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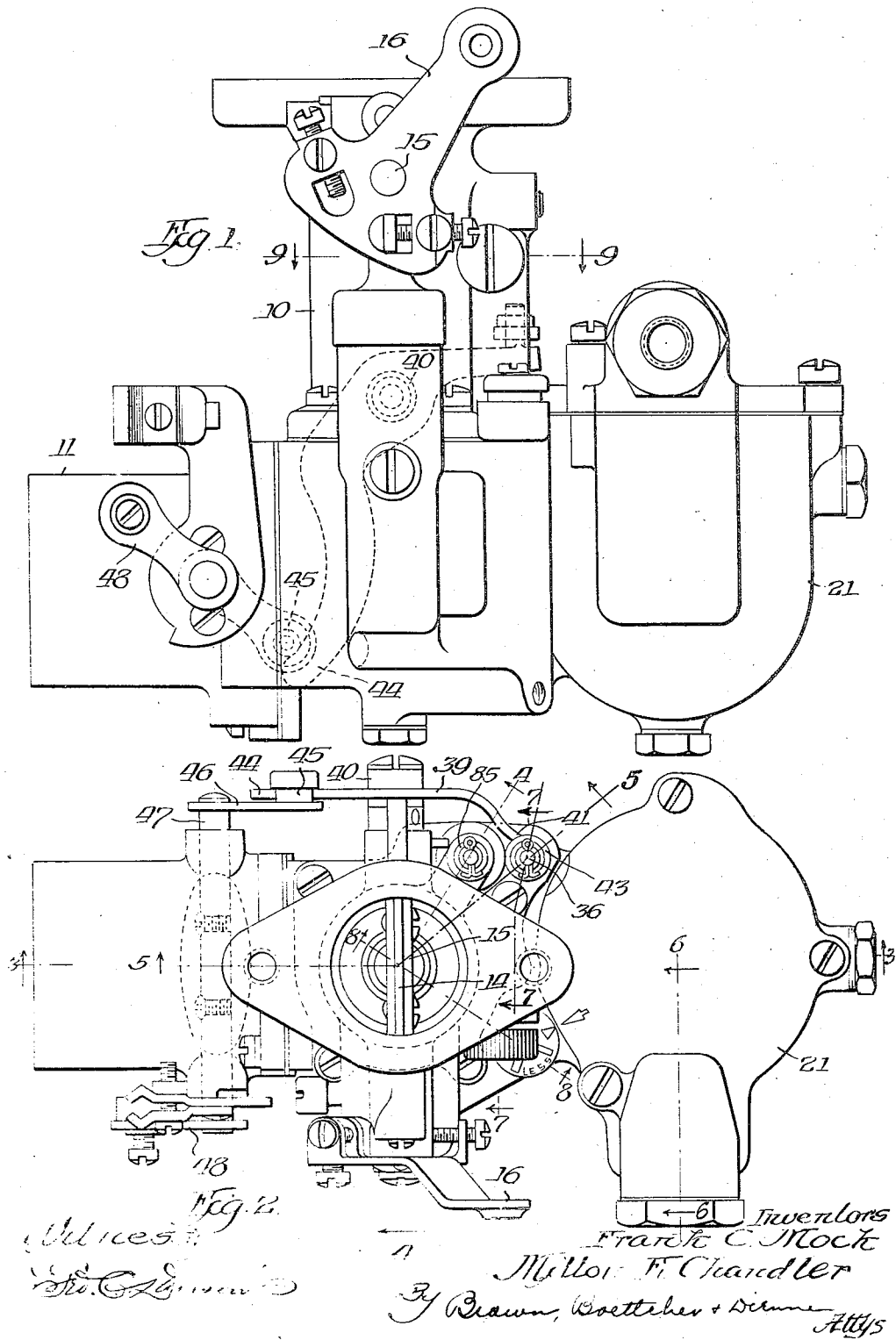
F. C. MOCK ET AL

