Jan. 17, 1961 E. K. MOORE 2,968,152

AIR SEPARATOR FOR MONOFUEL BURNER

Filed Oct. 1, 1956

FIG. 1

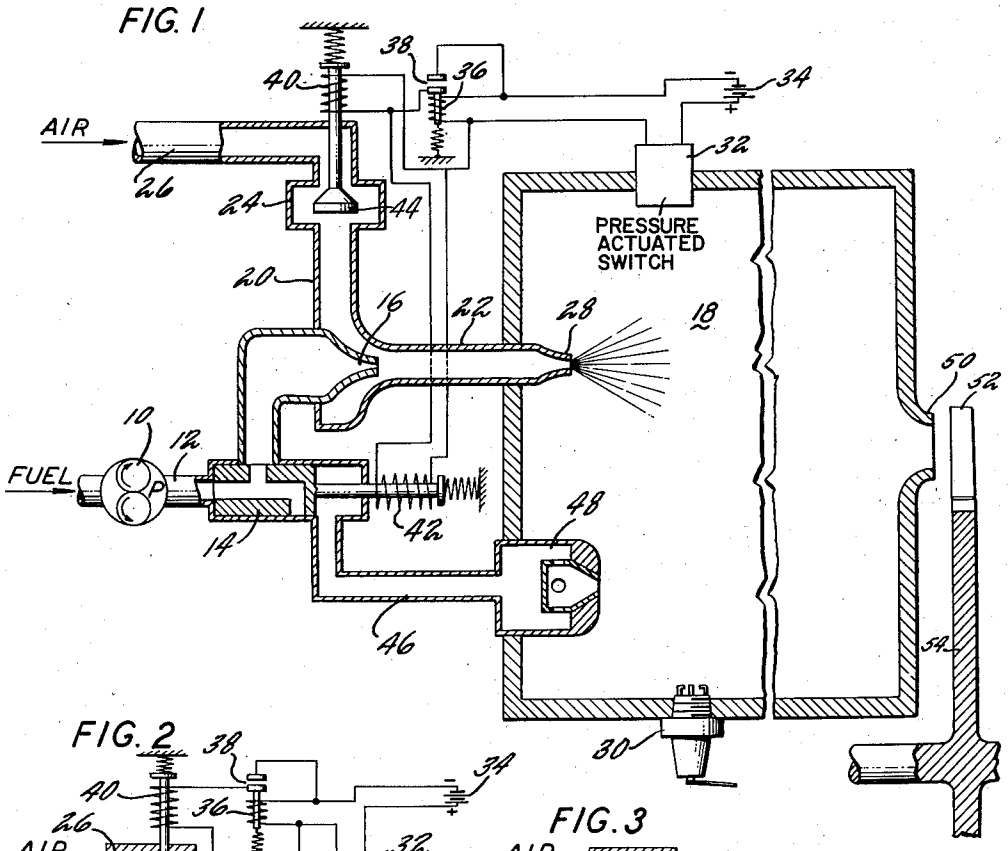


FIG. 2

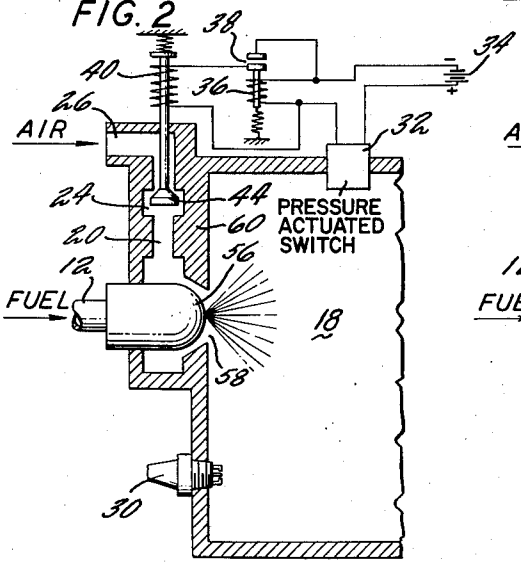
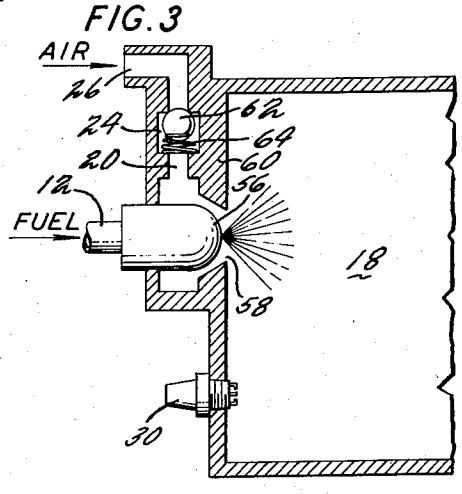


