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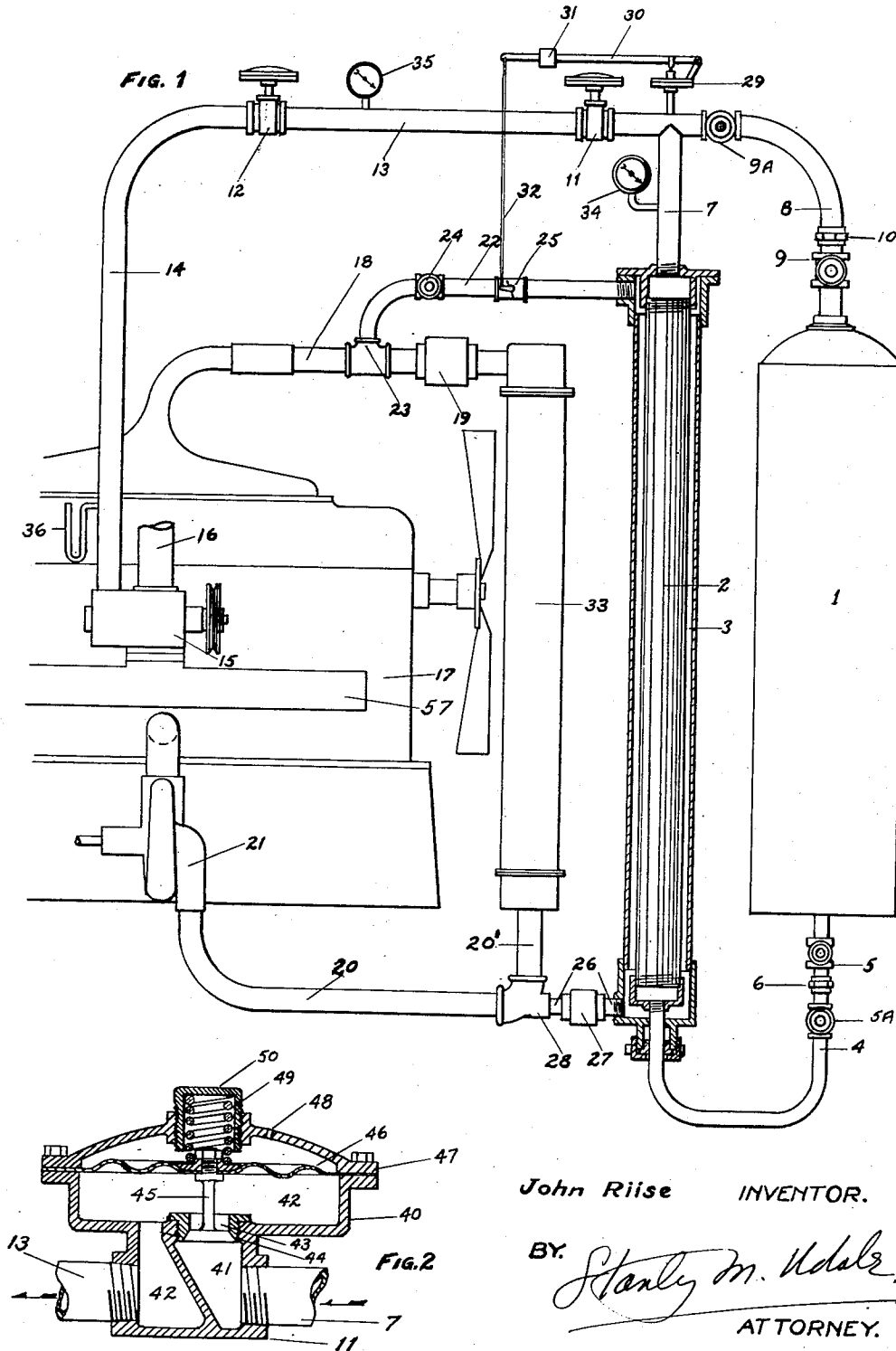
J. RIISE

