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M. J. KITTLER
AUTOMATIC CARBURETOR PRIMER

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2 Sheets-Sheet 2

FIG. 6.

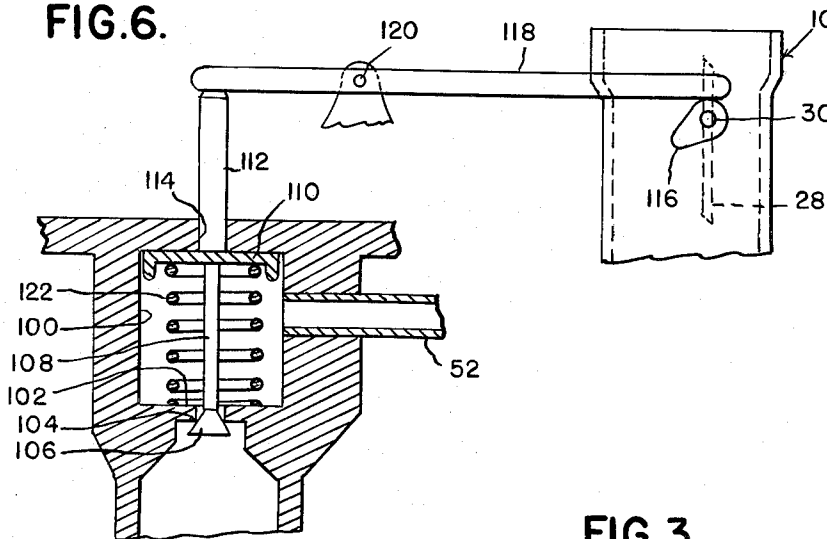


FIG. 3.

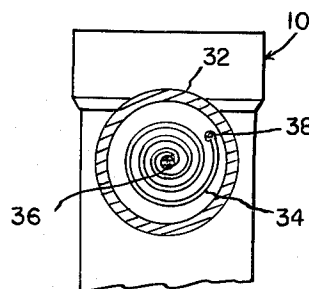
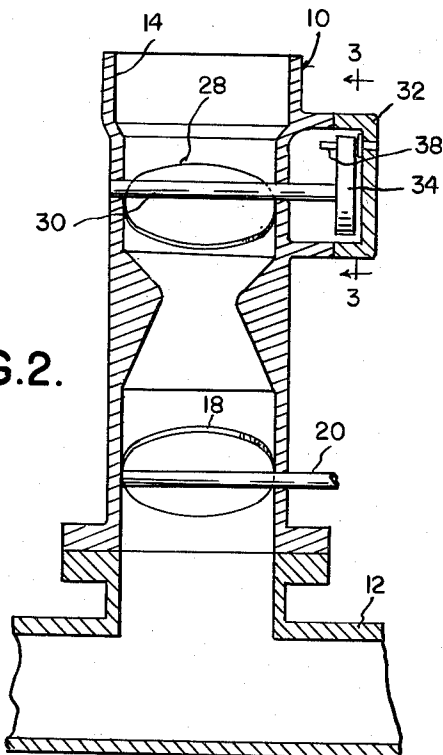


FIG. 2.



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AUTOMATIC CARBURETOR PRIMER

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The present invention relates generally to automatic priming for an internal combustion engine during cold starts, and more particularly to an arrangement in which priming fuel is introduced automatically into a carburetor during choked operation thereof.

It is an object of the present invention to provide an automatic primer including means responsive to choke induced vacuum, the position of the choke plate or valve, manifold vacuum, or any combination thereof, to control supply of priming fuel.

More specifically, it is an object of the present invention to provide in a carburetor, a primer passage and a valve controlling the primer passage responsive to choke induced vacuum, choke plate position, and/or manifold vacuum.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawings, illustrating preferred embodiments of the invention, wherein:

Figure 1 is a simplified sectional view illustrating the present invention.

Figure 1A is a sectional view of a modified detail shown in Figure 1.

Figure 2 is a section on the line 2—2, Figure 1.

