May 30, 1933. W. R. GRISWOLD 1,911,950

FUEL PUMP FOR INTERNAL COMBUSTION ENGINES

Filed April 19, 1930

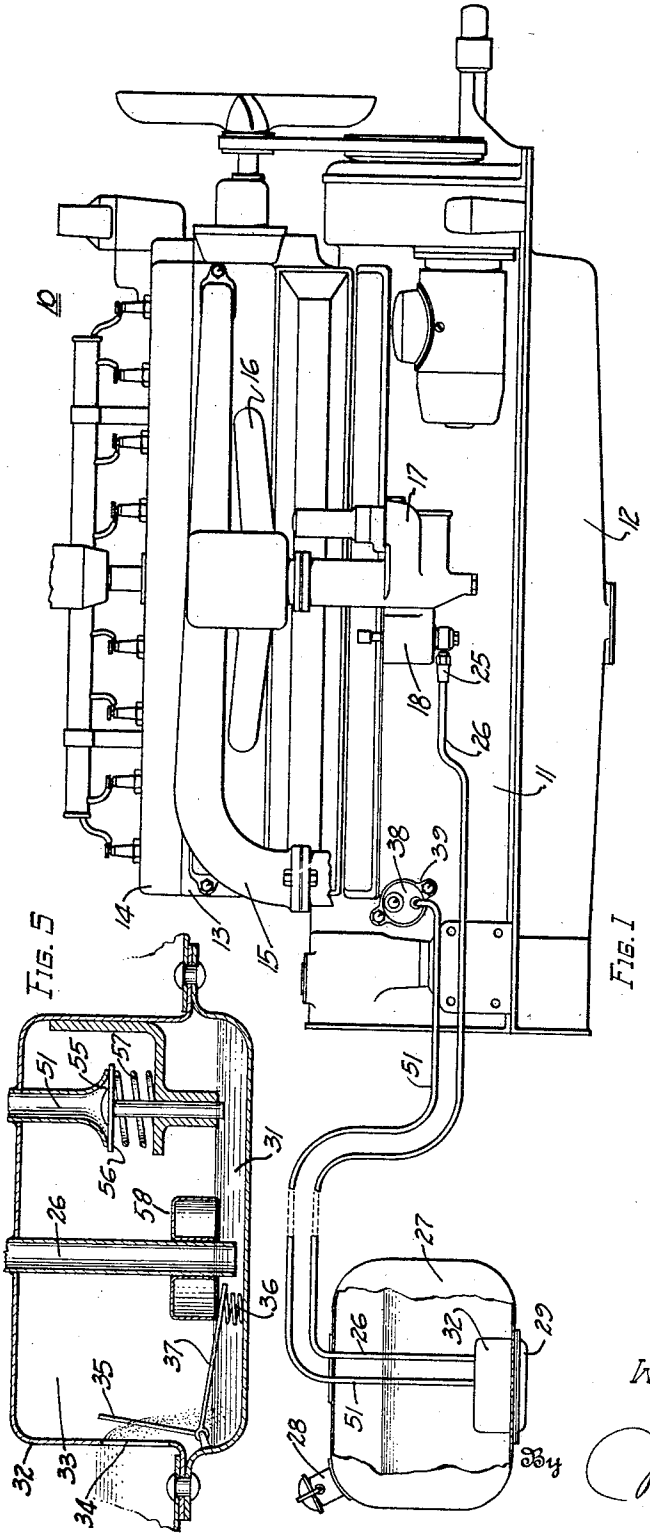


FIG. 1

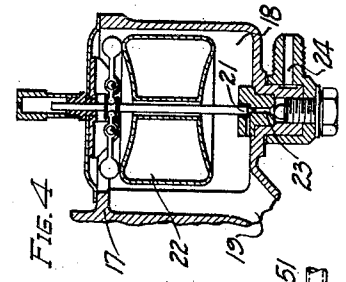


FIG. 4

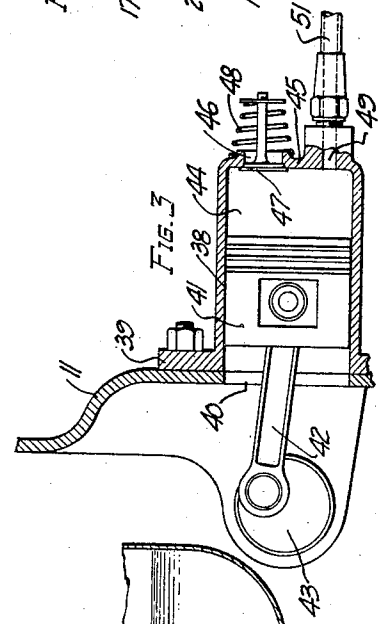


FIG. 3

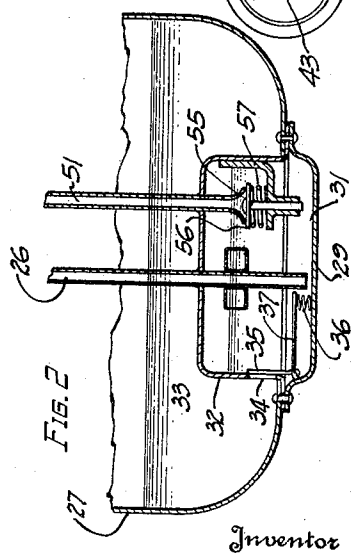


FIG. 2

FIG. 5

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UNITED STATES PATENT OFFICE

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FUEL PUMP FOR INTERNAL COMBUSTION ENGINES

Application filed April 19, 1930. Serial No. 445,762.

This invention relates to internal combustion engines and more particularly to the fuel supply system for the engines of motor vehicles.

It is frequently convenient to carry the supply of liquid fuel for such engines in a tank located on the vehicle at a distance from and at a level below that of the engine carburetor, and it is then necessary to raise the fuel to the carburetor level before it can be used.

The feeding of liquid fuel to the engine under these conditions has heretofore been effected in various ways. The arrangement in most common use for this purpose utilizes the suction or depression of the engine intake manifold to raise the liquid fuel from the main fuel tank to an auxiliary tank located above and close to the engine carburetor, from which it is fed to the carburetor by gravity. It has also been proposed to mechanically pump fuel from the main or storage tank to the engine by a pump driven from the engine, and air pressure has also been used to force liquid fuel from the storage tank to the engine carburetor.

These various devices as heretofore proposed have been open to certain objections. The vacuum system of feeding fuel has not been uniformly satisfactory, particularly for continuous full load operation of the engine, because under these conditions the available vacuum is usually lowest at the time when the demand for fuel is the greatest, so that engines are frequently unable to supply themselves with sufficient fuel. Furthermore, both the vacuum feeding system, and the direct pumping of fuel, subject the liquid fuel to considerable heat, before it reaches the mixing chamber of the carburetor, and frequently this results in partially gasifying the fuel which is then unable to pass through the carburetor nozzle or other restricted passages. This results in shutting off the supply of fuel and consequent stopping of the engine.

The pumping of fuel by compressed air, as heretofore practiced, requires an elaborate system in which the main fuel tank, and the entire length of piping between the engine, the pump and this tank, must be maintained substantially airtight. In practice this has been extremely difficult to accomplish. Moreover, in such systems, it is necessary to provide air presure in the tank before fuel can be fed for starting the engine, and as such preliminary pressure must be supplied by separate means, such as a manually operated pump, considerable delay occurs in starting the engine after it had been stopped for any considerable time.