2,368,680

BUTANE FUEL DEVICE

Filed Feb. 28, 1939

2 Sheets-Sheet 1



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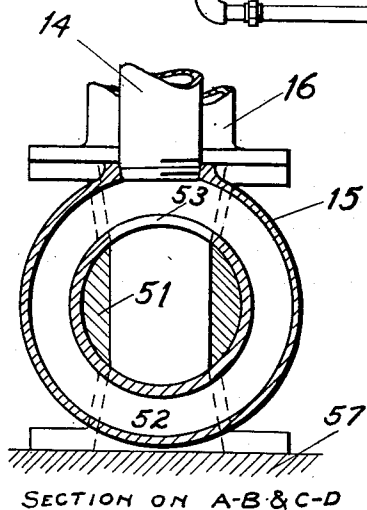
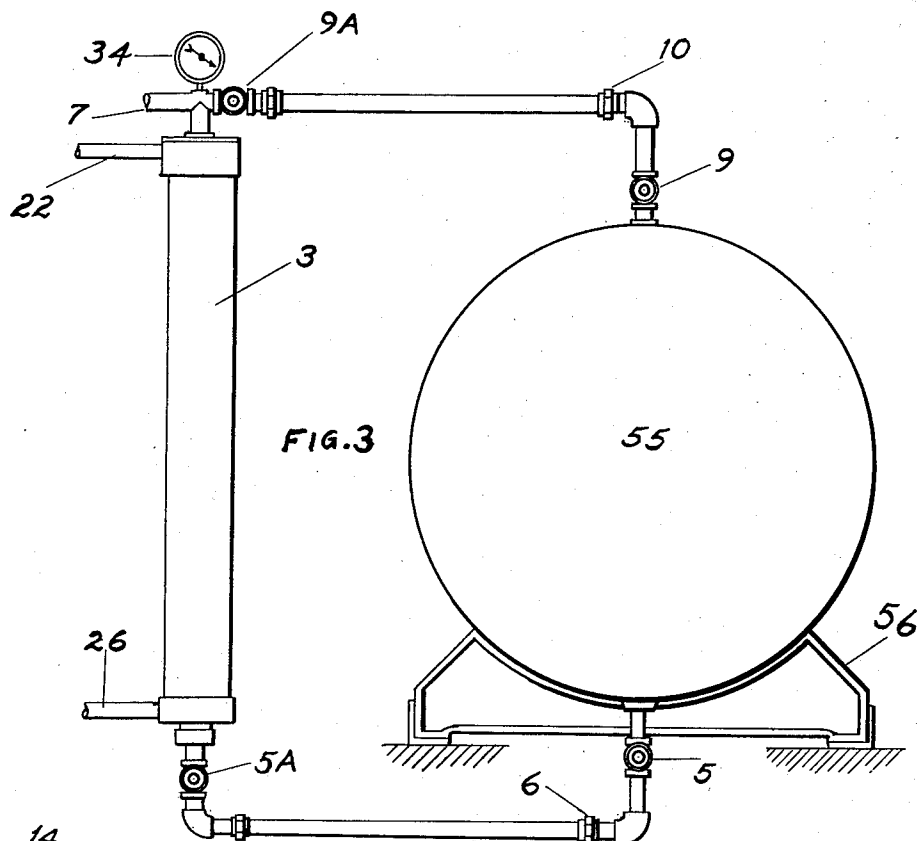


FIG. 5

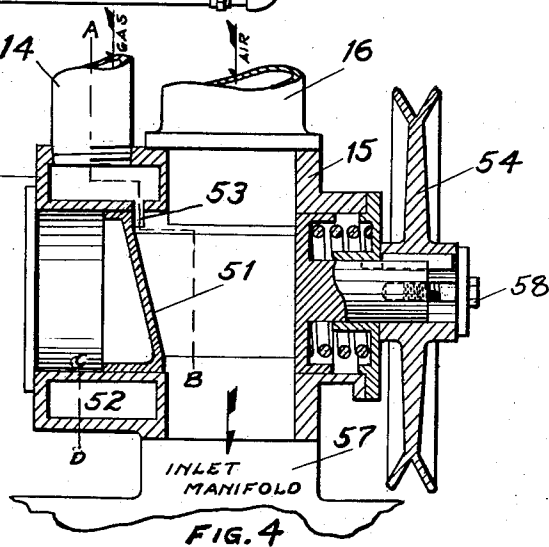


FIG. 4

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2,368,680

BUTANE FUEL DEVICE

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2 Claims. (Cl. 62—1)

The object of this invention is to utilize what is commercially known as butane, but what is actually a mixture of propane, butane, etc., in an internal combustion engine.