Figure 3 is a section on the line 3—3, Figure 2.

Figure 4 is a fragmentary sectional view illustrating a second embodiment of the invention.

Figure 5 is a sectional view similar to Figure 1 illustrating another embodiment of the invention.

Figure 6 is a fragmentary view, partly in section, showing yet another embodiment of the invention.

The present invention provides a flow of priming fuel to the carburetor during cranking, which flow is terminated or substantially reduced immediately as the engine commences to operate under its own power. In all embodiments of the invention the priming flow is from the usual fuel bowl through an auxiliary or priming nozzle into the air supply passage and is controlled by a valve which is responsive to a selected engine condition, either choke induced vacuum, choke plate position, or manifold vacuum, so that when the engine starts there is a change in the choke plate position or other control parameter and the primer valve instantly moves toward closed position to terminate or restrict the flow of priming fuel.

Referring first to the embodiment of the invention illustrated in Figures 1—3, the carburetor indicated generally at 10 is connected to the intake manifold 12 of an internal combustion engine. The carburetor includes the usual air supply passage 14 formed to provide a venturi 16 and having a throttle plate 18 mounted therein for movement about the axis of a throttle shaft 20.

The carburetor includes the usual fuel bowl 22 adapted to supply fuel to the throat of the venturi through a main nozzle 24 including an intake restriction or jet 26 located adjacent the bottom of the fuel bowl 22. Located upstream from the main nozzle 24 is a choke valve 28

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mounted for movement about a shaft 30. It will be observed that the shaft 30 is located eccentrically toward one side of the passage 14 so that suction induced by starting of the engine applies forces directed to the choke valve tending to move it toward open position.

As best seen in Figures 2 and 3, automatic choke means are provided for maintaining the choke valve closed during starting and permitting controlled opening movement of the choke as the engine starts dependent upon temperature and more particularly, a temperature dependent upon an engine condition. For this purpose the choke valve shaft 30 extends into a housing member 32 which contains a coiled bimetallic thermostatic element 34. One end of the thermostatic element is fixed to the shaft 30, as by being received in a slot therein, as indicated at 36 in Figure 3. The other end of the thermostatic element is fixed to a pin 38. The chamber provided by the housing member 32 which receives the thermostatic element 34 is connected to a passage (not shown) by means of which air heated by the engine is drawn into the chamber. Thus, the thermostatic element is subjected to a temperature dependent upon engine operation.

The arrangement is such that when the engine is cold and is not running the choke valve 28 remains fully closed. The slight vacuum induced by cranking of the engine is not ordinarily sufficient to open the choke valve, at least to any appreciable degree. However, when the engine starts to operate under its own power, the induced vacuum is of sufficient strength to open the choke valve 28 to an intermediate condition, even though the thermostatic element 34 remains cold. As the engine warms up the thermostatic element is progressively heated and when the engine temperature reaches a normal operating temperature the choke valve 28 reaches fully open position.

The fuel bowl is provided with a conduit 40 which may have a metering jet or restriction 42 at its bottom end. At its upper end the conduit 42 enlarges into a valve chamber 44 and in this chamber there is provided a primer control valve 46 cooperating with the valve seat 47 and having a stem 48 leading into a primer valve control device indicated generally at 50. Extending from the valve chamber 44 is a primer nozzle 52 which is located in the air passage 14 of the carburetor between the choke valve 28 and the throttle plate 18 and preferably between the choke valve and the venturi 16.

In Figure 1A there is illustrated a modification of the primer nozzle 52 in which its inner or discharge end is turned upwardly as indicated at 54. This modification of the primer nozzle may be employed in all of the embodiments of the invention illustrated in the present case. This form of nozzle prevents pressure differential between the end of the primer nozzle and the fuel bowl from causing priming fuel to flow when not needed at higher speeds.

