Sept. 22, 1959 G. V. B. HALL 2,905,165

FUEL ENRICHMENT DEVICE

Filed May 21, 1957

Fig. 1

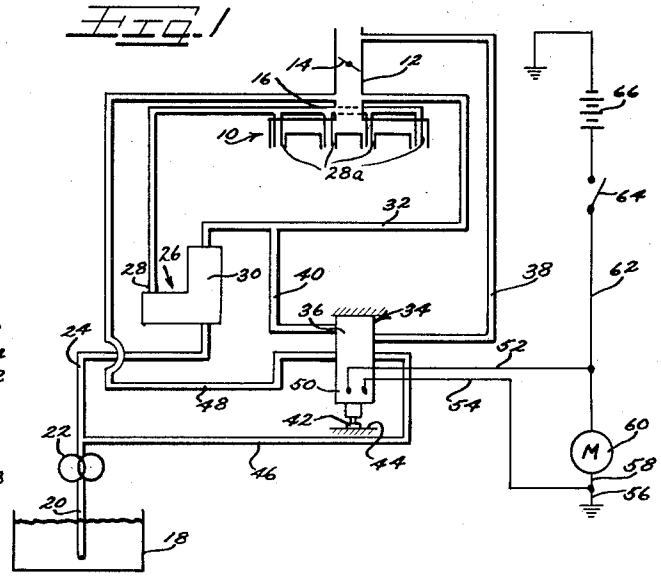


Fig. 3

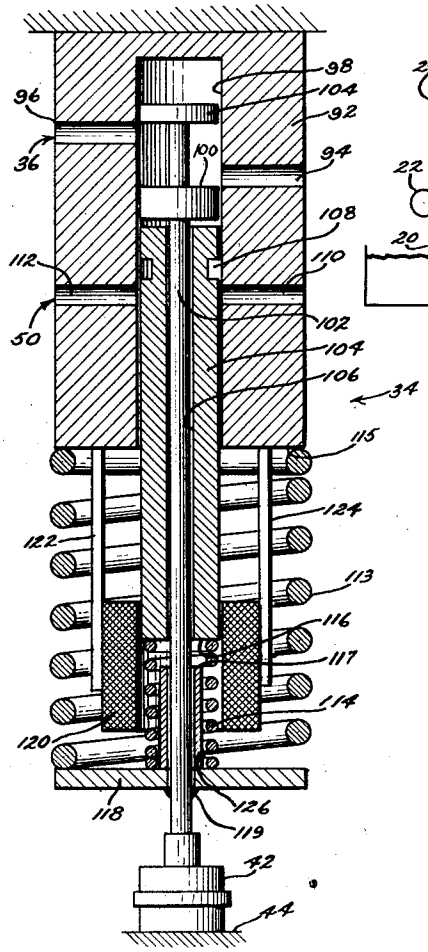
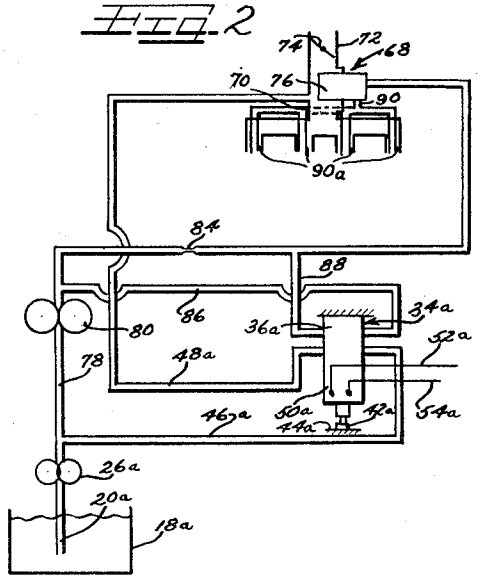


Fig. 2



Inventor
GEORGE V. B. HALL

By Hill, Sherman, Meroni, Gross & Simpson Attys

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FUEL ENRICHMENT DEVICE

George V. B. Hall, Euclid, Ohio, assignor to Thompson Ramo Wooldridge Inc., a corporation of Ohio

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The present invention relates to improvements in fuel supply systems for engines such as those utilizing fuel injection, and more particularly in a unique system and valve arrangement for supplying cold starting enrichment fuel and warm up enrichment fuel for engine operation.

