Dec. 6, 1938. C. W. McKINLEY ET AL 2,139,373

ELECTRIC FUEL PUMP

Filed Jan. 13, 1936 2 Sheets-Sheet 1

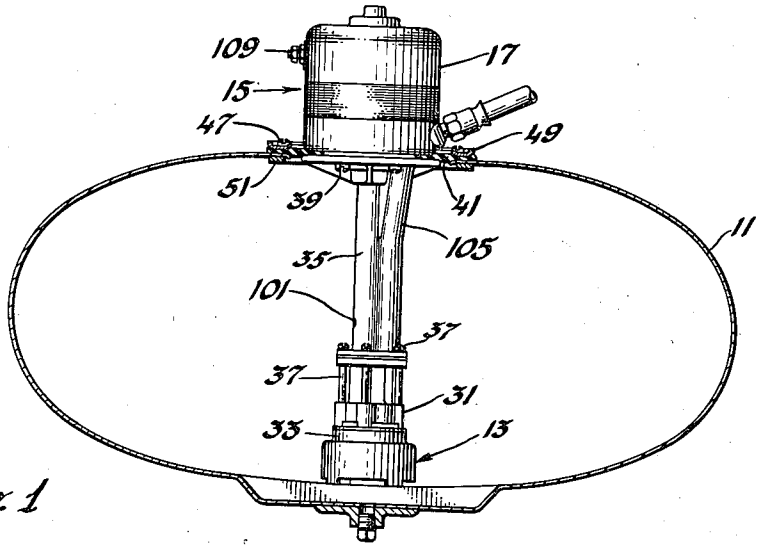

Fig. 1

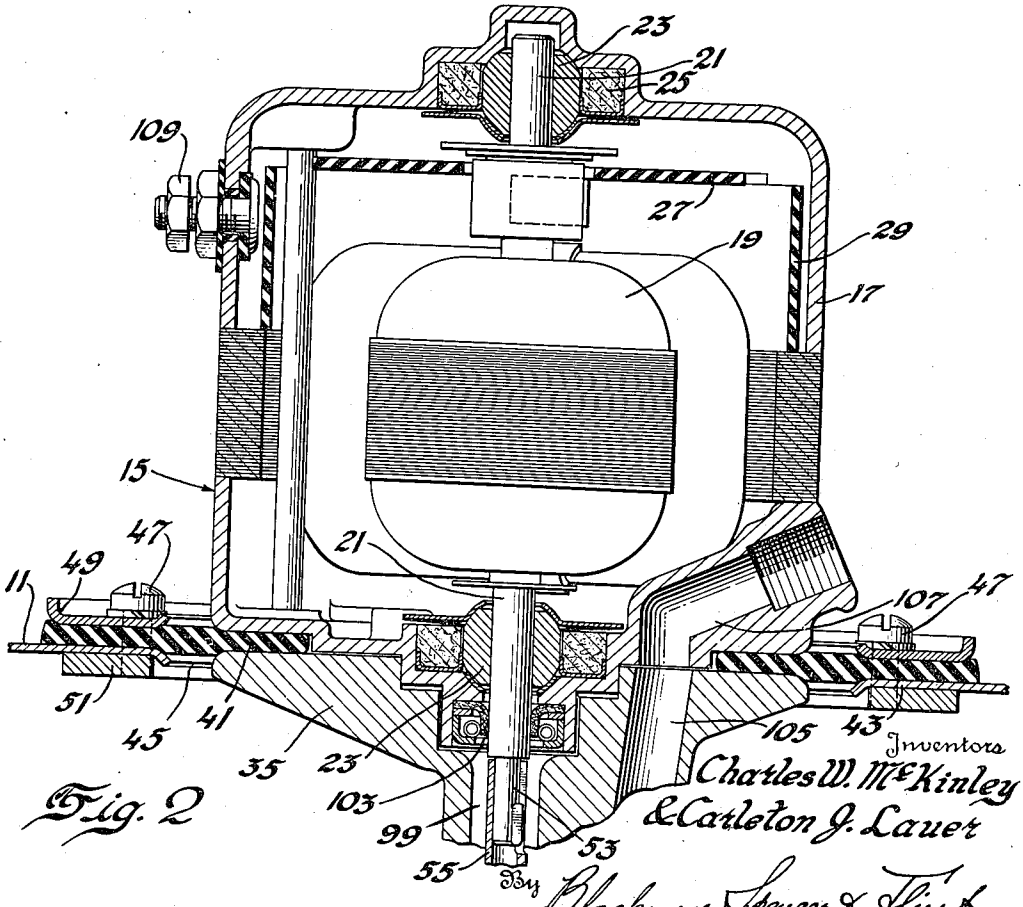

Fig. 2

Inventors
Charles W. McKinley
& Carleton J. Lauer

By Blackmore, Spencer & Flint
Attorneys

Dec. 6, 1938. C. W. McKINLEY ET AL 2,139,373

ELECTRIC FUEL PUMP

Filed Jan. 13, 1936 2 Sheets-Sheet 2

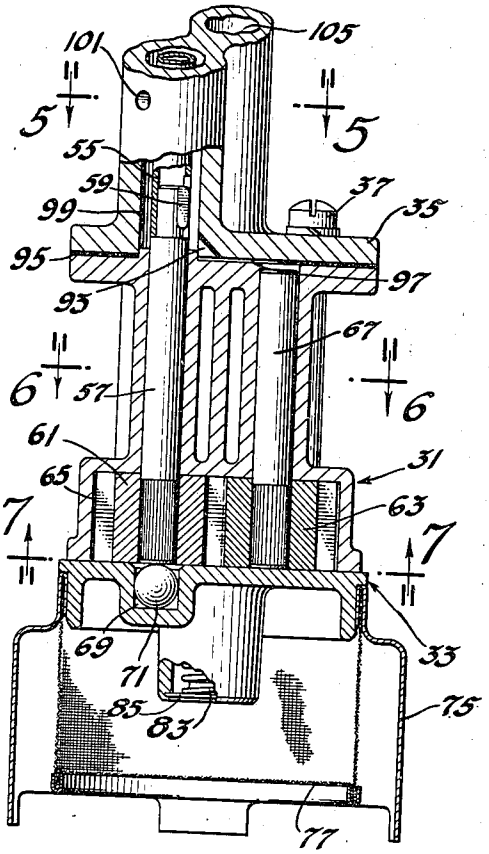

Fig. 3

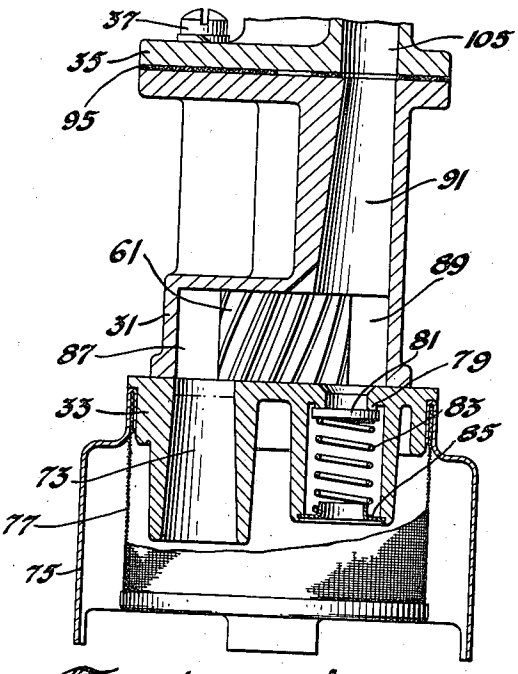

Fig. 4

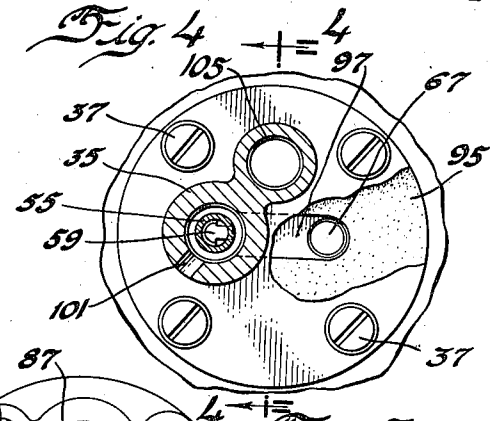

Fig. 5

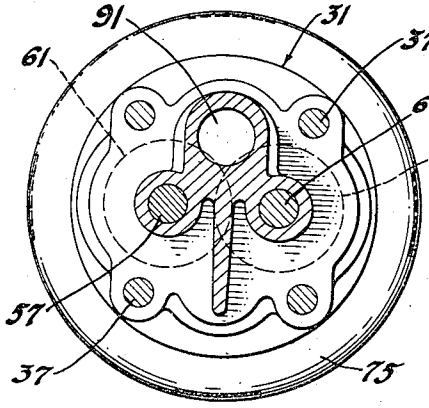

Fig. 6

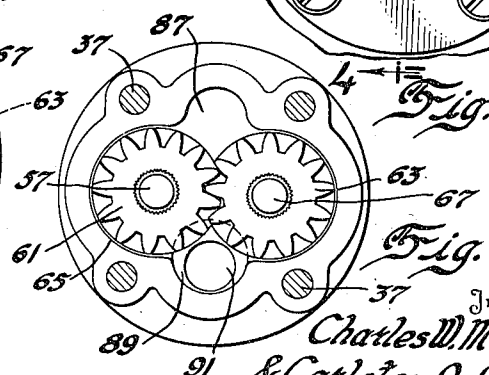

Fig. 7

Inventors
Charles W. McKinley
& Carleton J. Lauer
By Blackmore, Spencer & Flint
Attorneys

Patented Dec. 6, 1938

2,139,373

UNITED STATES PATENT OFFICE

2,139,373

ELECTRIC FUEL PUMP

Charles W. McKinley and Carleton J. Lauer, Flint, Mich., assignors to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application January 13, 1936, Serial No. 58,892

3 Claims. (Cl. 103—118)