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CARBURETOR

Filed March 21, 1927

5 Sheets-Sheet 1



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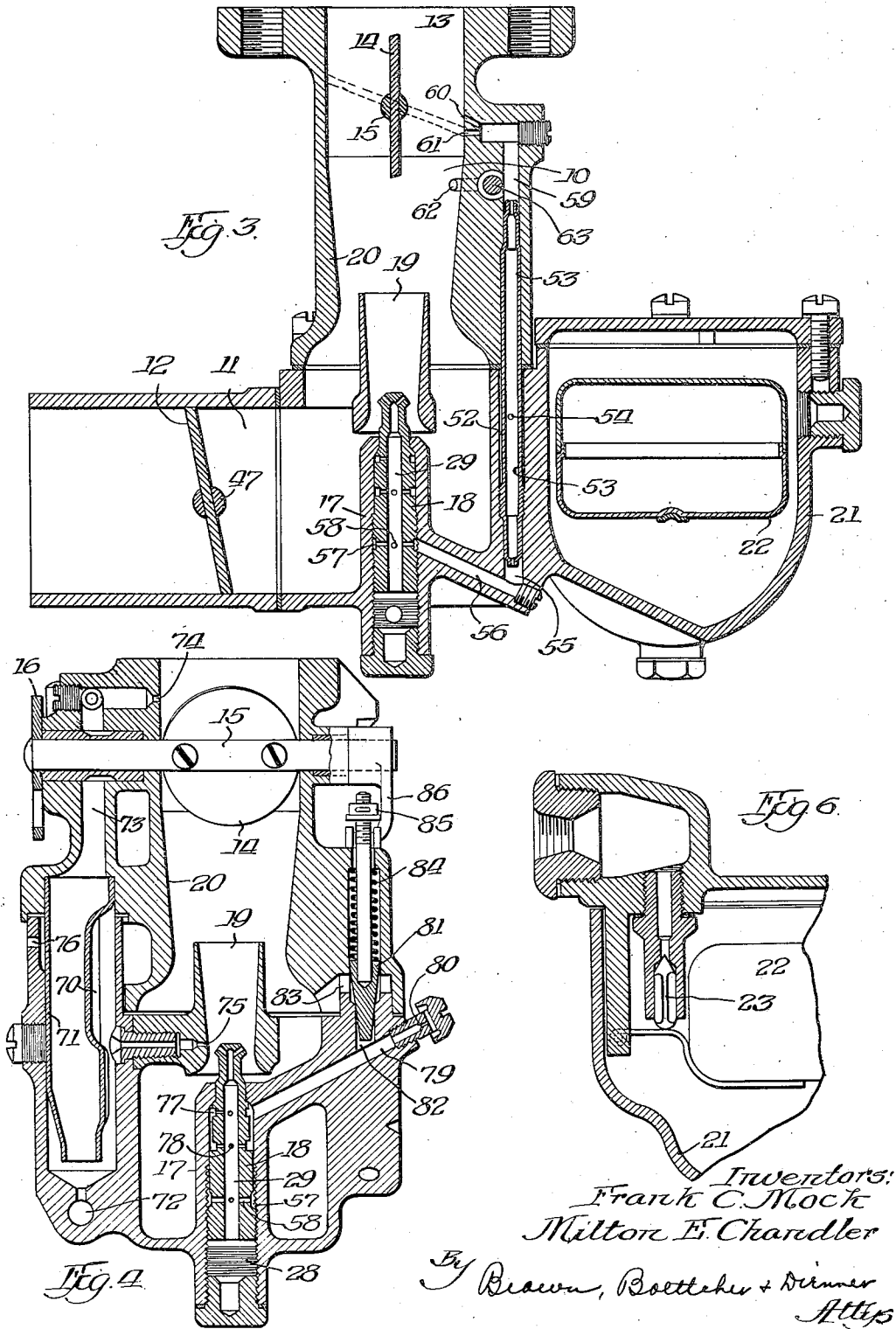
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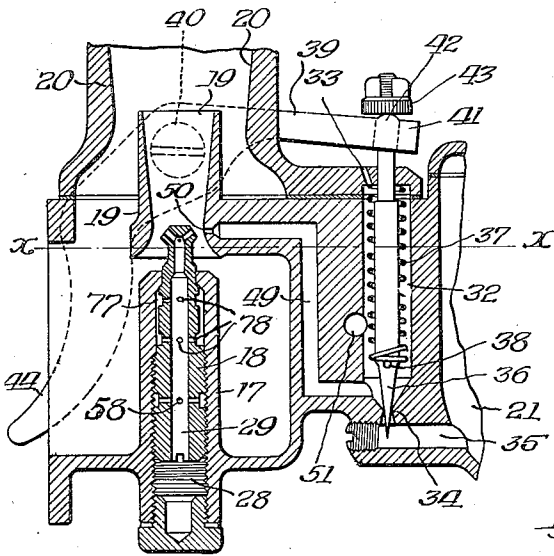


Fig. 5.

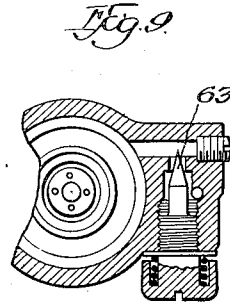


Fig. 9.

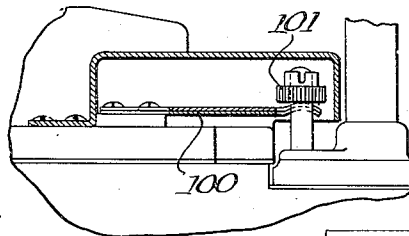


Fig. 7.

