United States Patent

[11] 3,592,175

[72] Inventor **William I. Hamilton**
Chicago Heights, Ill.

[21] Appl. No. **781,751**
[22] Filed **Dec. 6, 1968**
[45] Patented **July 13, 1971**
[73] Assignee **Allis-Chalmers Manufacturing Company**
Milwaukee, Wis.

[54] **PRESSURIZED FUEL SYSTEM**
7 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **123/136,**
123/119, 123/139, 137/565
[51] **Int. Cl.** **F02d 23/02**
[50] **Field of Search** ..... 123/119 C,
136, 137, 138, 139, 139.16, 139.18

[56] **References Cited**

UNITED STATES PATENTS

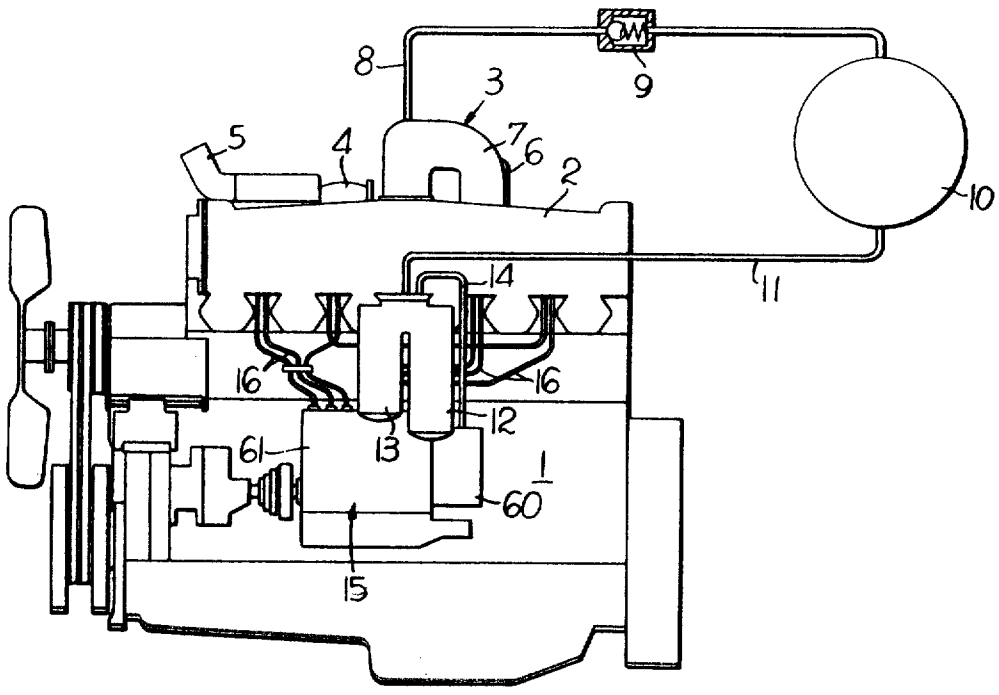
1,097,365	5/1914	Ritz-Woller	123/139.16
1,325,266	12/1919	Smith	123/119 C
1,396,976	11/1921	Spelts, Jr.	123/119 C
1,413,419	4/1922	Moss	123/119 C
1,471,417	10/1923	Rateau	123/119 C
1,830,732	11/1931	Almen	123/119 C
2,794,431	6/1957	Ginnow	123/136

OTHER REFERENCES

FUEL INJECTION AND CONTROLS FOR INTERNAL COMBUSTION ENGINES by P. G. Burman & F. DeLuca Simmons-Boardman Pub. Corp, New York copyright 1962 (pg. 233)

Primary Examiner—Laurence M. Goodridge
Attorneys—Arthur L. Nelson, Charles L. Schwab and Robert B. Benson

ABSTRACT: A fuel system pressurized by an engine supercharger.