The present invention provides a system for feeding fuel in which these and other faults of previously known systems are overcome, and an adequate supply of liquid fuel to the engine carburetor is insured under all conditions.

One of the objects of the invention is to provide a simple and effective system for supplying liquid fuel to the carburetor of an internal combustion engine.

Another object of the invention is to provide a fuel feeding system for internal combustion engines, which is not dependent upon engine suction, and in which the liquid fuel is not exposed to heat from the engine or from other sources.

Another object of the invention is to provide such a system in which the liquid fuel is directly moved by air pressure but without preliminary pumping or priming of a pump, and in which it is not necessary to maintain the main fuel storage tank air tight.

A further object of the invention is to provide a fuel supply system which shall operate to increase the fuel supply upon an increase in engine speed.

Other objects of the invention will appear from the following description taken in connection with the drawing, which forms a part of this specification, and in which:

Fig. 1 is a side elevation of an internal combustion engine showing an application of this invention thereto, part of the fuel feeding system being broken away;

Fig. 2 is a sectional view, to a larger scale, of the fuel tank and associated parts of the fuel feeding system shown in Fig. 1;

Fig. 3 is an enlarged sectional view of the pumping device;

Fig. 4 is an enlarged sectional view through a part of the engine carburetor, and

Fig. 5 is an enlarged view of part of the construction illustrated in Fig. 2, showing some of the parts in another position.

Referring to the drawing, at 10 is indicated generally an internal combustion engine having a crank case 11 provided with a cover or oil pain 12, and having a cylinder block 13 provided with a head 14. The engine has the usual exhaust manifold 15, and an intake manifold 16 through which fuel mixture is supplied to the engine cylinders from a carburetor 17. As shown in Fig. 4, the carburetor 17 is connected to a control or float chamber 18 by a passage 19, through which it receives liquid fuel, the level of the fuel in the float chamber being regulated by a needle valve 21, operated through suitable linkage from a float 22 immersed in the liquid fuel. This valve 21 controls a fuel inlet passage 23, communicating with a passage 24, which is in turn connected by any suitable coupling, such as shown at 25, to a fuel pipe or conduit 26 extending to the source of fuel supply.