The need for devices to enrich the air-fuel ratio of otto-cycle engines during cold starting and warm up periods has been known and in carbureted engines this need is accomplished through the use of a choke. The choke method is not practical in fuel injection systems and the present invention contemplates the provision of an enrichment system supplying separate quantities of enrichment fuel to take care of the need for cold starting or priming fuel while cranking the engine, and the need for enrichment fuel during the warm up period, which gradually decreases as the engine temperature increases. In fuel injection systems, the fuel supply to the engine may be controlled by a fuel metering unit and metered according to the parameters of engine speed and engine intake manifold pressure, and these systems are known as "speed-density systems." In these systems, fuel flow to the engine increases with an increase in speed or with an increase in manifold pressure, or both.

The present invention contemplates the control of fuel to the engine, such as by increasing fuel to meet special requirements during starting and engine warm up by falsifying one of the fuel governing parameters and sending a false signal to the fuel metering unit.

In one form of the invention, an internal combustion engine is supplied with fuel through fuel injectors supplied through a metering device, supplied from a pump receiving fuel from a tank. The metering device may be controlled by signals of engine speed by being delivered fuel from a pump operable by the engine, and by signals of manifold pressure manifested by an air density signal received from the intake manifold downstream of the throttle valve. The fuel metering device sensing either one or both of these signals is fed a false higher manifold pressure by bleeding atmospheric air through a first enrichment valve from the manifold upstream of the throttle valve in the manifold, may, in addition or alternately, be fed a false speed signal by increasing the fuel pressure from the pump. This is done by delivering the pump output through a flow obstruction in the line between the pump and the metering device and utilizing a second enrichment valve connected around the flow obstruction. The enrichment valves for supplying the false signal of manifold pressure or speed are controlled by a temperature responsive device which gradually closes the valves as the engine warms up.

The same temperature responsive device which gradually closes the warm up enrichment valve also controls the starting enrichment valve. The starting enrichment valve supplies an independent starting enrichment supply of fuel to the engine during cranking, and the amount of enrichment fuel is controlled by said temperature responsive device.

An object of the invention is to provide an improved

fuel flow control system for an engine operable on combustion fuel wherein a flow control operated by chosen engine conditions can be simply and readily modulated to change the flow irrespective of said chosen conditions.

Another object of the invention is to provide a fuel flow control system operable in accordance with signals reflecting operating conditions of the engine, and wherein false signals are generated to vary the fuel flow to meet certain fuel demand conditions.

Another object of the invention is to provide an improved fuel supply system for an engine wherein the fuel air ratio can be enriched in an improved manner during cranking and during warm up of the engine.

A still further object of the invention is to provide an improved fuel enrichment method and mechanism primarily for starting conditions wherein the engine employs a fuel supply regulating system operated by engine conditions of speed and/or manifold pressure.

A further object of the invention is to provide a fuel supply control system for an engine wherein the operating fuel supply is controlled by conditions of speed or manifold pressure and a simple valve arrangement is utilized to influence a fuel metering device utilizing the control factors of speed and manifold pressure.

A further object of the invention is to provide an improved valve arrangement for supplying starting and warm up enrichment fuel to an engine wherein the same temperature responsive device is used to control the operation of both the warm up and starting fuel enrichment devices.

Another object of the invention is to provide an improved valve structure and arrangement well adapted to use in a fuel enrichment system for supplying starting enrichment fuel and warm up enrichment fuel to an engine.

Other objects and advantages will become more apparent with the teachings of the principles and features of the invention in connection with the disclosure of the preferred forms thereof in the specification, claims and drawings, in which:

Figure 1 is a diagrammatic illustration of a fuel flow control system for an engine employing the principles of the present invention;

Figure 2 is a diagrammatic showing of a fuel flow control system for an engine illustrating another form employing the features of the invention; and,

Figure 3 is a sectional view taken through the axis of a preferred form of valve structure of the invention.

In the drawings, the invention is shown employed in the preferred forms and embodiments, but it will be understood that the invention may take other forms and may be used in other environments utilizing the inherent advantages and features of the inventive concepts. Although features of the invention find particular advantage in combination with a fuel supply system for a fuel injection type of engine, elements of the invention are not necessarily limited to being employed in this type of system.