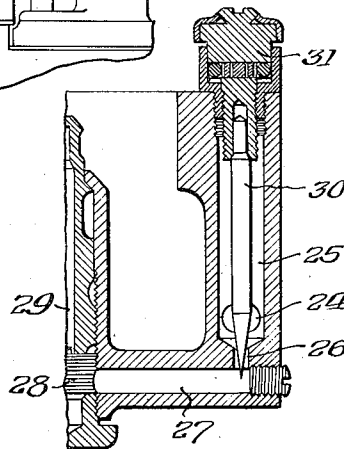
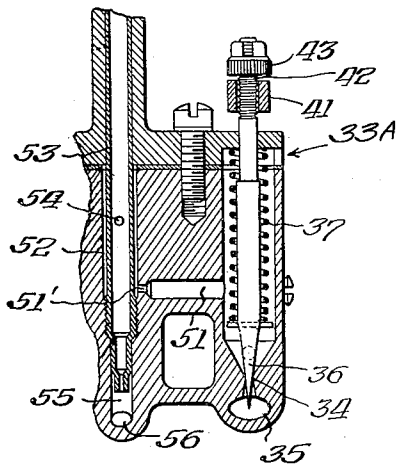


Fig. 8.

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Jan. 29, 1935.

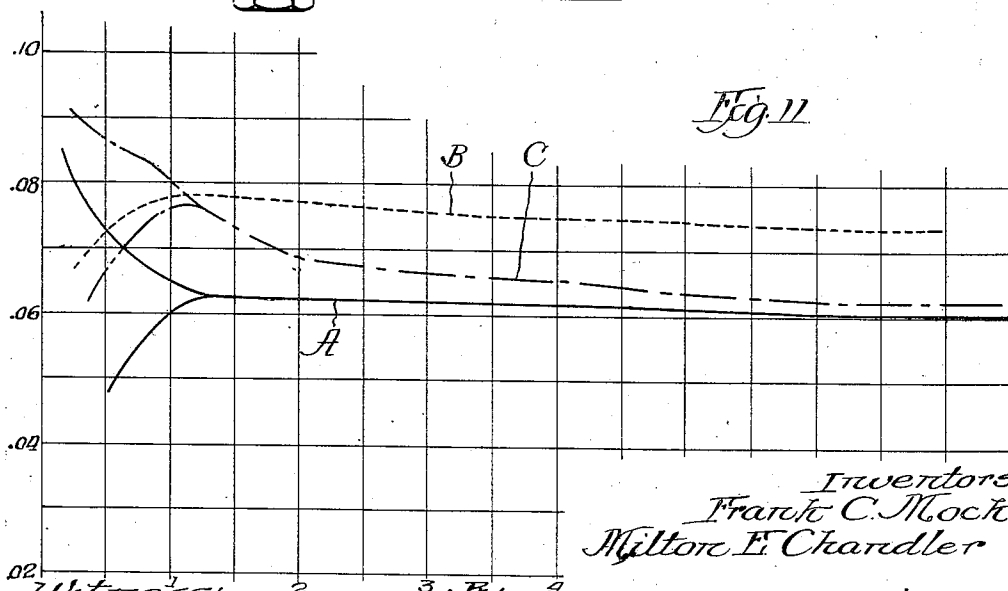
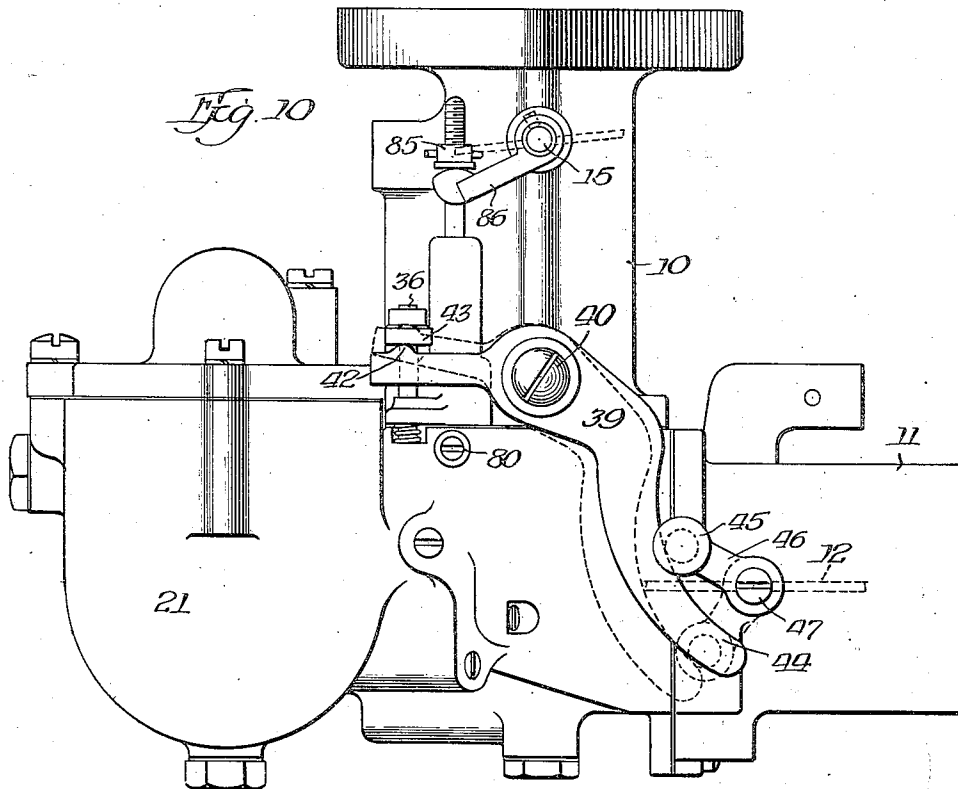
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CARBURETOR