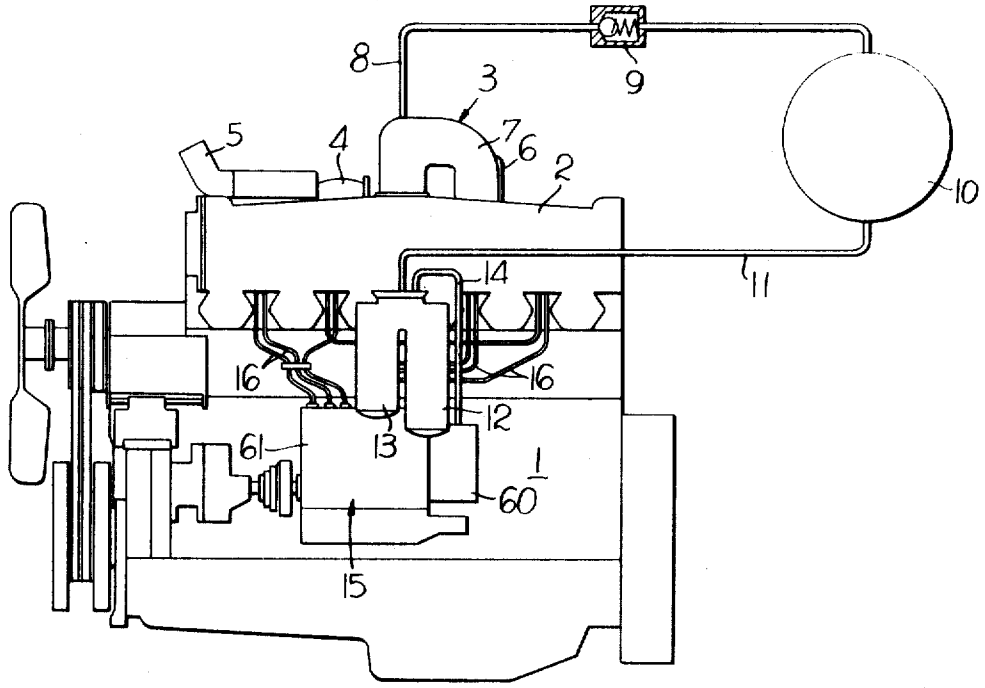


Fig.-1

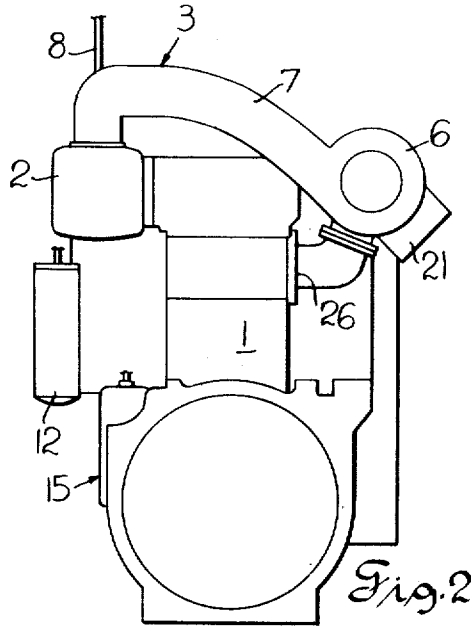


Fig.2

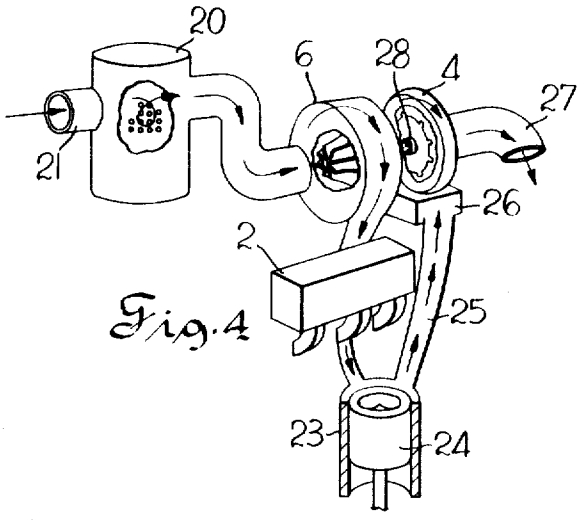


Fig.4

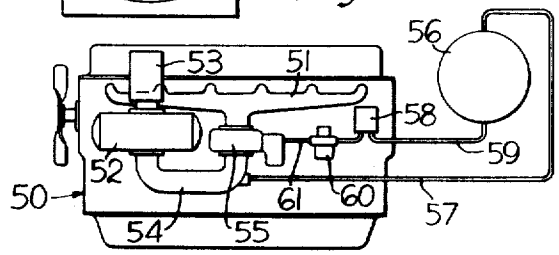


Fig.3

Inventor
William J. Hamilton
By
Attorney

PRESSURIZED FUEL SYSTEM

This invention relates to an internal combustion engine and more particularly to a supercharger pressurized fuel system.

The conventional internal combustion engine includes a fuel supply and a fuel feeding means at the intake to the combustion chamber. A fuel line from the fuel supply to the fuel feeding means at the engine intake transfers the fuel in response to a pressure differential created in the fuel line. Earlier automobile engines employed a gravity feed which produced a hydrostatic head causing the fuel to flow through the fuel lines. Due to the varied used today of the internal combustion engine the engine is often in a position where the fuel tank is not above the fuel feeding means, and also because of other forces acting on the fuel supply and fuel in the fuel line, the gravity feed has become impractical in many respects. Accordingly, this type of a fuel system has been outdated.