Referring to the drawings, Figure 1 shows the intake manifold **10** leading to the individual cylinders of an internal combustion engine. The intake manifold draws air into the air intake line **12**, which is provided with a throttle valve **14**. The intake manifold air pressure at **16**, downstream of the throttle valve **14**, is indicative of engine conditions and this manifold air pressure is used as a signal means for controlling the supply of fuel to the engine.

A source of fuel is provided by a fuel supply tank **18** into which is led a fuel line **20** connected to the intake of a fuel pump **22**. The fuel pump **22** delivers through a fuel line **24** to the fuel metering device **26**. The

metered fuel, which may be timed in relation to the engine or which may be continuously flowing, goes to the engine through connections indicated at **28** leading to injectors **28***a*. The metering device **26** includes a signal sensing means **30**, which controls the metering device **26** in accordance with the air density signal received from the intake manifold at **16** through a signal sensing air line **32**.

Thus, the fuel delivered by the metering device **26** will be controlled by the signal sensing means **30**, which is supplied an air density signal from the intake manifold **10**. To vary the fuel supplied to the engine by the metering device **26**, and especially to provide an increased amount of fuel to enrich the air-fuel ratio during the engine warm up, a falsified signal is fed to the signal sensing means **30** by the operation of the enrichment control valve **34**.

The enrichment valve **34**, in the position shown in the drawings, has an upper portion devoted to supplying the falsified signal for the warm up enrichment fuel. The upper section **36** of the valve controls the flow of air from the air line **38** connecting to the intake manifold upstream of the throttle valve **14**, to the air line **40** leading to the signal sensing air line **32**. When the upper section **36** of the enrichment valve **34** is open, the air pressure upstream of the throttle valve **14** is communicated to the signal sensing line **32** and the signal sensing means **30** senses an increased air pressure which is greater than the pressure downstream of the throttle valve in the intake manifold. This will cause the fuel metering device **26** to increase the supply of fuel to the injectors, enriching the fuel-air ratio during the time the section **36** of the valve **34** is open.

This enrichment valve **34** is controlled by a temperature responsive mechanism **42**, which operates in response to the operating temperature conditions of the engine. For this purpose, the temperature responsive element **42** is connected to a portion of the engine, such as to the wall of the exhaust manifold, which may be indicated schematically at **44** in the drawings. As the engine begins to warm up, the temperature responsive element **42** gradually closes the valve portion **36** in proportion to the increased temperature of the engine, thus reducing the amount of false signal that is fed to the signal sensing means **30**. When the engine reaches a predetermined temperature, the valve **36** will have closed and the signal sensing means **30** will receive only the true signal from the intake manifold.

An independent supply of fuel is fed to the engine for starting enrichment as compared to warm up enrichment. The starting enrichment fuel is obtained through a starting fuel line **46**, connected to the output of the fuel pump **22**. The fuel line **46** continues with the line **48**, which leads directly to the intake manifold area **16** to discharge raw fuel directly into the cylinders of the engine during the cranking period.

The flow of fuel through the starting fuel lines **46** and **48** is controlled by the lower section **50** of the enrichment valve **34**. This valve is opened only during cranking of the engine so that the priming fuel is fed to the engine only during that period.

For this purpose, the valve **50** is electrically operated and is connected in series with the switch which operates the starter of the engine. The electrical leads **52** and **54** connect to terminals on the valve **34** for supplying electricity for operating the section **50** of the valve. Lead **54** is connected to ground at **56**, which also grounds the lead **58** of the starter motor **60**, which cranks the engine. Lead **62** from the starter, with the lead **52** from the valve **50**, connects to the starter switch **64**, which when closed, completes the circuit between the battery **66** and the starter motor **60**, and also the valve **50**. Although the valve **50** is energized each time the starter switch **64** is closed, the valve **50** will be opened an amount controlled by the temperature responsive element **42**, as will be described in connection with the detailed review of the valve shown in Figure 3.

In Figure 2, the fuel enrichment control valve **34***a* is arranged to supply a falsified signal of engine speed to a fuel metering control. A signal sensing means **76** controls a fuel metering device **68**. This sensing means **76** is responsive to the pressure in the intake manifold and to engine speed, but the falsified influencing signal changes only the signal which corresponds to engine speed. It will be recognized with the description of the devices of Figures 1 and 2, that the enrichment control valves **34** and **34***a* for changing the signals of manifold pressure and speed may be used together in the same engine in certain circumstances depending upon the arrangement and operation thereof.