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5 Sheets-Sheet 4



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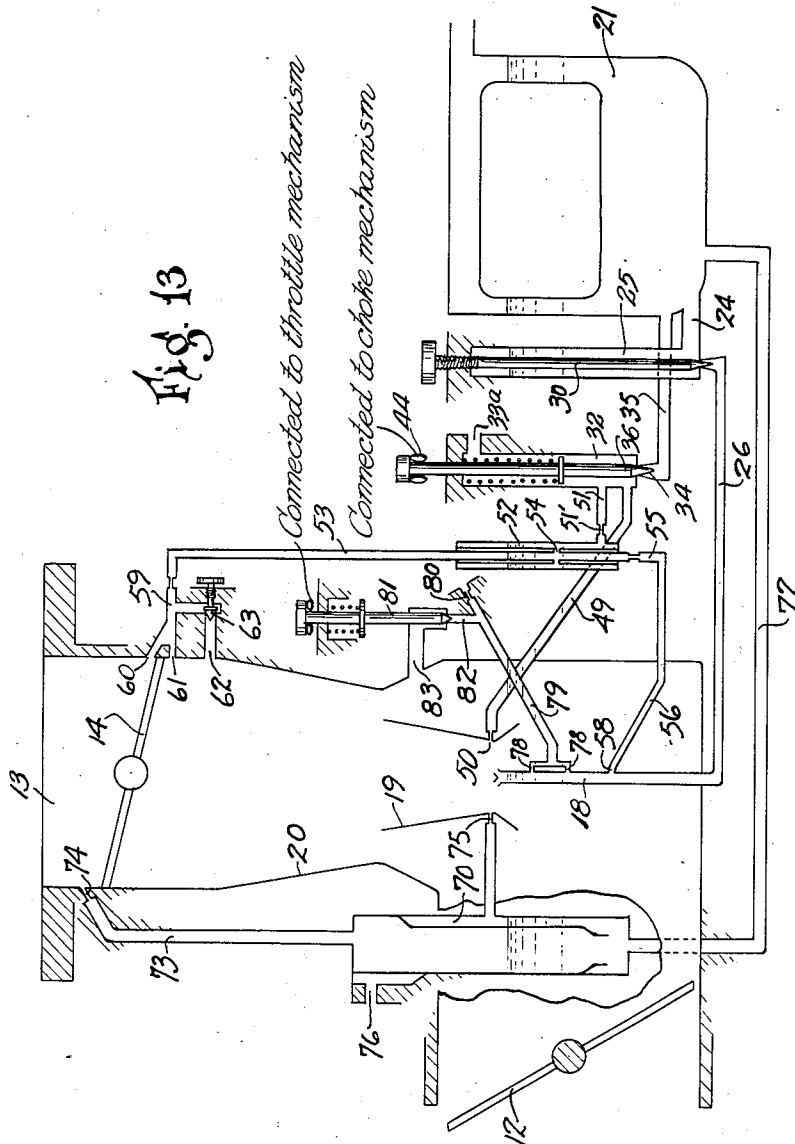
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CARBURETOR

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5 Sheets-Sheet 5



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1,989,210

CARBURETOR

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Application March 21, 1927, Serial No. 176,876

11 Claims. (Cl. 261—41)

Our invention relates to carburetors and, in general, the object is to provide a structure and control operable manually and automatically to produce efficiently and economically the particular degree of enrichment necessary for the various operating conditions of an engine, particularly in cold weather when an engine must be started and brought quickly to a temperature where it can efficiently perform the service required.

Heretofore attempts to correct the mixture for cold engine operation have enriched equally the mixture throughout the operating range, which is evidently wrong. Others have enriched the mixture slightly more at low speeds than at high speeds, which may be proper so far as wide open throttle operation is concerned, but which is not proper for closed throttle operation. Any one who has had driving experience has no doubt noted that with the present type of mixture control any given setting of the control seems to be more effective at high speed than at low speed. For instance, if just after leaving the garage, the control is set for driving twenty-five miles per hour smoothly, but the driver is forced by traffic to drop down to twelve miles per hour, he finds, as he tries to pick up by operating the accelerator that the mixture is apparently very lean, and then, if he should set the control so that the engine will get away or pick up from twelve miles per hour, as the speed of twenty-five miles per hour is approached the engine will fire very irregularly as from a much too rich mixture. It has been previously believed that this action was because the control enriched the mixture more at high speed than at low speed. We have found that this is not true, but that the degree of enrichment required by a cold engine is much greater at low speeds than at higher speeds, and that the desirable and most efficient type of control will be one which gives a degree of enrichment decreasing markedly as the speed increases. We have found this to be true throughout the range of operation of an engine with the exception of the idling operation, which we have found, does not require the same degree of enrichment, this being on account of the high vacuum existing in the intake manifold during idling, which vacuum greatly assists vaporization.