Fuel pumps are now included in most fuel supply lines which create a suction in the fuel line to draw the fuel from the fuel tank. These systems are an improvement but are not entirely satisfactory. These fuel systems often use a filter and the fuel pump draws the fuel through the fuel filter which produces an added restriction to the flow of fuel in the line. The fuel filters must be replaced and installed, which necessitates the bleeding of the fuel filters. The lower than atmospheric pressure in conventional fuel lines increases the possibility of air entering the fuel line. Fuel injectors used diesel engines are sensitive to restrictions on a suction side of the fuel supply. The fuel tanks and particularly gasoline fuel tanks, permit the evaporation of a substantial amount of fuel to the atmosphere. This not only is a loss of fuel but it also adds to the pollution of atmosphere which is becoming a problem in congested areas. A sealed fuel line system which pressurizes the fuel tank will overcome this evaporation problem. Accordingly, this invention will overcome the above disadvantages and provide a more positive fuel feeding system.

The supercharger used on the internal combustion engine provides a source of air pressure which is connected to the fuel tank. A check valve in an air conduit leading from the supercharger to the fuel tank maintains a residual pressure in the tank. Accordingly the fuel line will carry a higher a higher pressure which will prevent air from leaking into the line even if a fuel pump is used in the fuel line. It is possible to use a supercharger alone to pressurize the fuel tank causing the flow from the fuel supply through the fuel line to the fuel feeding means.

It is an object of this invention to provide a pressurized fuel tank for pressurizing the fuel system of an internal combustion engine.

It is another object of this invention to provide a supercharger pressurized fuel tank for increasing the pressure on the fuel supply end of the fuel line.

It is a further object of this invention to provide a turbocharger pressurized fuel supply to increase the pressure on the fuel line and create a higher than atmospheric pressure on the fuel supply line.

The objects of this invention are accomplished by using a source of air pressure such as a blower which may be used to suprecharge the internal combustion engine and for pressurizing the fuel tank. A connection between the blower or supercharger and the fuel tank may include a check valve to maintain the residual pressure in the fuel tank. The fuel line may or may not include a fuel pump and fuel filter through which the fuel will flow as it is transferred to fuel feeding mechanism. The fuel feeding means may be a carburetor-type of fuel and air mixing system or the fuel injection-type of fuel feeding means.

The preferred embodiments of this invention will be described in subsequent paragraphs and are illustrated in the attached drawings.

FIG. 1 is a side elevation of an internal combustion engine having a supercharger pressurized fuel tank.

FIG. 2 is an end view of the engine shown in FIG. 1.

FIG. 3 is a modification wherein a Roots blower is used to pressurize the fuel supply at a gasoline engine.

FIG. 4 is a schematic illustration of a turbocharger and fuel feed system.

Referring to the drawings FIGS. 1 and 2 illustrate a diesel engine 1 having an intake manifold 2 and a turbocharger 3. The turbocharger includes an exhaust turbine 4 driven by exhaust gases which are exhausted through the exhaust pipe 5. The turbine 4 drives a turbocompressor 6 which feeds into the intake air transfer conduit 7 connected to the intake manifold 2.

The turbocompressor pressure is transmitted through the air pressure conduit 8 containing a check valve 9 connected to the fuel tank 10.

The fuel system includes fuel tank 10 and the fuel line conduit 11 which is connected to a primary and secondary filters 12 and 13 which in turn are connected by fuel line conduit 14 connected to the fuel pump means 15. Fuel pump means 15 includes a transfer pump 60 for providing suction in the conduit 14. The fuel injection pump 61 pressurizes the fuel from transfer pump 60 and also provides the timing for the injection of fuel to the plurality of conduits 16.

FIG. 4 illustrates schematically a turbocharger system in which an air cleaner 20 connected to an air inlet 21 supplies the air to the turbocompressor 6. Turbocompressor pressurizes air and forces the air into the intake manifold 2 which in turn directs the air into the cylinder 23 of the internal combustion engine. The piston 24 reciprocates within the cylinder 23 and operates as conventional reciprocating engine.

The exhaust side of the internal combustion engine exhausts the exhaust gases through the passage 25 to the exhaust manifold 26 which is in communication with the exhaust turbine 4.

The exhaust turbine 4 is driven by the exhaust gases which pass through the turbine 4 and are exhausted through the exhaust pipe 27. The exhaust turbine 4 drives the turbocompressor by means of a shaft 28. It is the pressure from the turbocompressor 6 which is used to pressurize the fuel tank 10.