This invention relates to the fuel supply system for engines such as are used on motor vehicles, on boats, aircraft, and in stationary power plants. It is more particularly concerned with the delivery of fuel from the reservoir or tank to the remotely located engine. It is intended to replace such older means of delivering fuel as the vacuum tank and the engine operated suction producing pump. In both these older well known forms, the fuel, flowing from the reservoir under the influence of reduced pressure, has had a tendency to vaporize under excessive heat conditions and it is one of the primary objects of the present invention to devise a fuel supply system which shall avoid the disadvantage of fuel vaporization and "vapor lock" which, in the case of an engine operated pump, has interfered with the delivery of liquid fuel to the float bowl of the carburetor.

Among the other objects to be attained by the specific structural arrangements, there should be included the provision for substantially noiseless operation, the promptness in supplying the fuel to the engine, the high pumping capacity, the long life of the mechanism and the provision whereby fuel is prevented from reaching the electric motor which is used for operating the pump.

Still other objects and advantages will be understood from the following description.

In the drawings accompanying the description:

Fig. 1 is a view of the motor and pump assembly mounted on a fuel reservoir the latter being shown in transverse section.

Fig. 2 is a section on a vertical plane through the motor.

Fig. 3 is a section on a vertical plane through the pumping mechanism.

Fig. 4 is another similar section but in a different plane from that of Fig. 3.

Fig. 5 is a horizontal section on line 5—5 of Fig. 3.

Fig. 6 is a horizontal section on line 6—6 of Fig. 3.

Fig. 7 is a horizontal section on line 7—7 of Fig. 3.

Referring by reference characters to the drawings, numeral 11 represents a reservoir or tank carried by a motor vehicle from which fuel is to be delivered to the carburetor of the engine, the latter usually located in a position on the vehicle remote from the tank.