The source of fuel supply is illustrated as a fuel tank 27 of any well known form, which is usually located at a distance from and somewhat below the level of the carburetor 17, and which is provided with the usual filler tube or opening 28 having a removable cap. The bottom of the tank 27 is preferably provided with a depressed portion 29 forming a sump 31, which is the lowest part of the tank. Inside the tank and over the portion 29 is a housing 32 which forms with the sump a closed chamber 33, preferably air tight or substantially so. The fuel conduit 26 enters the tank 27 and extends through the housing 32 into this chamber 33, terminating in the sump 31 close to the lowest portion thereof.

The housing 32 is also provided with an opening 34 through which the chamber 33 communicates with the interior of the main tank 27 and which constitutes a fuel inlet port for the chamber. This port is adapted to be closed by a suitable valve 35, which may be of any desired form, but which is illustrated as a simple flap valve. This valve 35 is adapted to be opened by the pressure of the fuel in the tank 27, and to be closed by pressure within the chamber 33, and it assumes either its open or closed position in accordance with the higher of these pressures. In the embodiment disclosed it is biased toward its closed position by a light spring 36, acting on a lever arm 37 secured to the valve and projecting into the chamber near the bottom thereof. This arm permits the valve 35 to be positively opened without regard to the pressure within the chamber, by means and for a purpose presently to be described.

This pumping means of this invention is shown as mounted on the engine 10, preferably on the crank case thereof. It consists of a pump cylinder 38 having base lugs 39 by which it is secured in any suitable way over an opening 40 in the wall of the crank case 11. In the cylinder is provided a piston 41 actuated through a connecting rod 42 from any convenient moving part of the engine, as from a crank or eccentric 43 on the end of the engine cam shaft (not shown). This piston actuating mechanism is preferably designed so that the stroke of the piston 41 is short relative to the length of the cylinder 37, there being an expansion space 44 in the end of the cylinder beyond the extreme limit of piston travel, so that the compression ratio of the pump is comparatively low, thus limiting its maximum pressure. In practice, the pump is so arranged as to develop a pressure of from two to three pounds per square inch at maximum speed. In the head 45 of the cylinder 38 is provided an inlet port 46, which is controlled by a suitable valve 47 such as the poppet valve shown. This valve is urged to its seat by a spring 48 of usual form. By reason of the location of the valve 47 in the cylinder head, and its communication with the space 44, it will be seen that on each inward or suction stroke of the piston 41 the space 44 is reduced to atmospheric pressure. To this end the valve 47 is made of ample size to insure that there is no residual pressure in the space 44 at the end of the suction stroke of the pump. The cylinder head 45 is also provided with an outlet port 49 which is connected in any convenient way to a pressure pipe or conduit 51 which extends to and through the main fuel tank 27, and passes through the housing 32, terminating in the chamber 33 in the central or upper portion thereof.

The terminal of the pressure conduit 51 constitutes an air port 55, which is closed by a valve 56 of any suitable form, and is adapted to be opened by the pressure of air in the conduit 51 against a suitable spring 57.

The operation of the device as above described will be readily understood. While the engine 10 is running, the pump piston 41 is actuated to pump air through the conduit 51 to the interior of the chamber 33, this air being pumped in a series of waves or puffs, interspersed with periods or intervals of atmospheric pressure, by reason of the pump construction and the valve 47 as already described. This arrangement subjects the closed chamber 33 to a fluctuating, periodic pressure, the fluctuation extending from atmospheric pressure during

the suction stroke of the pump up to its maximum of from two to three pounds during the pressure stroke thereof. Thus on each pressure stroke of the pump, the valve 56 will be opened by the resulting puff of air, and the pressure will be increased within the closed chamber 33, this pressure at the same time closing the valve 35. On each suction stroke of the pump the pump space 44 and the associated pressure conduit 51 are reduced to atmospheric pressure, so that the valve 56 may be closed by its spring 57, while the valve 35 is permitted to open under the pressure head of the fuel in the tank 27, which is sufficient to overcome the light spring 36. During each of the successive pressure intervals, a quantity of liquid fuel will be forced by the increase of pressure in the chamber 33, upwardly through the conduit 26 to the inlet passage 24 of the carburetor, and if the level of fuel in the float chamber 18 is such that the valve 21 is open, this fuel will enter the float chamber and be available for use in the engine. The withdrawal of fuel from the chamber through the conduit 26 provides space in the chamber for the admission of fuel from the main tank or reservoir, which occurs during normal engine operation, upon every suction stroke of the piston 41.