In the arrangement used in the supply system of Figure 2, the metering device **68** is positioned with the signal sensing means **76** located internally of an intake manifold **70**. Thus, in an installation as this, it would be difficult to connect the mechanism of Figure 1, and a device which falsifies the speed signal is more expedient. The intake manifold **70** of Figure 2, is provided with an intake throttle valve **74** in an intake line **72**.

Fuel is again supplied from a fuel tank **18***a* through a transfer pump **22***a*, which is provided with intake fuel line **20***a*. The discharge of the transfer pump **22** is connected to a line **78** leading to a pressure pump **80**. This pressure pump has a fuel delivery output proportional to the speed of the engine so that the fuel delivery through line **82** also delivers a signal to the signal sensing means **76** corresponding to engine speed.

The fuel delivery line **82** is provided with a flow restriction **84** in the line in order for the valve section **36***a* of the enrichment valve **34***a* to be able to function as a by-pass valve. The by-pass of fuel past the restriction orifice **84** is permitted by the by-pass fuel lines **86** and **88**, which lead through the valve **36***a*.

When valve **36** is opened, fuel will flow through the lines **86** and **88** by-passing the restricting orifice **84** and increasing the pressure upstream of the orifice. This will create an increased fuel pressure in the signal sensing means **76**. The distance valve **36***a* is opened will be gradually diminished as the engine warms up by action of the temperature responsive control **42***a*, which is mounted on the wall **44***a* that is a part of the engine. As valve **36***a* closes, the amount of fuel which is by-passed around the restriction **84** is decreased and the fuel pressure recorded at the signal sensing means **76** will be gradually decreased until valve **36***a* is completely closed, when a true signal will be received at the signal sensing means **76**, which indicates the true engine speed.

In the arrangement shown in Figure 2, the starting enrichment, which provides separate fuel enrichment during cranking, is accomplished in the same manner as in the arrangement of Figure 1. Valve **50***a* is electrically operated and is connected to leads **52***a* and **54***a* which in turn are connected to the starter switch. When the starter motor is operated, the valve **50***a* is opened and enrichment fuel will flow through line **46***a*, through valve **50***a*, and through line **48***a* to be delivered directly to the intake manifold **70**. The amount of fuel permitted to flow through valve section **58** will depend upon the engine temperature and after the engine has warmed up, the temperature responsive control **42***a* will not permit valve **50***a* to open.

The detailed valve construction of valves **34** and **34***a* is shown in Figure 3. Valves **34** and **34***a* are of the same internal construction, and **34***a* and its parts are numbered with the suffix "*a*" to distinguish their usage from the arrangement of Figure 1.

As shown in Figure 3, the upper section of the valve is shown at **36** and the lower section at **50**. The valve is shown as having a unitary cast body **92** with an inlet

port 94 and an outlet port 96 for the upper valve 36. Communication between the ports is controlled by a valve head 100 which slides within the cylindrical bore 98 in the valve body 92. A valve head 100 is mounted on a controlling valve stem 102, which extends coaxially through the cylindrical bore 98.

The valve stem 102 extends beyond the valve head 100 and carries a pressure balancing disc 104. The valve head 100 is shown in the open position with flow being permitted between the inlet 94 and the outlet 96. When the valve stem 102 moves upwardly, the head 100 will cover the inlet port 94 to gradually close the valve 36 and stop flow between the ports 94 and 96. As used in Figure 1, the inlet port 94 next to the line 38 in the outlet port 96 connects to the line 40. As used in Figure 2, the inlet port 94 connects to the line 86 and the outlet port 96 connects to the line 88.

The valve section 50, which controls the starting or cranking of the fuel enrichment flow has an inlet port 110 and an outlet port 112 and communication is afforded between these ports when the valve is open through a groove 108 in the valve plunger 104. The valve plunger 104 is in the form of a sleeve slidably mounted in the cylindrical bore 98 of the valve body and has an opening 106 through the center in order to be independently slidable on the valve stem 102. The annular groove 108 in the valve plunger 104 provides a flow path between the inlet port 110 and the outlet port 112.