The primer valve control device 50 includes upper and lower housing members 56 and 58 respectively, between which is clamped the edge of a flexible diaphragm 60. The diaphragm divides the interior of the device into chambers 62 and 64, the chamber 64 being a vacuum chamber connected by a conduit 66 to the air supply passage 14 of the carburetor. The port 68 of the passage 66 is located intermediate the choke valve 28 and the throttle plate 18, and preferably between the choke valve 28 and the venturi 16. A preferred location for the port 68 is directly below the edge of the choke valve 28 in position to be traversed by the adjacent edge thereof upon initial small opening of the choke valve. Accordingly, as the choke valve moves to a limited predetermined open position, the intake port 68 of the passage 66 is transferred to a position above the choke valve and hence is no longer subjected to choke induced vacuum.

Received within the chamber 64 of the primer valve

actuated device 50 is a compression spring 70 biasing the diaphragm 60 downwardly and tending to maintain the valve 46 in closed position. The chamber 62 below the diaphragm is vented to atmosphere as indicated at 72.

From the foregoing description the operation is believed evident but will be briefly reviewed. The engine is cranked with the throttle plate 18 open to some degree and the cranking of the engine develops a pressure differential across the choke valve 28, which is closed at this time. This pressure differential subjects the chamber 64 of the device 50 to a partial vacuum or reduced atmospheric pressure which is sufficient to overcome the spring 70 and to open the valve 46. This in turn allows additional priming fuel to be drawn through conduit 40 and primer nozzle 52 into the air passage 14 below the choke valve 28. When the engine starts to run under its own power, even though it remains cold, the choke valve 28 opens partially.

It was previously stated that the conduit 40 may if desired be provided with a metering restriction or jet indicated at 42. If the metering restriction or jet 42 is not provided, the supply of priming fuel to the air passage of the carburetor will be metered between the valve element 46 and the valve seat 47. This requires a definite correlation between the area of the diaphragm 60, the effectiveness of the spring 70, and the shape and location of the port 68. It is apparent that by a proper correlation of these factors, a substantial flow of priming fuel may be supplied during the cranking operation of the engine. Immediately upon starting of the engine, which results in partial opening of the choke valve, the primer valve 46 may partially close and restrict but not completely terminate the flow of primer fuel. Thus, the fuel supply to the engine will be somewhat enriched at this time. As the choke valve 28 continues to open in response to an increase in engine operating temperature, the pressure differential across the choke valve will be reduced and at some predetermined value, the primer valve 46 may close and completely terminate flow of primer fuel.

Alternatively, the primer valve control device 50 may be arranged such that the valve 46 is in fully open condition and the flow of fuel through the primer nozzle 52 is metered by the jet 42. In this case the primer valve 46 will move to fully closed position as soon as the engine starts.

Referring now to Figure 4 there is illustrated a second embodiment of the present invention. It will be understood that the structure shown in Figure 4 includes many of the elements illustrated in Figure 1. Where the same elements are provided in both figures, like reference numerals have been applied.

In the arrangement of Figure 4 a primer control valve 80 having a valve stem 82 connected to the primer valve control device 50 is provided. Specifically, the valve stem 82 connects to the flexible diaphragm 60 and is urged downwardly by the compression spring 70. In this embodiment of the invention the upper pressure chamber 64 is connected by a passage 84 to the intake manifold 12. Accordingly, since the chamber 64 in this embodiment of the invention is subjected to manifold vacuum which increases incidental to starting of the engine, the conduit 40 is provided with an inwardly extending annular flange 86 providing a downwardly facing valve seat 88 cooperable with the valve 80.

With this embodiment of the invention the spring 70 is effective to maintain the valve 80 in open position when the engine is not operating and is sufficiently strong to maintain the valve 80 open during cranking of the engine. Thus, during the cranking operation priming fuel is drawn upwardly through the conduit 40 and into the air supply passage 14 of the carburetor through the primer nozzle 52 by the choke induced vacuum therein. However, as soon as the engine becomes self-sustaining, the manifold vacuum increases to such a value that the re-

sulting pressure differential across the diaphragm 60 is sufficient to move the diaphragm upwardly against the force of the spring 70 and thereby to close the primer valve 80.