This fuel is delivered in tank loads and transferred to the customer's storage tanks, or in smaller cylinders or "bottles." Pressures in these tanks may vary from practically zero to 200 pounds or over, depending on the composition and temperature of the fuel.

Successful use of this fuel in internal combustion engines requires sufficient heat to evaporate the liquid as fast as the engine uses it, the avoidance of dangerously high pressures and the presentation of the fuel vapor to the engine at a practically constant low pressure.

My invention is operative through a wide range of pressure in the fuel tanks and requires no delicate or unstable mechanisms or adjustments.

I provide a fuel storage tank, a smaller heater tank in free communication with the storage tank for circulation of liquid and vapor, means for applying heat to the heater and means operated by the pressure of the vapor to reduce the high and variable pressure at the tanks to a low and practically constant pressure at the engine, said means comprising a plurality of pressure reducing units acting in series to progressively reduce the vapor pressure.

At the engine I pass this vapor through a special mixing valve which maintains the desired proportion of fuel to air by simultaneous adjustment of gas and air ports.

I provide means for controlling the heat applied to the liquid fuel and so proportion and dispose my heater and storage tank that there is at all times a volume of vapor above the liquid available for starting and to take care of sudden demands of the engine.

Fig. 1 shows the form which my invention would take when using the small cylinders or "bottles" in portable jobs, plants or short jobs.

Fig. 2 shows in cross sectional elevation one of the pressure reducing valves.

Fig. 3 shows the arrangement using a large storage tank which is replenished from tank cars or trucks.

Fig. 4 shows in cross sectional elevation the gas mixing valve.

Fig. 5 shows a cross sectional elevation taken on planes A—B and C—D of Fig. 4.

Description

In the figures:

Fig. 1 shows a small fuel tank 1 having a shut off valve 9 on top and a shut off valve 5 at the bottom. A union 10 connects valve 9 to an elbow 8 to which is connected a shut off valve 9A. The bottom valve 5 is connected to another shut off valve 5A by a union 6. The U shaped pipe 4 con-

nects the bottom of tank 1 with the bottom of a heater tank 2 which has a liquid jacket 3.

The top of heater tank 2 is connected through pipe 7, through the shut off valve 9A with the top of tank 1. The heater tank 2 and storage tank 1 are thus in free communication with each other.

As a source of heat I prefer to use the engine cooling liquid (usually water), it is safe and its maximum temperature is limited by the boiling point of the liquid (water). To the usual engine cooling system having a hot water outlet 18, a radiator 33, thermostat 19 and pump 21 and cold water outlet 20' from the radiator and pump inlet 20, I connect a bypass circuit at T 23 between thermostat 19 and hot water outlet 18. This bypass leads through pipe 22, heater jacket 3 and pipes 26 and outlet 28 to pump 21 which maintains the circulation of the cooling liquid in the usual way. A valve 24 serves as hand regulator and shut off for the bypass circuit. If an additional automatic control of the heat is desired, two other means are available: a pressure operated control 25 or a thermostatic valve 27 set to close when the desired maximum pressure (temperature) is reached. The temperature at the bottom of the jacket 3 and of the butane in the bottom of the tank 2 will not differ by many degrees.

The pressure control comprises a damper regulator, indicated at 29, in which a diaphragm or corrugated bellows responsive to pressure in the tanks, raises lever 30 to close the valve 25 by means of a wire 32. A sliding weight 31 regulates the pressure at which valve 25 is closed. The pressure of the vapor is reduced by two pressure reducing valves placed in series 11 and 12.

In Fig. 2 a pressure reducing valve is shown diagrammatically in which the high pressure vapor enters through the T piece 7 and the entrance 41 past the valve 45 which is located in passage 43 in valve seat 44.