Positional control of the warm up enrichment valve plunger 100 is derived from the temperature responsive operator 42 acting against the coil compression spring 113. The spring at one end bears against the base 115 of the valve body and at the other end bears against the plate 118. This plate is suitably secured, such as by a weld 119 to the valve stem 102 which is reciprocated by the temperature responsive operator 42.

The warm up enrichment valve head 100 is shown in the open position where it will be located when the engine is cold. As the engine warms up, the rod 102 is pushed upwardly by the temperature responsive operator 42 until the valve 36 is gradually closed.

The starting enrichment valve plunger 104 is controlled in position by operation of the solenoid coil 120 which is supported and fixed in position relative to the valve body 92 by brackets 122 and 124 extending from the valve body. The valve plunger 104 acts as the core of the solenoid and when the coil 120 is energized, the core will be pulled downwardly to bring the flow groove 108 in alignment with the ports 110 and 112.

When the solenoid is deenergized, the coil compression spring 114 takes over and moves the valve plunger 104 to closed position, as it is shown in Figure 3. This coil compression spring bottoms on the plate 118 and moves the valve plunger 104 by engagement with the end 116 of the plunger.

The amount of movement of the valve plunger 104 to open position is controlled by a tubular stop 126. This stop is mounted on the plate 118 and surrounds and moves with the valve stem 102. As the solenoid coil 120 is energized, the starting enrichment valve plunger 104 will move downwardly until it strikes the end 117 of the stop 126.

As the engine warms up and the temperature responsive operator 42 moves the valve stem 102 upwardly, the stop tube 126 will also move upwardly, thereby limiting the amount of movement permitted for the valve plunger 104. When the engine is fully warm, the stop sleeve 126 will be moved to a position where the valve plunger 104 cannot have sufficient travel to open the the valve 50. Thus, while the engine is not fully warm, the valve plunger 104 will open, but the amount of opening permitted will depend on the temperature of the engine. The amount of starting enrichment fuel delivered to the engine will then depend on the temperature of the engine. Both the amount of warm up enrichment fuel delivered to the engine and the starting enrichment fuel delivered are controlled by the temperature responsive operator 42.

Reviewing the operation of the system, as shown in Figure 1, in the light of the details of the valve construction of Figure 3, the fuel is supplied to the engine through the intake manifold by a metering device 26 which is controlled by a signal sensing means 30. This signal sensing means is responsive to air pressure in the intake manifold 10. During warm up of the engine, the air pressure signal is modulated by atmospheric air pressure bled to the signal line 32 through the valve 36. This valve is slowly closed as the engine warms up to a predetermined operating temperature. The fuel sensing signal means 30 senses only the air pressure which it receives and will cause the metering device to supply fuel according to the temperature of the engine to thereby supply an additional amount of enrichment fuel during the warm up period.

The valve 50 supplies a separate starting enrichment fuel supply which is delivered as raw fuel directly to the intake manifold 10. The valve 50 is electrically operated and connected to the starter switch, and is opened during cranking of the engine. While it is open, fuel flows through the line 46 to line 48 and into the intake manifold 10. The amount that valve 50 will be opened depends on the engine temperature so that a starting enrichment fuel will be delivered only when the engine is cold and the amount of starting enrichment fuel will be gradually diminished in proportion to the heat of the engine.

In the arrangement of Figure 2, the metering device 68 is controlled by a signal sensing means 76 which senses manifold pressure and engine speed. The signal corresponding with speed is received by means of a pump driven by the engine and having an output proportional to engine speed. For providing an increased amount of fuel during a warm up period, a restriction 84 in the fuel delivery line is bypassed through the warm up enrichment control valve 36*a*. The valve 36*a* permits a bypass flow of fuel through lines 86 and 88 whereby the signal sensing means 76 receives a false increased fuel pressure and increases the delivery of fuel to the engine through the delivery line 90 leading to injectors 90*a*. The by-pass valve 36 gradually closes as the engine warms up by the action of the temperature responsive operator 42*a*.

Starting enrichment fuel is provided through valve 50*a* which delivers raw fuel to the intake manifold 70 through lines 46*a* and 48*a*. This valve is again controlled electrically through leads 52*a* and 54*a* connected to the starter switch. The amount that valve 50*a* opens depends on the temperature of the engine and the opening will gradually become less with an increase in engine temperature.