Referring now to Figure 5 there is illustrated another embodiment of the invention. This embodiment differs primarily in that mechanical, rather than pressure differential operated means are provided for effecting movement of the valve. In this figure the parts which are identical with those shown in Figures 1 and 4 are given like reference numerals and the description of these parts will not be repeated.

In this embodiment of the invention a primer valve 90 is provided having a lower valve portion 92 cooperable with a valve seat 94 formed in the lower part of the valve chamber 44. The valve 90 includes an arm 96 extending through a slot 98 into the interior of the barrel or air passage 14 of the carburetor in position to be engaged by an edge of the choke valve 28. The arrangement is such that when the choke valve 28 is moved to fully closed position, which is the position which it occupies as the engine is cranked, the choke valve engages the arm 96 and lifts the valve portion 92 of the primer valve off of the valve seat 94. Thus, during cranking, the vacuum induced below the closed choke valve 28 draws priming fuel through the primer nozzle 52 into the barrel of the carburetor. As soon as the choke valve 28 moves away from its fully closed position as it does in response to the increased pressure differential induced by rapid engine operation, the primer valve portion 92 seats by gravity on the valve seat 94, thus terminating flow of primer fuel.

Figure 6 is a modification of the invention illustrated in Figure 5, the parts not shown in Figure 6 being identical with those shown in Figure 5. In this embodiment of the invention the upper end of the conduit 40 is shaped to provide a chamber 100 having a radially inwardly projecting flange 102 at its lower end defining a valve seat 104 thereat. The primer control valve 106 is carried below the flange in cooperating relation to the valve seat and is provided with a valve stem 108 by means of which it connects to a spring seat 110 fixed to an extension 112 extending through an opening 114 communicating with the chamber 100. In this case the shaft 30 which carries the choke valve 28 extends to the exterior of the carburetor barrel where it is provided with a cam 116.

An actuating lever 118 is provided, mounted on a fixed pivot support 120 and having one end portion engageable with the cam 116 and its other end portion engageable with the extension 112. Located within the chamber 100 is a compression spring 122 normally biasing the primer valve 106 toward closed position. When the choke valve 28 is in its fully closed position, as it will be during cranking of the engine, the cam 116 will have rocked the lever 118 counterclockwise from the illustrated position to a position in which the primer valve 106 is open. At this time the choke induced vacuum existing within the air passage 14 of the carburetor below the choke valve will cause a priming flow of fuel through the primer nozzle 52. However, the primer valve 106 is permitted to close under the action of the spring 122 as the choke valve 28 moves toward open position. With this arrangement the closing movement of the primer valve may exert a predetermined metering effect so that if desired a small flow of fuel through the primer nozzle may be permitted during initial engine operation until the choke valve is opened a predetermined degree in response to an increase in engine operating temperature.

All of the embodiments of the invention disclosed herein have in common the provision of means for supplying a priming flow of fuel to the engine during the cranking operation and either terminating this priming flow when the engine becomes self-sustaining, or of reducing it to a smaller flow to provide fuel enrichment until the choke valve moves to a predetermined substantially open posi-

tion in response to increasing engine operating temperature.

It will be understood from the foregoing that in the structure shown in Figure 1 the primer valve is responsive to pressure existing just below the choke valve during cold starting and that this choke induced vacuum is essentially cranking manifold vacuum on a cold start since the thermostatic choke maintains the choke valve closed during cranking while the engine is cold. As soon as the engine starts the choke valve moves to partially open position transferring the port 68 of the passage 66 to a position upstream of the choke valve. In the structure shown in Figures 5 and 6 the priming valve is directly responsive due to mechanical linkages, to the position of the choke valve. Thus in the structure of Figures 1, 5 and 6, the primer valve is responsive to choke valve position. In the construction shown in Figure 4 the primer valve is responsive directly to cranking manifold vacuum. This in turn is dependent upon the position of the choke valve. With this arrangement it is of course necessary to employ a spring 70 selected to maintain the priming valve 80 closed under all conditions of manifold vacuum except manifold vacuum existing during cranking of a cold engine while the choke valve 28 is closed. It is thus seen that the primer valve is responsive to any combination of choke induced vacuum, choke valve position, or manifold vacuum.