Our invention provides a new warming up control which gives improved starting ability and unusually smooth operation after starting while the engine is cold. It comprises a gravity fed control or supplemental fuel well which is open to atmosphere and to which the fuel supply

from the float chamber is controllable from the driver's seat, the well being connected to supply supplemental fuel at the proper time to the main nozzle delivery or the idling stream for enriching the mixture, or for supplying air to thin out the mixture and prevent overenrichment. Preferably a regulating valve for the well is controlled by the movements of the carburetor choke valve.

We also provide idle and low speed fuel jets above the throttle with separate idle adjustment for smooth low speed performance; an accelerating well which gives an extra supply of fuel just after the throttle is opened; and economizer arrangement which permits the carburetor to operate on a comparatively lean and economical mixture during the closed throttle positions of average driving, but which automatically shifts to the necessary richer setting when the full power of the engine is called for.

The various features of our invention are incorporated in the structure disclosed on the accompanying drawings, in which drawings:

Figure 1 is a side elevation;

Fig. 2 is a plan view;

Fig. 3 is a sectional view on plane 3—3 of Fig. 2;

Fig. 4 is a sectional view on plane 4—4 of Fig. 2;

Fig. 5 is a sectional view on plane 5—5 of Fig. 2;

Fig. 6 is a sectional view on plane 6—6 of Fig. 2;

Fig. 7 is a sectional view on plane 7—7 of Fig. 2;

Fig. 8 is a sectional view on plane 8—8 of Fig. 2;

Fig. 9 is a sectional view on line 9—9 of Fig. 1; Fig. 10 is a view of the side opposite to that shown in Fig. 1;

Fig. 11 shows curves graphically indicating carburetor operation;

Fig. 12 shows a modified form of the invention including a thermostatic control of the supplemental fuel controlling valve; and

Fig. 13 is a diagrammatic view of the device shown in Figures 1 to 10.

The carburetor shown comprises the mixing chamber 10 having the air inlet passageway 11 controllable by a choke valve 12, and having the outlet passageway 13 controllable by the throttle valve 14. The throttle valve is mounted on a shaft 15 having at its outer end the lever 16 which in practice is connected by suitable means (not shown) with controlling means on the vehicle dashboard or steering wheel.

Extending upward axially relative to the carbureting chamber 10 is the main nozzle frame 17 within which is the nozzle plug or tip 18 projecting a distance upwardly therefrom into the throat of the primary Venturi tube 19, which tube terminates in the throat of the secondary Venturi structure 20.

At one side of the carbureting chamber is the float chamber 21 in which the float 22 controls the inlet valve 23 to maintain the fuel in the float chamber at constant level.

The float chamber as shown in Figure 8, is connected by the duct 24 with the valve chamber 25 from which the port 26 opens to the duct 27 leading into the space 28 in the nozzle frame 17, with which space the center passageway 29 of the nozzle plug 18 communicates. The outlet 26 is controlled by the high speed needle valve 30 which is adapted to be adjusted by means of its head 31 which is threaded into the upper end of the valve chamber.

A control well 32 as shown in Figures 5 and 7 is provided which at its top is open to the atmosphere through vents 33 and 33A. At its lower end the well is connected by the port 34 with the duct 35 which is fed from the float reservoir. A needle valve 36 controls the flow through the port 34, a spring 37 encircling the valve stem between the valve housing and the pin 38 tending to close the valve. In accordance with our invention we control this valve by the movement of the choke valve 12 in the air inlet of the carburetor. As shown, an L-shaped lever 39 is pivoted at its elbow to the carburetor frame on the stud 40. The end of the horizontal leg of the lever has the hook end 41 receiving the outer end of the stem of the valve 36, the abutment ridges 42 on the hook end being adapted to engage with the under side of the abutment nut 43 adjustable on the valve stem.

The vertical leg of the lever 39 has the cam surface presented to the cam roller 45 at the end of the arm 46 secured to the shaft 47 on which the choke valve 12 is secured. At its other end the shaft 47 has the lever 48 secured thereto which in practice is connected to be controlled from the driver's seat to set the choke valve in any desired position.

