fuel from said accelerating fuel supply chamber, and heating means for contacting with and heating the fuel discharged from said supplementary fuel inlet independently of the main fuel supply from said main fuel inlet.

11. The combination of a carburetor having a fuel supply chamber, a suction controlled fuel supply orifice, an accelerating fuel supply chamber having an orifice, and a throttle controlling the rate of delivery from said orifices, of a separate hot spot disposed in position to receive the discharge of accelerating fuel from said second orifice only upon sudden opening movement of said throttle for accelerating the engine.

In witness whereof, we hereunto subscribe our names this 30th day of June, 1921.

FRANK C. MOCK.
JOHN A. DIENNER.