While the invention has been illustrated and described in connection with a carburetor, it is apparent that it may be employed with other types of fuel controls having carburetor features, or other fuel supply systems such as fuel injection systems.

The drawings and the foregoing specification constitute a description of the improved automatic carburetor primer in such full, clear, concise and exact terms as to enable any person skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What I claim as my invention is:

1. In a carburetor for an internal combustion engine having an intake manifold, the carburetor having an air supply passage provided with a venturi, a choke valve upstream from the venturi, a throttle plate downstream from the venturi, a fuel bowl, a main nozzle, and a main fuel supply passage connecting the bowl and main nozzle, the improvement which comprises a primer nozzle having an outlet located in said air supply passage between said choke valve and throttle plate, a primer fuel supply passage connecting said bowl and primer nozzle, and means for limiting flow of primer fuel to said primer nozzle except when said engine is being cranked while cold, said means comprising spring biased valve means for controlling the degree of communication between said bowl and said nozzle in accordance with the degree of engine vacuum.

2. In a carburetor for an internal combustion engine having an intake manifold, the carburetor having an air supply passage provided with a venturi, a choke valve upstream from the venturi, a throttle plate downstream from the venturi, a fuel bowl, a main nozzle, and a main fuel supply passage connecting the bowl and main nozzle, the improvement which comprises a primer nozzle having an outlet located in said air supply passage between said choke valve and throttle plate, a primer fuel supply passage connecting said bowl and primer nozzle, and spring biased valve means biased in the closing direction for limiting flow of primer fuel to said primer nozzle except when said engine is being cranked while cold.

3. In a carburetor for an internal combustion engine having an intake manifold, the carburetor having an air supply passage provided with a venturi, a choke valve upstream from the venturi, a throttle plate downstream from the venturi, a fuel bowl, a main nozzle, and a main fuel supply passage connecting the bowl and main nozzle,

the improvement which comprises a primer nozzle having an outlet located in said air supply passage between said choke valve and throttle plate, a primer fuel supply passage connecting said bowl and primer nozzle, and valve means responsive to the restriction of air supply to said engine for limiting flow of primer fuel to said primer nozzle except when said engine is being cranked while cold.

4. In a carburetor for an internal combustion engine having an intake manifold, the carburetor having an air supply passage provided with a venturi, a choke valve upstream from the venturi, a throttle plate downstream from the venturi, a fuel bowl, a main nozzle, and a main fuel supply passage connecting the bowl and main nozzle, the improvement which comprises a primer nozzle having an outlet located in said air supply passage between said choke valve and throttle plate, a primer fuel supply passage connecting said bowl and primer nozzle, and valve means responsive to choke induced vacuum for limiting flow of primer fuel to said primer nozzle except when said engine is being cranked while cold.

5. In a carburetor for an internal combustion engine having an intake manifold, the carburetor having an air supply passage provided with a venturi, a choke valve upstream from the venturi, a throttle plate downstream from the venturi, a fuel bowl, a main nozzle, and a main fuel supply passage connecting the bowl and main nozzle, the improvement which comprises a primer nozzle having an outlet located in said air supply passage between said choke valve and throttle plate, a primer fuel supply passage connecting said bowl and primer nozzle, and valve means responsive to engine manifold vacuum for limiting flow of primer fuel to said primer nozzle except when said engine is being cranked while cold.

6. In a carburetor for an internal combustion engine having an intake manifold, the carburetor having an air supply passage provided with a venturi, a choke valve upstream from the venturi, a throttle plate downstream from the venturi, a fuel bowl, a main nozzle, and a main fuel supply passage connecting the bowl and main nozzle, the improvement which comprises a primer nozzle having an outlet located in said air supply passage between said choke valve and throttle plate, a primer fuel supply passage connecting said bowl and primer nozzle, and valve means responsive to the position of said choke valve for limiting flow of primer fuel to said primer nozzle except when said engine is being cranked while cold.