FIG. 3



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AIR SEPARATOR FOR MONOFUEL BURNER

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This invention relates to an air induction fuel atomizer and more particularly to an air aspirator energized by ejection of a monofuel from an atomizing nozzle to draw air into a combustion chamber and mix it with the injected monofuel.

An object of this invention is mechanism which will draw air into a combustion chamber incident to injection of a monofuel.

A further object is mechanism which will utilize the fuel flow to draw air into a combustion chamber and block the air flow to and combustion gas from the combustion chamber after the fuel has been ignited.

A further object is mechanism which will mix a monofuel with air as it is being introduced into a combustion chamber and then automatically block the air passage upon ignition of the fuel.

A further object is mechanism utilizing the energy in the fuel stream for introducing air into a combustion chamber and utilizing the energy in the fuel for blocking the air passage to the combustion chamber.

Other and additional objects will be apparent from the following specification and the attached drawings in which:

Fig. 1 is a schematic side view partly in section of the air induction fuel atomizer having two fuel injection nozzles.

Fig. 2 is a modification of Fig. 1 showing the device with a single fuel injection and atomizing nozzle.

Fig. 3 is a modification of the device shown in Fig. 2, utilizing a different shutoff valve for the air.

In the ignition and burning of some types of monofuels in a combustion chamber, it has been found that when the device is started after a previous firing, unless the exhaust gases are cleared from the combustion chamber or auxiliary air supplied, difficulty may be experienced in igniting the monofuel although the monofuel itself contains sufficient oxidizer to sustain burning after the ignition has taken place.

It has been customary to provide an air purge of the combustion chamber before each firing in order to clear the exhaust gases from the previous firing and introduce a quantity of air necessary for the ignition and initial burning of the monofuel. A separate pump or air pressure source has been used to supply the air to purge the combustion chamber. In order to avoid the necessity for pump purging, this invention utilizes the flow of fuel through the nozzle to suck or aspirate air around the nozzle and mix it with the fuel to initiate combustion. After the fuel is ignited, the air passage is blocked by mechanism which is responsive to the increase in pressure in the combustion chamber, indicating that ignition has satisfactorily taken place.

In the embodiment shown in Fig. 1, monofuel is drawn from a fuel supply, not shown, by pump **10** and introduced under pressure to a pipe **12** and a valve **14** and thence to a nozzle **16** from which it is atomized and discharged into a combustion chamber **18**. A tube **20** is arranged around nozzle **16** and has a portion **22** extending in the direction of the flow of the discharged fuel of the nozzle **16**.

The tubes **20** and **22** form an aspirator which draws air or oxygen through a valve chamber **24** and an inlet pipe **26** either from the atmosphere or any other suitable supply. Fuel discharged from the nozzle **16** is atomized and mixed with the air drawn through the pipes **20** and **22** and the combined air and fuel is discharged through a nozzle **28** into the combustion chamber **18**.

An igniter **30**, shown as an electric spark plug but which may be any suitable type of igniter, is energized simultaneously with the discharge of the fuel-air mixture into the chamber **18** and serves to ignite the mixture. The air introduced with the monofuel provides sufficient oxygen in the neighborhood of the fuel to initiate and sustain combustion even if the chamber were contaminated by burned gases from a previous firing. After the ignition and initial burning of the monofuel, the air supply can be cut off as the monofuel itself contains sufficient oxygen or other ingredients to support combustion without the addition of any air or other oxygen from the outside.