An arrangement now in common use employs a pump located adjacent the engine and operated by a moving part of the latter. One stroke of the pump creates suction in the pump chamber and the conduit connecting the pump chamber and reservoir resulting in the flow of fuel to the pump. The other pump stroke delivers fuel from the pump chamber to the carburetor. The location of the pump adjacent the engine is such that the fuel is heated and the reduced pressure of the pump action lowers the boiling point. In consequence there may develop a quantity of fuel vapor which may merely compress and expand under the influence of pump operation, so that no liquid fuel is delivered to the carburetor. The present invention removes the pump from the region of the engine and does not use suction as a means for causing the flow through the conduit. This is accomplished by mounting the pump 13 within the reservoir 11 and operating it by an electric motor 15 supported upon the reservoir or tank 11. This location avoids the heating effect of the engine and since the fuel is pushed under superatmospheric pressure, the liquid fuel is much less likely to boil.

The details of the electric motor and pump assembly are productive of several advantages including those above set forth. The motor marked 15 has an outer shell 17 and a rotor 19, the latter provided with a rotor shaft 21. Shaft 21 is mounted in bearings 23 having an external spherical counter. The bearings are of porous metal oil absorbing material and are supplied with lubricant by oil saturated felt washers 25 mounted in suitably shaped upper and lower pockets of the shell. The extreme lower end of shaft 21 extends below the motor housing 17 for a purpose to be explained. The brush carrying plate 27 is spaced by a paper collar 29. The collar, in addition to other functions, serves to prevent transmission of noises from the brushes. The motor is so designed as to avoid magnetic hum. The commutator is designed to be sparkless. It is intended that the motor shall last throughout the life of the car and require no lubrication.

The pump is formed by uniting two parts, an upper part 31 and a lower part 33. A spacer 35, an elongated member, houses suitable means for transmitting the drive of the motor to the pump and has a conduit or passage for the flow of fuel from the pump. Bolts or other fastening means 37 secure the pump parts 31 and 33 to the lower end of the spacer. The upper end of the spacer 35 is secured by fastening means 39 to the motor shell 17. A thick rubber ring 41 is clamped between the casing 17 and the spacer 35. The

outer margin of the rubber ring 41 is secured to the peripheral region 43 surrounding an opening 45 in the reservoir 11 by fastening means 47 extending through a ring 49 adjacent the motor casing 17, the rubber ring and an inner ring 51.

The reduced end 53 of rotor shaft 21 is received within and keyed to a tubular driving shaft 55, the latter extending through a tubular passage in the spacer 35. At the lower end of the spacer the tubular shaft 55 is similarly keyed in driving relation to the reduced upper end of the pump shaft 57, the numeral 59 indicating the coupling key. The shaft 57 carries the helical pump gear 61. This gear 61 together with a cooperating gear 63 constitutes the gear pump, the two gears being located in a suitable chamber 65 formed in the lower part of the upper pump chamber. The driven gear 63 is secured to a shaft 67 journaled in a tubular bore as shown in Fig. 3.

A recess 69 in the top of the lower pump member houses a ball 71 which supports the shaft 57 and, with it, the shafts 55 and 21 together with the rotor element of the motor, thereby providing an antifriction thrust bearing.

The lower pump member 33 is formed with an inlet passage 73 communicating with the gear pump chamber. To the lower member 33 is also secured a suction bell 75 which is positioned just above the bottom of the reservoir and encloses a filter screen 77. This lower pump member also has a bypass valve leading from the discharge side of the gear pump to the region within the screen. It employs a valve seat 79 adapted to be engaged by a disc valve 81 held by a spring 83 having an abutment 85.

The inlet passage 73 in the lower pump member communicates with inlet region 87 in the upper pump member. The outlet region of the pump chamber is marked 89. It registers with a passage 91 extending from the pump chamber to the top of the upper pump section 31. This passage 91 is enlarged or relieved toward the junction with the pump chamber to allow fuel to be squeezed out from between the pump teeth without noise.

The lower end of the spacer is formed with a notch 93 and the gasket 95 has a slot 97 as shown by Fig. 5. The tubular space 99 within the spacer through which the drive shaft extends is in communication not only with the bore in the upper pump member for shaft 57 but also, by means of the notch 93 and the slot 97, with the bore carrying shaft 67. Lubrication of the pump shafts is thus provided.