For the purposes of our invention the cross-sectional area of the air inlet in which the choke valve is placed is sufficiently greater than that at the throats of the Venturi passageways within the carburetor, that the first half of the movement of the choke valve toward closed position will produce very little, if any, effect upon the air content of the mixture delivered by the carburetor. In the normal position of the choke valve, that is, when it is wide open, the lever 39 will be released from the atmosphere well valve 36 so that this valve may be kept closed by its spring. During movement of the choke valve to its closed position, the cam roller 45 will engage with the lever to swing it and to open the atmospheric well valve, but, as just stated, during the first half of the movement of the choke valve to closed position the air supplied to the carburetor through the air inlet 11 will not be materially influenced and there will be only increased flow of fuel by way of the atmosphere well valve, as will be presently described. However, during the latter half of the movement of the choke valve to closed position, the air flow to the carburetor will be restricted and the suction on the fuel outlet will be correspondingly increased.

When the valve 36 is opened, fuel will flow by gravity from the float chamber into the control well 32. Referring to Fig. 5, a passageway 49 leads from the bottom of the well 32 to the fuel port 50 leading to the passage of the Venturi tube 19 preferably at the throat thereof. This port 50 and the outlet end of the nozzle tip 18 are normally above the fuel level indicated by the dotted line $x-x$. When the control well valve 36 is closed the suction at the port 50 will cause the well and the passageway 49 to be drained of fuel and then only air will enter the small venturi through the port 50 to mix with the fuel drawn from the main nozzle. However, when the well valve is opened, fuel will be drawn into the small venturi through the port 50 to assist the main nozzle in supplying the necessary fuel content to the carburetor mixture.

We also supply a passageway 51 from the control well 32 to the idling well 52 from a point below the normal fuel level in the wells, the inlet 51' from the passageway 51 to the idling well being restricted and the fuel entering the idling tube 53 through ports 54 located a distance above the normal fuel level. The lower end of the idling tube plugs into the upper end of the cylindrical space 55 which at its lower end communicates through the passageway 56 with the annular space 57 around the main nozzle plug 18 as shown in Figure 3, which space connects through ports 58 with the nozzle passageway 29, the inlet to the lower end of the idling tube 53 being restricted as indicated. The tube has threaded engagement in the surrounding frame work above the space 55, communication between the space 55 and the idling well 52 being only by way of the ports 54.

At its upper end the idling tube 53 as shown in Figure 3 has restricted connection with the passageway 59 which communicates with the carburetor outlet 13 by means of the upper and lower ports 60 and 61, the port 61 being adjacent to the edge of the throttle valve when the valve is in closed position. Air for the idling mixture is primarily delivered through the passageway 62 to the passageway 59 under control of the valve 63 (Fig. 9).

By means of the well 32 and the passageway 51 to the idle stream the fuel supply and the air supply for idling operation may be modified to suit the conditions of operation of the engine. The location of the passageway 51 is such that it will be slightly above the level at which the fuel will stand in the compensating well when the engine is idling normally with the valve 36 closed. With this arrangement when the valve is closed and the level of the fuel in the well has fallen down below the passageway 51 additional air will be bled into the idle stream by way of the well and the passageway so that over enrichment during idling operation will be prevented. However, if enrichment is desired then the valve 36 is opened so that the level of the fuel can rise above the passageway 51 and then the air bleed will be shut off and fuel will flow instead of air into the idling stream for the desired enrichment.

As before stated, we have found that in operating a cold engine the enrichment should increase as the speed decreases, and this is true except during very light loads, such as during normal idling, probably because of the high vacuum existing in the intake manifold at that time, which vacuum greatly assists vaporization. As above explained, over-enrichment at such times

is prevented by the additional air flow bled into the idle stream through the compensating well and the passageway 51.

An accelerating well 70 may be provided as shown in Figure 4 to assure proper and rapid enrichment when the throttle valve is suddenly moved away from idling or slow running position for increasing the engine speed and power for driving. In this well extends the tube 71 which at its lower end is open to the well to receive fuel flow from the float chamber through the passageway 72. The tube communicates at its upper end with the passageway 73 which connects through a restricted port 74 with the carburetor outlet passageway at a point above the throttle valve so that during closed or nearly closed position of the throttle valve, at which time the vacuum above the throttle is very high, the suction will be effective in the well to draw fuel thereinto to a considerable height. Then, when the throttle valve is suddenly opened and the suction effect at the top of the well is reduced and the suction effect at the primary Venturi tube is increased, such Venturi suction will cooperate with gravity to cause rapid fuel flow into the venturi at the throat thereof through the nozzle inlet 75. The necessary amount of fuel and enrichment will thus be available for quickly adapting the engine for operating the vehicle. The accelerating well is provided with the air vent 76 for venting the well for the rapid outflow of fuel into the Venturi passageway.

As before stated, the enrichment should decrease as the speed increases. As the throttle valve is opened wider for increased speed and more and more fuel is being drawn from the main nozzle, the choke valve is opened wide for the full air capacity, and the control or gravity well 32 is closed to fuel flow. The upper end of the nozzle plug 18 is surrounded by the well 77 communicating with the nozzle bore through the ports 78, and through a passageway 79, this well is connected with the atmosphere through a metering plug 80. During the slower speed the well 77 will be kept filled with fuel, but as the speed and consequently the suction on the main nozzle increases, this well will gradually be drained and then air will flow into the fuel stream through plug 80 and ports 78.