To obviate any possibility of maintaining sufficient air pressure in the housing 33 to prevent opening of the valve 35, and reducing the level of fuel in the chamber 33 below the end of the conduit 26, means is provided in the chamber to insure opening of the valve. This means is illustrated as comprising a float 58 of annular construction surrounding the conduit 26, which acts as a guide, and is supported by the fuel in the chamber, wherein it rises and falls with the level of said fuel. Near its lowermost position in the sump 31 it is adapted to contact the end of the lever arm 37, and it is of sufficient weight to overcome the light spring 36 connected to this arm so as to positively open the valve 35 against any air pressure which may exist in the upper part of the chamber, as clearly shown in Fig. 5. The opening of this valve 35 permits the immediate filling of the chamber 33 with fuel from the main fuel tank 27, after which the system resumes its normal operation in which the valve position is determined by the pressure of the fuel in the tank 27 and the pressure of the air in the chamber. In this way all danger of pumping the chamber dry, with consequent stopping of the engine, is obviated.

While a specific embodiment of the invention has been herein described, which is deemed to be new and advantageous and may be specifically claimed, it is not to be understood that the invention is limited to the exact details of the construction, as it will be apparent that changes may be made therein without departing from the spirit or scope of the invention.

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

1. In a fuel feeding system having a fuel supply tank, a pressure chamber in said tank, an outlet conduit extending within said chamber, means to periodically vary the air pressure in said chamber, admitting air thereto, pressure responsive means in the chamber for pressure responsive means to admit fuel to said pressure chamber during periods of low pressure therein, and means including a float having a guiding connection with the conduit to admit fuel regardless of said pressure when the level of fuel in the chamber becomes low.

2. In a fuel feeding system having a fuel supply tank, a pressure chamber in said tank, fluid pressure means including a conduit to periodically expel fuel from the chamber, a valve in the chamber operable in response to the pressure created by said fluid pressure means to admit fluid under pressure to the chamber, a valve operable in response to pressure in said chamber to admit fuel from the tank to the chamber between the said periods, and means including a float having a guiding connection with said conduit and located in said chamber operable to open said fuel valve regardless of pressure in the chamber upon a predetermined fall of fuel level in said chamber.

3. In a liquid feeding system which includes a liquid supply tank connected with a housing therein defining a pressure chamber and conduits communicating with the housing and extending interiorly thereof, control mechanism comprising a pressure responsive valve in the pressure chamber controlling the passage of liquid from the supply tank to the housing, and a float interiorly of the housing associated with one of the conduits and adapted to regulate the valve to admit liquid from the supply tank to maintain a predetermined level in the housing.

4. In a liquid feeding system which includes a liquid supply tank connected with a housing therein defining a pressure chamber and a liquid outlet conduit communicating with the housing and extending interiorly thereof, control mechanism comprising a pressure responsive valve in the pressure chamber controlling the passage of liquid from the supply tank to the housing, and a float encircling the outlet conduit interiorly of the pressure chamber and being freely slidable on the conduit, said float being adapted to open and close said valve to maintain a predetermined level in the housing.

5. In a liquid feeding system which comprises an air compressing pump, a liquid supply tank having a housing therein defining a pressure chamber, air inlet and fluid outlet conduits communicating with the housing, a spring-pressed valve in the housing associated with the air inlet conduit to admit air pressure to the interior of the housing, a spring-pressed valve in a wall of the housing communicating with the interior of the supply tank, and a float in the housing encircling the outlet conduit adapted to control said liquid inlet valve to maintain a predetermined low level of liquid in the housing.

6. In a liquid feeding system which includes a liquid supply tank connected with a housing therein defining a pressure chamber and a conduit in said housing, control mechanism comprising a pressure responsive valve in the pressure chamber associated with the air inlet conduit to admit air pressure to the interior of the housing, control mechanism comprising a pressure responsive valve in the chamber controlling the passage of liquid from the supply tank to the pressure chamber, and means including a float having a guiding connection with said conduit for regulating the liquid valve position to automatically maintain a predetermined level of liquid in the housing.

In testimony whereof I affix my signature.

WALTER R. GRISWOLD.

CERTIFICATE OF CORRECTION.

Patent No. 1,911,950. May 30, 1933.

WALTER R. GRISWOLD.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, line 55, for "presure" read pressure; page 2, line 12, for "pain" read pan; page 3, line 77, claim 1, after "chamber" insert the words pressure responsive means in the chamber for; and lines 78 and 79, same claim, strike out the words "in the chamber for pressure responsive means"; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 14th day of November, A. D. 1933.

F. M. Hopkins

(Seal) Acting Commissioner of Patents.