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CONTROL FOR FUEL SUPPLY SYSTEMS

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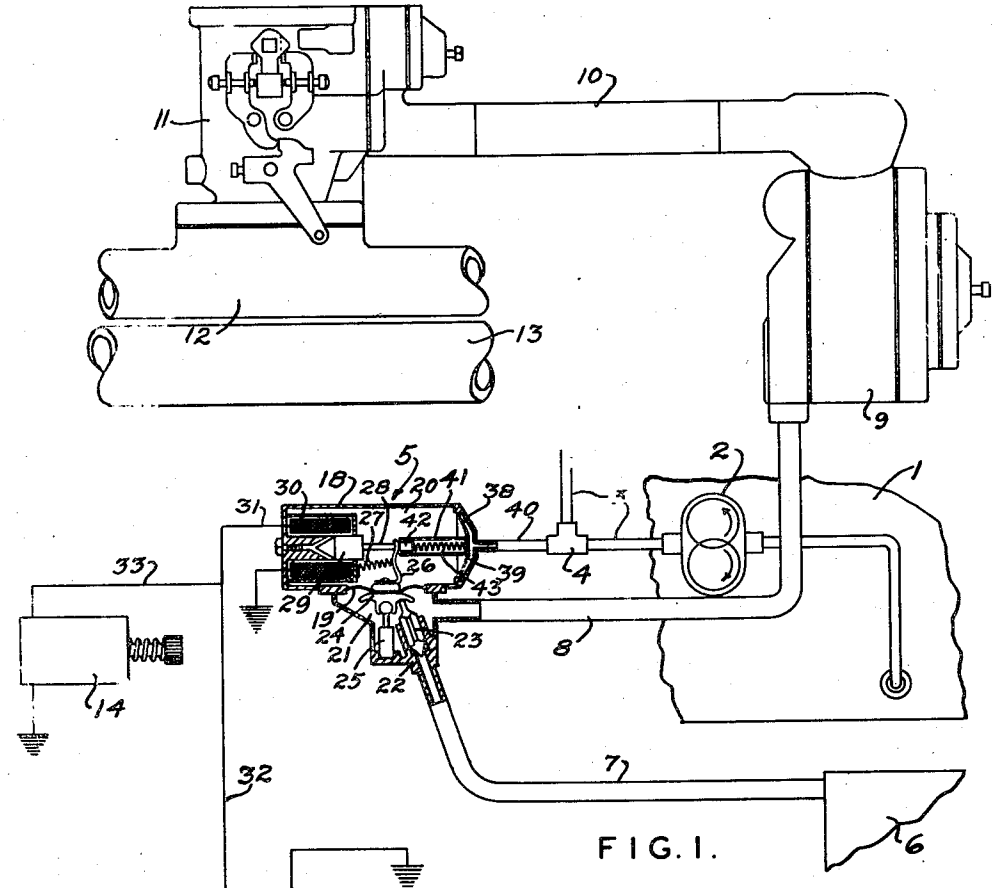


FIG. 1.

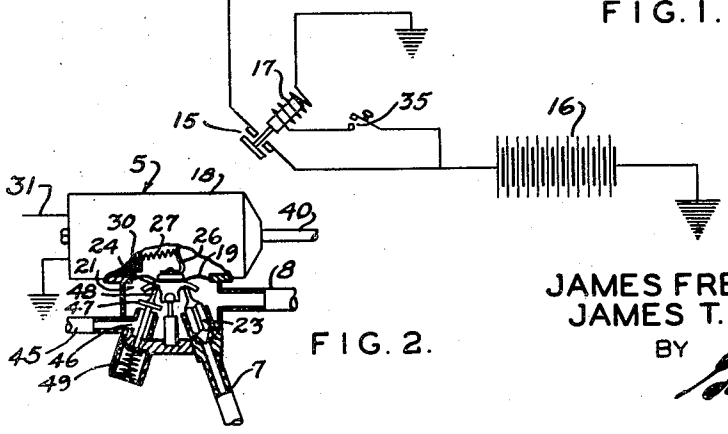


FIG. 2.

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CONTROL FOR FUEL SUPPLY SYSTEMS

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8 Claims. (Cl. 123—179)

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This invention relates to safety valve devices and consists particularly in novel controls for such a device used in connection with the high pressure fuel supply system of an internal combustion engine.