We also provide an economizer valve 81 controlling the flow of air through the valve passageway 82 to the passageway 79. The valve passageway at its upper end is in communication with the air inlet passageway of the carburetor through the space 83. A spring 84 tends to keep the valve seated, and at its upper end the valve has the abutment nut 85 with which is adapted to cooperate the end of a lever 86 extending from the throttle valve shaft.

When the throttle valve is closed or only partly open for the ordinary speed running conditions, the lever 86 will be in position to hold the economizer valve 81 raised and thus to expose the passageway 79 to the air inlet 83, and the air flow to this inlet will reach the main nozzle and will assist the air flow through the bleed 80 in holding down the fuel flow from the nozzle and preventing over-enrichment. When speed and fuller power are required the throttle valve is moved toward wide open position and during such movement the lever 86 will permit the economizer valve 81 to close and shut off the air bleed to the inlet 83, and when the throttle valve is wide open this air inlet will be fully shut off and the suction will be more effective on the main nozzle and the nec-

essary quantity of fuel will be drawn therefrom for a properly enriched mixture for high speed or full power operation.

In addition to the automatic control of the fuel and air flow, the operator can control the fuel flow by the operation of the choke valve. During the first part of the travel of the choke valve to closed position the control valve is operated to control the amount of additional or compensating fuel flow into the carbureting passage and mixture supply, and during the latter part of the choke valve movement the air flow into the air inlet 11 will be checked or choked so that the suction on the operating fuel outlets will be correspondingly increased, such increased suction together with the additional or supplemental fuel flow insuring a sufficiently voluminous and rich mixture during the various conditions of operation of the engine and vehicle. The operator merely sets the choke valve and the throttle valve for the desired operation at one speed and then the mixture will receive the proper proportion of air and fuel to just the necessary degree of enrichment for other speeds and with the elimination of over-enrichment.

Figure 11 shows curves graphically indicating the operation of our improved carburetor with a cold engine, and also the operation of the carburetor of prior structure operating with a warm engine. On the diagram the ordinate indicates the proportion of gas and air or the nature of the mixture, while the abscissa indicates pounds of air per minute or the speed. The curve A in full line indicates the proper mixture ratio with a normally warm engine. The dotted line curve B indicates the mixture obtained with the use of the choke valve alone. The dot-and-dash line C shows the enrichment obtainable by our improved structure and arrangement. There is adequate enrichment but not over-enrichment during the idling, and as the speed increases the degree of enrichment correspondingly decreases.

Briefly summarizing the operation, when the engine is at rest the throttle valve is closed and the choke valve is opened, and the compensating well is closed by its valve to the fuel reservoir. When the warm engine is to be started all that is usually necessary is to press the starting button after opening the throttle a small distance. However, when the engine is cold enrichment is necessary and with our improved arrangement the choke valve can be moved first to actuate only the control well valve, and if the resultant enrichment is not enough the choke valve can be moved further to add the choke effect on the air inlet. When the control valve is opened both the idling channel and the main nozzle supply will receive additional or supplemental fuel flow through the passageways 49 and 51 respectively.

After the engine has been started, and before the vehicle is to be driven, the throttle valve is moved to the idling position and the choke valve is opened to permit reclosing of the control well valve. Under normal conditions the engine receives sufficient fuel supply through the idling passageway and by way of the passageway 56. Over-enrichment is prevented by the air vented into the idling passageway through the passageway 51. Under abnormal conditions, as for example, during very cold weather, or when the engine has not yet become fully warmed up, more enrichment may be desired and in that case the choke valve can be operated sufficiently to open the control well valve for the admission of fuel

into the well and flow of enriching fuel through the passageway 51 into the idling stream.

When the vehicle is to be driven the throttle valve is opened a distance for speeding up the engine depending upon the conditions under which the vehicle is to be started. When the engine is cold and enrichment is necessary this can readily be acquired by operation of the choke valve. When the throttle is set for running of the vehicle at ordinary speeds and conditions the compensating valve 81 is open for additional air bleed into the main nozzle through the passageway 79 so that under normal operation of the engine over-enrichment will not result. However, if such additional air bleed should result in too lean a mixture the control well valve can be operated for compensating flow of fuel.

The accelerating well will function at the proper time to supply a charge of fuel into the main nozzle stream and at other times will supply air into the stream.

As shown in Fig. 12, the adjustment of the control valve 36 would be automatically accomplished by thermostatic means. The means shown comprises the tongue 100 of thermostatic metal structure anchored at its outer end and engaging with its forked inner end under the abutment nut 101 on the control valve stem. The thermostat element is subjected to the heat of the engine and opens the control valve when the engine is cold and closes it when the engine comes to normal temperature, the control being thus entirely automatic. By adjusting the nut 101 the thermal control of the valve can be made to begin at any desired temperature, and the rate of opening of the valve can be controlled by the proper selection of the thermostat element 100.