A pressure responsive device such as a pressure actuated switch **32** of any well known type may be used to close the circuit from the power source **34** to an electromagnet **36**, thus closing switch **38** and energizing electromagnets **40** and **42**. Electromagnet **40**, when energized, will lift valve **44** and block the inlet pipe **26** and tube **20**, thus cutting off the supply of air to the aspirator and blocking the flow of any further air to or the escape of combustion gases from the combustion chamber. Energization of electromagnet **42** will move valve **14** to the right as viewed in Fig. 1 and connect the discharge from pump **10** through pipe **46** with a second atomizing nozzle **48** and cut off the flow of fuel to the combined atomizing and aspirating nozzle **16**.

After ignition is started and pressure is built up in combustion chamber **18**, the products of combustion are discharged through a suitable discharge orifice and may be utilized for any desired purpose such as energizing a rocket engine or an engine starter.

Fig. 1 shows an embodiment utilizing the gases in an engine starter having a nozzle **50** directing the combustion gases so as to impinge upon the blades **52** of a turbine wheel **54** which may be used to energize the starter for a turbine-jet or other type of engine.

In the modification shown in Fig. 2, the fuel under pressure in line **12** is led to an atomizing nozzle **56** which is arranged in an orifice **58** of the wall **60**, of the combustion chamber **18** to produce the aspirating action. The orifice **58** is connected by a passage **20** with a valve chamber **24** having a valve **44** therein controlling the inlet passage **26**. A pressure responsive switch **32** is used to close the valve **44** in the same manner as described in connection with Fig. 1 upon the increase in pressure in the combustion chamber **18** incident to ignition of the fuel.

In the modification shown in Fig. 3, the fuel under pressure from pump **10** is led through pipe **12** to the atomizing nozzle **56** in the same manner as described for the modification in Fig. 2. The fuel ejected from the nozzle **56** will aspirate air from the inlet **26** through valve chamber **24** and passage **20** and through orifice **58** in the same manner as described in connection with the device in Fig. 2. In the mechanism of Fig. 3, however, a ball check valve **62** is provided in place of the spring and electromagnetically actuated valve **44** of the device shown in Figs. 1 and 2. Ball check **62** is urged to a closed position by a light spring **64**. Upon the start of the injection of fuel, the pressure reduction around the nozzle **56** will cause valve **62** to open against pressure of spring **64** and thus permit the nozzle **56** to

aspirate air and mix it with the fuel being ejected from the nozzle **56**. Upon ignition of the fuel by the igniter **30**, which acts in a similar manner in all of the modifications disclosed, the increase in pressure in the combustion chamber **18** will react through orifice **58** and passage **20** to increase the pressure on the lower side of the ball **24** and with the assistance of spring **64** close the valve.

Air aspirated by the nozzle and mixed with the fuel thus avoids the necessity for any special power consuming device for purging the chamber prior to ignition.

Although only one embodiment has been shown and described herein, it will be apparent that various changes and modifications may be made in the construction and arrangement of the various parts without departing from the scope of this novel concept.

What is desired to be obtained by Letters Patent is:

1. In a system feeding monofuel to a combustion chamber contaminated with burned gases, an aspirator having an air supply line connecting the atmosphere with said combustion chamber, means discharging said fuel under pressure through said aspirator into said combustion chamber to atomize said fuel and draw air through said line into said combustion chamber and mix said atomized fuel with said air substantially free of said burned gases to provide a relatively easily ignitable mixture and means responsive to the pressure in said combustion chamber, incident to ignition of said discharged fuel, blocking said aspirator air supply line.

2. In combination with means including a nozzle for atomizing and feeding a pressurized monofuel into a burned-gas-contaminated combustion chamber for ignition and burning therein, means for supplying air to said atomized monofuel for the ignition and initial burning of said monofuel comprising an aspirator, energized by the fuel discharge from said nozzle, for drawing air into said combustion chamber and mixing the air with said atomized fuel, means connecting said aspirator with a supply of air at a pressure lower than said fuel, a valve in said connecting means, and means responsive to a pressure rise in said combustion chamber incident to ignition of said fuel and while fuel is being fed to said combustion chamber for closing said valve and blocking said connecting means.

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