Where an engine combustible fuel supply is normally maintained at superatmospheric pressure as in the case of butane gas, or fed by gravity from an elevated tank, it is desirable to provide a safety device which positively prevents the leakage of the fuel when not needed. It is possible to use the pressure of the engine lubricating system or some other pressure differential as that in the intake or exhaust manifold, which exists when the engine is operating normally, to open a safety valve which at other times serves this purpose. However, means must also be provided to insure the temporary supply of fuel during starting of the engine when the mentioned pressure is not appreciable or sufficient to serve as a valve control.

In some instances, as in motor boats with gravity feed, it is also desirable to drain the supply connections when the engine is out of operation to eliminate fire hazard and such a drainage arrangement may be incorporated with the safety valve.

Accordingly, it is the main object of the present invention to provide a safety valve for the pressure fuel supply system of an internal combustion engine with suitable controls insuring proper opening of the valve during normal running of the engine and also, temporarily, during starting.

It is a more detailed object to provide such a safety valve control system in which the valve is normally closed to prevent leakage of the fuel, but is opened responsive to energizing of the engine self starter and also responsive to the existence of normal pressure in the engine lubricating system.

A further object is to provide safety cut off means of the above type in conjunction with means to drain the fuel supply line when no fuel is required.

These objects and other more detailed objects hereafter appearing are attained by the device illustrated in the accompanying drawing in which

Figure 1 is a diagrammatic representation showing part of an internal combustion engine equipped with the invention.

Figure 2 is a detail section illustrating a modified safety valve device.

The engine 1 is provided with an oil pump 2 which supplies lubricant under pressure to a pipe

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3 leading to various engine parts to be lubricated. This pipe is connected by a T fitting 4 and tube 40 to the right hand extremity of the safety valve device, indicated generally at 5. The engine is provided with a fuel tank 6 for storing a normally gaseous fuel, such as butane, in a high pressure, liquid condition, the tank being connected to the safety valve device by a tube 7. The fuel is led from the safety valve through a pipe 8 to a regulator 9 and thence through a pipe 10 to the carburetor 11 mounted on the engine intake manifold 12. Exhaust pipe 13 extends adjacent the intake manifold in the usual manner. This regulator and carburetor are fully disclosed and claimed in co-pending application, Serial No. 717,932, filed December 23, 1946, in the names of the present inventors. A starter motor is shown at 14, a starter switch at 15 and a storage battery at 16.

The detailed structure of the safety valve is disclosed and claimed in a co-pending application, Serial No. 734,433 filed March 13, 1947 in the names of the present inventors. This device comprises a casing 18 centrally divided by a horizontal flexible diaphragm 19 to form an upper chamber 20 and lower chamber 21. Fuel supply tube 7 terminates in lower chamber 21 through a valve seat element 22 receiving a needle valve 23. Secured to the center portion of the diaphragm is a casting 24 pivotally mounted on a pin 25 projecting from the lower wall of the casing and overlying needle valve 23 so as to urge the same closed when the casting is tilted in a clockwise direction with relation to the figure.

Projecting upwardly from diaphragm 19 is a finger 26 which is constantly urged clockwise by a coil spring 27 so as to normally hold valve 23 tightly closed. Finger 26 at its upper extremity is slidably received on a stem 28 connected at its left end to the armature 29 of an electromagnet 30. This electromagnet is connected by wires 31 and 32 to starting switch 15 controlled by solenoid 17. Wire 32 is also connected by a wire 33 to the starting motor 14. Solenoid 17 is controlled by the usual manual starting switch 35.

At the opposite end of casing 18 there is provided a flexible diaphragm 38 which forms an expansible chamber 39 connected by tube 40 to the oil pressure system. A tube 41 projects leftwardly from diaphragm 38 and slidably receives an enlargement 42 on stem 28 which is constantly urged toward the left by a coil spring 43.

This arrangement is such that upon closing of the starter switch 15 to energize the starting motor, electromagnet 30 is also energized to draw armature 29 to the left, thus tilting finger 26

and casting 24 so as to permit opening of needle valve 23 by the gas pressure. When the engine starts to run under its own power, oil pressure will be built up by the oil pump and will cause diaphragm 38 to move to the left and through tube 20, tilt finger 26 counterclockwise, in the same manner as during starting so as to permit opening of valve 23. Thus, the valve is actuated selectively, responsive to energizing of the starting circuit and also the existence of normal operating pressure in the lubricating system so as to insure the supply of gaseous fuel when it is needed. At other times, spring 27 positively holds the valve closed to prevent leakage of gas.