We claim:—

1. In a carburetor, the combination of a carbureting chamber having an air inlet, a mixing chamber, main fuel supply means, a fuel supply reservoir, a supplemental fuel supply well leading into said mixing chamber adjacent the main fuel supply means open to atmosphere and gravity fed from said reservoir, a choke valve in said air inlet, and valve mechanism controlled by the movement of said choke valve to regulate the flow from said reservoir to said well.

2. In a carburetor, the combination of a carbureting chamber having an air inlet, main fuel supply means, an idling passageway, a fuel supply reservoir having connection with said main fuel supply means and said idling passageway, a supplemental fuel supply well open to atmosphere and gravity fed from said reservoir and feeding into the carbureting chamber independently of the main fuel supply means, a choke valve for said air inlet, a valve for regulating the flow from said reservoir to said well, and an interconnection between said valves whereby the operation of one will cause operation of the other.

3. A carburetor comprising, an air passage having a choke valve, a fuel reservoir, a main fuel passage leading therefrom, a supplemental fuel passage, an idling passage, a supplemental fuel well open to atmosphere feeding both the supplemental and idling passages, said well having a fuel opening from the reservoir, and a valve for said opening operatively connected with said choke valve.

4. A carburetor comprising a fuel reservoir, a main fuel passage leading therefrom, a supplemental fuel passage, a supplemental fuel well open to atmosphere feeding said supplemental

fuel passage, said well having a fuel opening from said reservoir, and a thermostatically controlled valve therefor.

5. A carburetor comprising a fuel reservoir, a main fuel passage leading therefrom, a supplemental fuel passage, an idling passage, a supplemental fuel well open to atmosphere feeding both said supplemental fuel passage and said idling passage, said well having a fuel opening from said reservoir, and a thermostatically controlled valve therefor.

6. In a carburetor the combination of a carbureting chamber having an air inlet, main fuel supply means, an idling passageway, a fuel supply reservoir having connections with said main fuel supply means and said idling passageway, a supplemental fuel supply well communicating with the carbureting chamber independently of the main fuel supply means and gravity fed from said reservoir, a choke valve for said air inlet operable during only the latter parts of its movement to materially restrict the air flow through said air inlet, and valve mechanism operated during the earlier part of movement of said choke valve and controlled thereby to regulate the flow from said reservoir to said well.

7. In a carburetor: a carbureting chamber having an air inlet; a choke valve in said air inlet; a main fuel supply means discharging into the carbureting chamber and designed to furnish fuel for normal operation of the carburetor; a fuel supply reservoir communicating with the main fuel supply means; a supplemental fuel supply well having an unrestricted opening to atmosphere, having a separate discharge passage opening into the carbureting chamber, and gravity fed from said reservoir; and means operated by movement of the choke valve and controlling the flow of fuel from the reservoir to the well.

8. A carburetor comprising an air passage having a choke valve, a fuel reservoir, a main fuel supply passage designed to furnish fuel for normal operation of the carburetor and an idling passage leading therefrom, a supplemental fuel passage communicating with the air passage independently of the main fuel supply passage, a supplemental fuel well having an unrestricted opening to atmosphere and feeding both the supplemental and idling passages, said well having a fuel opening from the reservoir, and a valve for said opening operatively connected with the choke valve.

9. In a carburetor, a carbureting chamber, a fuel nozzle designed to furnish fuel to the carbureting chamber for normal operation of the carburetor, an auxiliary fuel nozzle in the carbureting chamber, a fuel reservoir, a control well having a restricted communication with the fuel reservoir and supplied by gravity therefrom, said control well having an unrestricted opening to atmosphere, a passageway leading from the control well below the normal level of fuel therein to the auxiliary fuel nozzle, and a choke valve, said restricted communication being variable in accordance with movements of the choke valve.

10. In a carburetor having a mixing chamber and a fuel system for feeding fuel thereto during normal running operations including a fuel reservoir, a choke valve in the air inlet of said mixing chamber, an auxiliary starting fuel system communicating with said fuel reservoir and mixing chamber, a fuel valve for controlling the admission of fuel from said reservoir into said starting fuel system, and means for operating said choke

valve and said fuel valve in timed relation so as to open the latter only when said choke valve is closed.

11. In a carburetor, a carbureting chamber, a fuel nozzle designed to furnish fuel to the carbureting chamber for normal operation of the carburetor, an auxiliary fuel nozzle in the carbureting chamber, a fuel reservoir, a control well having a restricted communication with the fuel

reservoir and supplied by gravity therefrom, said control well having an unrestricted opening to atmosphere, a passageway leading from the control well below the normal level of fuel therein to the auxiliary fuel nozzle, and an idling passage supplied from said control well and also from said first mentioned fuel nozzle.

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