A diaphragm 46 is bolted between cover 47 and fuel chamber 40. This diaphragm carries valve 45 and is controlled by a spring 49 located in an adjustable housing 50. An opening 48 admits atmospheric pressure above the diaphragm. The fuel flows out of pressure regulating chamber 42 into the outlet pipe 13.

Gages 34 and 35 indicate the pressure in the tanks and between the reducing valves and a manometer 36 registers pressures in ounces or inches of water, as the vapor flows out of the outlet pipe 14.

I feed the fuel to the engine through a mixing valve 15 shown in section in Figs. 4 and 5 and fully described in my Patent No. 2,031,332 dated Feb. 18, 1936.

Air enters the mixing valve through pipe 16 and gas through pipe 14. A barrel throttle 51 controls both air and fuel. The fuel vapor flows into an annular chamber 52 and through a slot

53 into the middle passage of the barrel throttle.

Adjustment of throttle 51 endwise by screw 58 alters the relative areas of air and gas ports and consequently alters the ratio of fuel to air in the charge. Rotation of the throttle alters the areas of gas and air ports simultaneously while retaining their relation. The charge is thus under positive mechanical control and its proportions are not materially affected by variations in speed, power or suction of the engine.

This positive mechanical control of the mixture and the wide range of pressure allowable in the tanks, together with the progressive reduction of pressure of the fuel to a practically uniform low pressure at the mixing valve, combine to produce a rugged device needing little attention.

I make the heater 2 of liberal proportions to insure adequate heating surface and to provide a sufficient volume of gas above the liquid to facilitate starting. A four inch diameter tube can be used. I prefer to have the top of the heater above the top of the storage tank and I extend the bottom of the heater below the bottom of the storage tank to insure a reserve of fuel when changing tanks.

Operation—(Fig. 1)

To start the engine valves 5, 5A, 9 and 9A are opened. In warm weather the tanks absorb enough heat from the atmosphere to run on. In colder weather valve 24 may be opened.

The engine will start on the gas above the liquid and run on the vapor evaporated by the heat of the liquid and that absorbed from the atmosphere, until the jacket water temperature rises enough to keep evaporation up to engine demands. Thermostat 19 keeps the radiator circuit shut off until the water warms up to around 150 degrees F.

Vapor pressure of liquid	Pounds per square inch (gauge)	
	Butane	Propane
10 degrees F.....	1	32
32 degrees F.....	8	53
60 degrees F.....	24	98
80 degrees F.....	38	134
105 degrees F.....	62	192
130 degrees F.....	93	269

It is evident that at temperatures around zero the proportion of propane in the fuel may be increased or additional heat may be used for starting.

It is also evident that close regulation of the water is not necessary and that hand adjustment of valve 24 is quite practical when using butane. When propane is used the automatic controls 25, 32, 31, 30, 29 may be set to act as limit devices to prevent dangerously high pressures.

Fig. 3 shows a large tank 55 to take the place of the small tank 1 of Fig. 1. Tank 55 is mounted on supports 56 and is connected to the heater 3 by a liquid outlet valve 5 and coupling 6 and also by a vapor valve 9 and coupling 10 on top.

The operation with the large tank is similar to the operation with the small tank.

What I claim is:

1. In a system for preparing gaseous fuel under a low but substantially constant pressure for use in internal combustion engines, a tank adapted to contain liquid fuel under pressure, a chamber for gasifying fuel connected thereto below the level of the liquid therein, means for applying heat to said chamber, a common outlet from the top of said tank and the top of said chamber, said outlet having a primary, high pressure reducing valve and a secondary, low pressure reducing valve acting in series and a control means for the heating means responsive to the pressure in the upper portions of the chamber and tank.

2. In a system for preparing gaseous fuel under a low but substantially constant pressure for use in internal combustion engines, a tank adapted to contain liquid fuel under pressure, a chamber for gasifying fuel connected thereto below the level of the liquid therein, means for applying heat to said chamber, a common outlet from the top of said tank and the top of said chamber, said outlet having a high pressure reducing valve and a control means for the heating means responsive to the pressure in the upper portions of the chamber and tank.

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