Figure 2 shows a modified form of safety valve device including oil operated diaphragm 38, sealing diaphragm 19, needle valve 23, and solenoid 30 as in the previous form. Formed in the lower part of the device opposite the needle valve, is a drainage coupling 45 threaded for attachment of a suitable pipe, if desired. This coupling communicates with chamber 21 through an orifice 46 controlled by a poppet valve 47. This valve has an extension 48 disposed to be engaged by actuator casting 24, when it is tilted to open needle valve 23, so as to close port 46. Poppet 47 is urged open by a spring 49 when casting 24 is tilted in the other direction to close needle 23. Thus, when the fuel line 22 is cut off, port 46 is opened to permit the fuel in tube 8 and the safety device to dissipate to atmosphere. This feature is of especial advantage on motor boats where the coupling would be connected to a tube leading outside the hull.

Broadly speaking, a fluid pressure other than the oil pressure, such as the differential pressure normally existing in the intake or exhaust manifold, may be used to actuate diaphragm 38 for the normal running gas supply.

The invention may be modified in this and other respects as will occur to those skilled in the art and the exclusive use of all modifications as come within the scope of the appended claims is contemplated.

We claim:

1. The combination with an internal combustion engine having a battery, a self-starter, a pressure lubricating system, and a source of fluid fuel under superatmospheric pressure, a valve controlling said source, and means responsive individually to normal operation of said starter and said lubricating system to actuate said valve.

2. In combination with an internal combustion engine having a source of fuel under pressure and also having an electrical circuit adapted to be energized and a device which normally creates differential fluid pressure, each as a necessary incident to operation of the engine, a safety valve controlling the supply of fuel from said source, and means individually and alternatively responsive to energization of said circuit and the existence of said differential fluid pressure for actuating said valve.

3. The combination described in claim 2 further including means normally closing said safety valve, said valve actuating means functioning to open said valve, respectively, when said circuit is energized and when said differential pressure is created.

4. In combination with an internal combustion engine having a starter circuit, a battery, a pressure lubricating system, and a source of fuel under pressure, a safety valve controlling the supply of fuel from said source, and means responsive individually to energizing of said starter circuit and the existence of normal pressure in said lubricating system for actuating said safety valve.

5. In combination with an internal combustion engine equipped with a battery, a self-starter circuit, a pressure lubricating system, and a source of fluid fuel normally stored under high pressure, a safety valve controlling the supply of fuel from said source, an electro-magnet adapted to be energized upon closing of said starter circuit, an expansible chamber device connected to said lubricating system, and means operatively connecting said magnet and said device to said valve for opening said valve, respectively, responsive to closing of said circuit and the existence of normal pressures in said system.

6. In combination with an internal combustion engine having a starter circuit and an element normally exposed to differential fluid pressure during operation of the engine, a source of fuel normally maintained under pressure, a safety valve controlling the supply of fuel from said source, a drainage port and a valve controlling the same in the supply line between said source and the engine, and means responsive individually to normal operation of said starter circuit and to the exposure of said element to differential pressures for actuating said safety and drainage valves.

7. In combination with an internal combustion engine having a starter circuit, a pressure lubricating system, a source of fuel under pressure, and a duct connecting said source and the engine, a safety valve controlling said duct, a drainage port and valve controlling the same in said duct between said safety valve and the engine, and means responsive individually to energizing of said starter circuit and the existence of normal pressure in said lubricating system for actuating said valves.

8. In combination with an internal combustion engine having a self-starter circuit, a pressure lubricating system, a source of fluid fuel normally stored under pressure, and a duct connecting said source with the engine, a safety valve controlling said duct, a drainage port and valve controlling the same in said duct between said safety valve and the engine and means operable responsive to the energizing of said starter circuit or the existence of normal pressure in said lubricating system to open said safety valve and close said drainage port said means functioning to close said safety valve and open said drainage valve when said starter circuit is not energized and subnormal pressure exists in said lubricating system.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
872,039	Adams	Nov. 25, 1907
1,718,238	Kettering	June 25, 1929
2,010,960	Pogue	Aug. 13, 1935