Thus, it will be seen that I have provided an improved system with a unique unitary valve structure for providing both warm up enrichment fuel and starting enrichment fuel to an engine. The disclosed invention is well adapted to use with an engine employing a fuel supply system.

The valve arrangement and the combined system are uncomplicated in nature and capable of continuous operation under any operating conditions. It is adaptable to be used in existing fuel supply systems or in new constructions. A single temperature responsive operator is employed for regulating the supply of both warm up enrichment fuel and starting enrichment fuel, thus simplifying the valve construction and enabling a correlation of both types of enrichment fuel supply with engine temperature.

I have, in the drawings and specification, presented a detailed disclosure of the preferred embodiments of my

invention, but it is to be understood that I do not intend to limit the invention to the specific forms disclosed, but intend to cover all modifications, changes and alternative constructions and methods falling within the scope of the principles taught by my invention.

I claim as my invention:

1. An internal combustion engine having a fuel supply system comprising a fuel supply metering device controlling the flow of fuel to the engine, signal means connected to the metering device and responsive to engine conditions to supply a signal to the metering device controlling the supply of fuel, a warm up enrichment means responsive to engine temperatures and connected to vary the signal of the signal means while the engine is cold to increase the flow of fuel thereto, an independent cold starting fuel supply means delivering starting fuel to the engine to enrich the supply during cranking, and means responsive to the temperatures of the engine and operably connected to the warm up enrichment means and the cold starting means and terminating their operation at a predetermined engine temperature.

2. In a fuel supply system for an engine operable on a combustible fuel, a fuel supply valve for supplying warm up and cold starting enrichment fuel comprising a valve body having passageways therein defining a warm up enrichment fuel flow path and a cold starting enrichment fuel flow path, a first movable valve member operably associated with said valve body and movable between an open position wherein the warm up enrichment fuel flow path is open and a closed position wherein said path is closed, a second valve member operable with respect to the valve body and movable between an open position wherein said cold starting fuel flow path is open and a closed position wherein said cold starting fuel flow path is closed, an operator for said second valve member moving the valve member to open position during cranking of the engine, and a temperature responsive operator for the first valve member moving the valve member from open to closed position as the engine warms up to gradually terminate the flow of warm up enrichment fuel and positioned in the path of movement of the second valve member whereby its movement to open position will be gradually blocked as the first valve member moves toward closed position.

3. A fuel injection system for an internal combustion engine comprising a fuel injection mechanism operative to supply fuel to the cylinders of an engine through injectors, metering apparatus connected to the fuel injection mechanism and responsive to engine conditions to control the injection means, an auxiliary starting fuel supply means connected to supply a separate flow of fuel to the engine directly to the engine intake, and means connected to operate said auxiliary fuel supply means during engine cranking periods.

4. A fuel injection system for an internal combustion engine comprising a fuel injection mechanism operative to supply fuel to the cylinders of an engine through injectors, metering apparatus connected to the fuel injection mechanism and responsive to engine conditions to control the injection means, an auxiliary starting fuel supply means connected to supply a separate flow of fuel to the engine directly to the engine intake, means connected to operate said auxiliary fuel supply means during engine cranking periods, and temperature responsive means responding to the temperature of the engine and connected to said auxiliary fuel supply means reducing the fuel supplied thereby inversely proportional to the engine temperature whereby the need of the engine for less starting fuel at higher temperatures is automatically accommodated.

5. A fuel injection system for an internal combustion engine comprising a fuel injection mechanism operative to supply fuel to the cylinders of an engine through injectors, metering apparatus connected to the fuel injection mechanism and responsive to engine conditions to control the injection means, an auxiliary starting fuel supply means connected to supply a separate flow of fuel to the engine directly to an intake manifold of the engine, means connected to operate said auxiliary fuel supply means during engine cranking periods, and means responsive to a predetermined engine temperature and connected to the auxiliary fuel supply means and operative to prevent operation thereof at engine temperatures above said predetermined temperature.