7. In a carburetor for an internal combustion engine having an intake manifold, the carburetor having an air supply passage provided with a venturi, a choke valve upstream from the venturi, a throttle plate downstream from the venturi, a fuel bowl, a main nozzle, and a main fuel supply passage connecting the bowl and main nozzle, the improvement which comprises a primer nozzle having an outlet located in said air supply passage between said choke valve and throttle plate, a primer fuel supply passage connecting said bowl and primer nozzle, and valve means for limiting flow of primer fuel to said primer nozzle except when said engine is being cranked while cold, said primer valve being movable between open and closed positions, and a metering restriction in said primer fuel supply passage operable to restrict the flow of primer fuel when said primer valve is open.

8. In a carburetor for an internal combustion engine having an automatic choke including means responsive to engine temperature to prevent full opening of the choke until the engine reaches a proper operating temperature, a primer nozzle in said carburetor, a valve controlling the flow of primer fuel, and means responsive to the restriction of air supply through the carburetor to maintain said valve open when said engine is being cranked while cold and to close said valve when the engine starts.

9. In a carburetor for an internal combustion engine having an automatic choke including means responsive to engine temperature to prevent full opening of the choke until the engine reaches a proper operating temperature, a primer nozzle in said carburetor, a valve controlling the flow of primer fuel, and means responsive to choke induced vacuum to maintain said valve open when said engine is being cranked while cold and to close said valve when the engine starts.

10. In a carburetor for an internal combustion engine having an intake manifold and an automatic choke including means responsive to engine temperature to prevent said choke from becoming fully opened before full engine operating temperature is reached, a primer nozzle in said carburetor, a valve controlling the flow of primer fuel, and means responsive to manifold vacuum to maintain said valve open when said engine is being cranked while cold and to close said valve when the engine starts.

11. In a carburetor for an internal combustion engine having an intake manifold, the carburetor having an air supply passage provided with a venturi, a choke valve upstream from the venturi, a throttle plate downstream from the venturi, a fuel bowl, a main nozzle, and a main fuel supply passage connecting the bowl and main nozzle, the improvement which comprises a primer nozzle having an outlet located in said air supply passage between said choke valve and throttle plate, a primer fuel supply passage connecting said bowl and primer nozzle, said primer nozzle being located away from the throat of the venturi, and means responsive to engine vacuum for limiting flow of primer fuel to said primer nozzle except when said engine is being cranked while cold.

12. In a downdraft carburetor for an internal combustion engine having an intake manifold, the carburetor having an air supply passage provided with a venturi, a choke valve upstream from the venturi, a throttle plate downstream from the venturi, a fuel bowl, a main nozzle, and a main fuel supply passage connecting the bowl and main nozzle, the improvement which comprises a primer nozzle having an outlet located in said air supply passage between said choke valve and throttle plate, a primer fuel supply passage connecting said bowl and primer passage, said primer nozzle being located away from the throat of the venturi and having an end portion directed upwardly in the direction opposed to air flow through said air supply passage.

13. In a carburetor for an internal combustion engine having an intake manifold, the carburetor having an air supply passage, a spaced apart throttle plate and choke valve therein, and a fuel bowl, a primer comprising a primer nozzle having an outlet between the choke valve and throttle plate, a passage connecting said primer nozzle and bowl, a primer valve in said passage, and means responsive to choke induced vacuum during cranking to maintain said primer valve open during cranking of the engine while cold and closed while the engine is running.

14. In a carburetor for an internal combustion engine having an intake manifold, the carburetor having an air supply passage, a spaced apart throttle plate and choke valve therein, and a fuel bowl, a primer comprising a primer nozzle having an outlet between the choke valve and throttle plate, a passage connecting said primer nozzle and bowl, a primer valve in said passage, and means responsive to the position of said choke valve to maintain said primer valve open during cranking of the engine while cold and closed while the engine is running.