An aperture 101 is formed in the spacer leading from space 99, so that fuel may freely enter this space. To prevent this fuel from reaching the motor an air seal washer 103 is provided as shown on Fig. 2. When the reservoir is filled with fuel, the fuel enters the space 99 and the air at the top of this space is compressed between the top of the column of liquid fuel and the seal whereby the fuel is prevented by the seal from reaching the motor.

The spacer is formed with a tubular bore 105 registering with outlet passage 91 and itself communicating with passage 107 in the motor casing, which latter is terminally screw-threaded for connection with any suitable conduit for supplying the carburetor of the engine. Suitable terminals for wires are of course present as shown at 109.

It will be understood that such a pump and motor assembly will largely overcome the difficulty of vapor lock since the mechanism is wholly free from subatmospheric conditions and because the operating parts are removed from the heat of the engine. The rubber mounting ring constitutes a floating and non-resonant vibration absorbing mounting for the motor and pumping mechanism, the desirability of which is obvious. The pump gears are preferably made of phenolic condensation product to render the operation as quiet as possible. This material has almost no appreciable wear when operating with gasoline. The drive tube 55 connecting the solid shafts 21 and 57 provides a sort of universal connection to accommodate any slight misalignment of the shafts. The rotor element of the motor and the shafts have an anti-friction thrust bearing conveniently formed by the ball 71.

The pump shafts should be chrome plated because such a surface runs well in the die cast upper pump member when lubricated with gasoline. The pump capacity is such as to provide for maximum requirements and the spring loaded bypass is available to restore to the region within the filter screen the fuel in excess of that which can be delivered to the conduit and carburetor.

The provision for avoiding noise from the squeezing of fuel from the pump gears has been referred to above.

In case the reservoir is pumped dry the fuel remaining in the tubular space 99 is sufficient to lubricate the pump shafts for a short time.

It is to be observed also that the electric motor circuit may be closed by the ignition switch with the result that the fuel is pumped to the carburetor as soon as the switch is closed, even before the starter comes into action.

Referring again to the power plant, it is the intent that the pump shall have a minimum capacity of twenty gallons per hour at four pounds pressure. No greater pump capacity is needed for any present day automobile and it is unnecessary for more than a single size of pump to be manufactured. The motor is very efficient in that it supplies the twenty gallons per hour, drawing less than two amperes at six volts. The self-aligning bearings have obvious utility. The seal effectively prevents any gasoline reaching and damaging the electric motor.

We claim:

1. In a motor and pump assembly for delivering fuel from the fuel tank of a motor vehicle, a motor, a spacer and a pump including a pump casing connected in superposed relation, said motor and pump having aligned shafts, said spacer having an elongated liquid carrying space and a fuel discharge passage, a shaft in said liquid carrying space coupled to said motor and pump shafts, said pump having a second parallel pump shaft journalled in the casing of said pump, cooperating pump gears on said parallel pump shafts, and said spacer formed with a notch at its lower end leading from the liquid carrying space and directed toward the upper end of said second parallel shaft, means affording communication between said notch and the journal for said second pump shaft whereby liquid from said space may lubricate said second pump shaft.

2. The invention defined by claim 1, said last named means being a gasket between said spacer and pump, said gasket having a slot connecting the notch and the journal bearing for the second pump shaft.

3. In a motor and pump assembly, a motor, a spacer and a pump including a pump housing connected in superposed relation, said motor and

pump having aligned shafts, said spacer having an elongated liquid carrying space and a separate pump discharge passage, a shaft in said liquid carrying space, coupled to said motor and pump shafts, said pump housing having an axial bore, a second parallel pump shaft journaled in said bore, cooperating pump gears on said pump shafts in said pump housing, and a connecting passage between the lower end of said liquid carrying space and the upper end of said bore for the purpose of conducting liquid from said space to said bore to lubricate the second pump shaft.

CHARLES W. McKINLEY.
CARLETON J. LAUER.