6. A fuel injection system for an internal combustion engine comprising fuel supply means for delivery of operating fuel to an engine, an auxiliary starting fuel system for delivering an additional starting fuel to the engine, a starting fuel valve means connected in the starting fuel system and including a movable valve member movable between a closed and an open position to determine the valve opening and the flow of starting fuel to the engine, means connected to operate the movable valve member during engine starting periods, a stop movably positioned in the path of the movable valve member to limit its movement toward open position, and a temperature responsive operator for the stop controlling its position in accordance with engine temperature whereby the starting fuel to the engine is decreased as the engine temperature increases.

7. A fuel enrichment system for an engine comprising means for supplying a starting enrichment supply of fuel to an engine through a starting fuel flow path, an operator connected to the starting supply means causing the flow of fuel through the starting flow path during engine starting periods, means for supplying a warm up enrichment supply of fuel to the engine through a warm up enrichment flow path, and a temperature responsive device responsive to engine temperature conditions and connected to control the fuel flow through the starting flow path and the enrichment flow path.

8. A fuel enrichment system for an engine comprising means for supplying a starting enrichment supply of fuel to an engine through a starting fuel flow path, a starting flow valve positioned in the starting fuel flow path and movable between closed and open positions, a starting valve operator connected to the starting valve and opening the valve during engine starting, means for supplying a warm up enrichment supply of fuel to the engine through a warm up enrichment flow path, a warm up valve positioned in the warm up fuel flow path and movable between an open and closed position, and a temperature responsive control responsive to condition of engine temperature and connected to said starting valve and said warm up valve and moving said valves toward their closed positions with increase in engine temperature.

9. In an engine operable by a combustible fuel, a fuel supply system comprising means delivering a supply of operating fuel to the engine, a metering device connected to control the supply means, a condition sensing means connected to said metering device to change the flow of fuel to the engine with change of conditions, and a false signal supply element connected to the condition sensing means to change the flow of fuel from that corresponding with existing conditions.

10. In an engine operable by a combustible fuel, a fuel supply system comprising means delivering a supply of operating fuel to the engine, a metering device connected to control the supply means, a condition sensing means operative to sense engine running conditions and connected to said metering device to change the flow of fuel to the engine with change of conditions, a false signal supply element connected to the condition sensing means and operative to induce a false signal in the condition sensing means to increase the flow of fuel to the engine, and a temperature responsive device operated by changing engine temperature conditions and operatively connected to the false signal supply element whereby an

increased amount of starting fuel is fed to the engine when it is cold.

11. In an internal combustion engine having a throttle valve controlled intake manifold, a fuel supply system comprising means delivering a supply of operating fuel to the engine, a metering device connected to control the supply means, a pressure sensing means connected to the intake of the engine downstream of the throttle valve and connected to control the metering device in accordance with manifold pressure, and a fuel enrichment valve connected to the pressure sensing means and operative to bleed higher pressure into the pressure sensing means so that the pressure sensing means receives a false manifold pressure whereby the fuel-air ratio may be increased during starting.

12. A fuel supply in accordance with claim 11 including a temperature responsive fuel enrichment valve operating means connected to the enrichment valve and operative to close the valve as the engine warms up.

13. A fuel supply system for an engine operable on combustible fuel comprising a fuel supply metering device for controlling the flow of fuel to an engine, a supply conduit means leading to the metering device and delivering fuel thereto, an auxiliary supply conduit means also leading to the metering device for supplying additional fuel thereto for engine starting, means controlling the flow of fuel through the auxiliary supply conduit means, and temperature responsive means connected to said control means and causing a flow of fuel through said auxiliary conduit at cold engine starting temperatures.

14. A fuel supply system for an engine operable on a combustible fuel comprising a fuel supply metering device for controlling the flow of fuel to an engine, a supply conduit means leading to the metering device and delivering fuel thereto, a fuel pump delivering fuel through said supply conduit, a flow restriction in said supply conduit, a by-pass valve connected in said supply conduit leading around said flow restriction, and temperature responsive means connected to open said by-pass valve at cold engine temperatures.

15. In a fuel supply system for supplying fuel to an engine with an air intake manifold and operable on a combustible fuel, a fuel metering device controlling the quantity of fuel flow, signal means responsive to engine speed and connected to supply a signal to the metering device to control flow, signal means responsive to intake manifold pressure and connected to supply a signal to the fuel metering device to control flow, and means for falsifying one of the signals and supply the signal to the metering device to influence the flow of fuel irrespective of the true engine signal.

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