15. In a carburetor for an internal combustion engine having an intake manifold, the carburetor having an air supply passage, a spaced apart throttle plate and choke valve therein, and a fuel bowl, a primer comprising a primer nozzle having an outlet between the choke valve and throttle plate, a passage connecting said primer nozzle and bowl, a primer valve in said passage, and means responsive to engine manifold vacuum to main-

tain said primer valve open during cranking of the engine while cold and closed while the engine is running.

16. In a fuel supply system for an internal combustion engine including an air supply passage, spaced apart valves therein, the upstream valve having temperature responsive means connected thereto to maintain said upstream valve closed while the engine is cold and not running, a primer fuel supply system including a primer nozzle intermediate said valves, a conduit leading to said nozzle, a primer valve in said conduit, and means responsive to starting of the engine to maintain said primer valve open during cranking of the engine while cold and closed while the engine is running.

17. In a fuel supply system for an internal combustion engine including an air supply passage, spaced apart valves therein, the upstream valve having temperature responsive means connected thereto to maintain said upstream valve closed while the engine is cold and not running, a primer fuel supply system including a primer nozzle intermediate said valves, a conduit leading to said nozzle, a primer valve in said conduit, and means responsive to the position of said upstream valve to maintain said primer valve open during cranking of the engine while cold and closed while the engine is running.

18. In a fuel supply system for an internal combustion engine including an air supply passage having an air valve therein, a primer fuel supply, a primer nozzle in said air supply passage, a primer valve between said primer fuel supply and said primer nozzle, and means responsive to starting of the engine and engine temperature to maintain said primer valve open during cranking of the engine while cold and closed while the engine is running.

19. In a carburetor for an internal combustion engine having an intake manifold, the carburetor having an air supply passage provided with a venturi, a choke valve upstream from the venturi, a throttle plate downstream from the venturi, a fuel bowl, a main nozzle, a main fuel supply passage connecting the bowl and main nozzle, and automatic choke regulating mechanism for maintaining the choke closed during cold starts and to provide a controlled opening of the choke upon starting of the engine and upon an increase in an operating temperature of the engine, the improvement which comprises a primer nozzle having an outlet located in said air supply passage between the choke valve and throttle plate, a primer fuel supply passage connecting said bowl and primer nozzle, a primer valve controlling the flow of primer fuel through said primer passage, and an operating connection between said choke and said primer valve including a cam movable in accordance with movement of said choke to regulate the position of said primer valve in accordance with the position of said choke.

20. In a carburetor for an internal combustion engine having an intake manifold, the carburetor having an air supply passage provided with a venturi, a choke valve upstream from the venturi, a throttle plate downstream from the venturi, a fuel bowl, a main nozzle, and a main fuel supply passage connecting the bowl and main nozzle, a primary nozzle having an outlet located in said air supply passage between said choke valve and throttle plate, a primer fuel supply passage connecting said bowl and said primer nozzle, said primer nozzle being located away from the throat of the venturi and having an end portion directed upwardly in the direction opposed to air flow through said air passage and means responsive to engine vacuum for limiting flow of primer fuel to said primer nozzle except when said engine is being cranked while cold.

21. In a carburetor for an internal combustion engine having an intake manifold, an air supply passage provided with a venturi located in said carburetor, a choke valve upstream from the venturi, a throttle plate downstream from the venturi, a fuel bowl, a main nozzle and a main fuel supply passage connecting the bowl and main

nozzle, a primer comprising a primer nozzle having an outlet located in said air supply passage between said choke valve and said throttle plate, a primer fuel supply passage connecting said primer nozzle and bowl, a primer valve in said primer passage for controlling fuel flow therethrough, and engine vacuum operated means responsive to starting of the engine for maintaining said primer valve in an open position during cranking of the engine while cold and closed while the engine is running.

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