Referring to FIG. 3 a gasoline engine is illustrated. The pressurizing means is similar to that shown in FIGS. 1 and 2. The engine 50 is provided with an intake manifold 51. A Roots blower 52 receives air through the air filter 53. The air inlet conduit 54 receives air from the Roots blower 52 which is supplied to the carburetor 55 which provides the air fuel mixture to the intake manifold 51. The fuel tank 56 is pressurized by means of a conduit 57 connected between the air inlet conduit 54 and the fuel tank 56. A fuel filter 58 is positioned in the fuel conduit 59. A fuel pump 60 receives the fuel and pumps it through the fuel line conduit 61 and the carburetor 55.

It is understood that the supercharger as shown is used in conjunction with a fuel pump on the engine. Fuel pumps on the conventional engines of today are standard equipment. With pressure in the fuel tank 56 or 10 it is possible under some circumstances that a fuel pump would be eliminated. This is particularly true if a filter were not used in a fuel line. For most satisfactory and positive operation, however, a fuel pump would be used since it creates a better pressure control from the fuel supply to the fuel feeding means for the engine.

The preferred embodiments of this invention have been illustrated and described and their operation will be described in the following paragraphs.

For the purpose of illustration FIGS. 1, 2 and 3 will be used to describe the operation. The engine 1 while in operation expels exhaust gas from exhaust manifold 26 which pass through the exhaust turbine 4 and are exhausted through the exhaust pipe 27. The exhaust turbine 4 drives the turbocompressor 6. The turbocompressor receives air through the inlet pipe 21 and the air filter 20 and pressurizes the air which passes into the intake manifold 2. The air in the transfer conduit 7 is pressurized. The pressure in the transfer conduit 7 is tapped by the pressure conduit 8 which is in communication with fuel tank 10. The check valve 9 permits unidirectional flow through conduit 8 and maintains the pressure in the tank in response to

the pressure in the turbocompressor 3. The check valve 9 maintains a more constant pressure in the fuel tank and does not transmit the pressure fluctuations from the turbocompressor 3.

The fuel tank 10 supplies fuel through the fuel line conduit 11 to the filters 12 and 13. The fuel then passes through the fuel line conduit 14 to the transfer pump 60. The transfer pump 60 supplies fuel to the fuel injection pump 61 which in turn provides injection fluid pressure to the plurality of fuel injection lines 16 for the diesel engine.

The pressurizing of the air supplied to the intake manifold is used to maintain the pressure on the fuel tank which in turn maintains a pressure in the fuel line. The fuel transfer pump is also used to provide a suction on the fuel feeding end of the fuel line. The pressurized fuel tank is helpful in bleeding of the fuel filters because it keeps the air out of the fuel line during normal operation. The control of the fuel pressure to the fuel injection pump is more constant and accordingly the fuel injection pump is less sensitive to pressure changes and this in turn provides better engine performance.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows: I claim:

1. A closed pressurized fuel injection system for an internal combustion engine comprising, a fuel supply tank, a fuel feeding means including a fuel injection pump for feeding fuel to said internal combustion engine, a fuel supply line connecting said fuel supply tank with said fuel feeding means, a source of pressurized air adapted for supplying combustion air to said engine, an air conduit directly connecting said source of pressurized air to said fuel supply tank, said source of pressurized air continuously pressurizing the supply tank and said fuel supply line thus maintaining a higher than atmospheric pressure in said fuel supply line, a fuel pump in said fuel supply line producing fuel flow and maintaining pressure on the fuel supplied to said fuel feeding means to thereby provide an enclosed and pressurized fuel injection system.

2. A pressurized fuel system as set forth in claim 1 wherein said air conduit from said source of pressurized air to said fuel tank includes a check valve for unidirectional flow of pressurized air and maintaining a residual pressure in said tank.

3. A pressurized fuel system as set forth in claim 1 wherein said source of pressurized air comprises an air blower for connection to said fuel supply tank.

4. A pressurized fuel system as set forth in claim 1 wherein said fuel supply line includes a fuel filter between said fuel tank and said fuel pump for filtering the fuel flowing through said supply line.

5. A pressurized fuel system as set forth in claim 1 wherein said source of pressurized air includes a supercharger for connection to an internal combustion engine for pressurizing said fuel supply tank.

6. A pressurized fuel system as set forth in claim 1 wherein said source of pressurized air includes a turbocharger pressurizing said fuel supply tank.

7. A pressurized fuel system as set forth in claim 1 wherein said source of pressurized air includes an air filter for filtering the air supplied for pressurizing said fuel supply tank.