

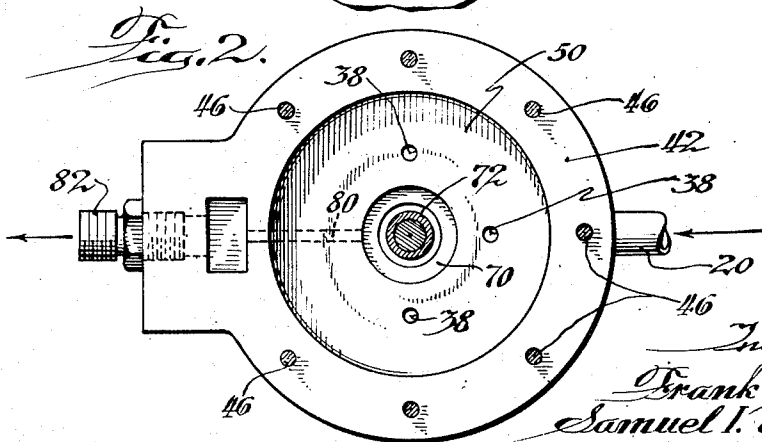
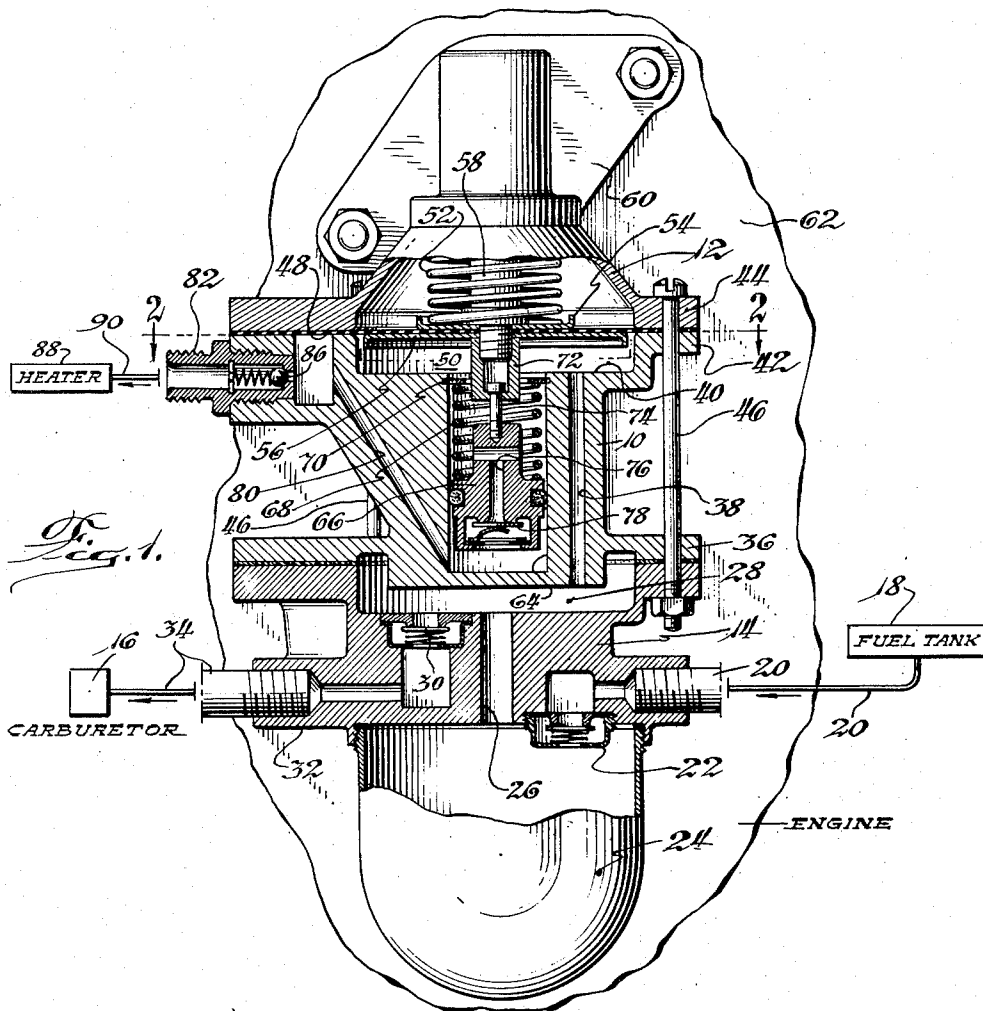
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HIGH AND LOW PRESSURE FUEL SYSTEM

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HIGH AND LOW PRESSURE FUEL SYSTEM

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The present invention relates to the problem of supplying fuel to high efficiency nozzle type combustion heaters used in vehicles. Designed to operate on the same fuel as the vehicle engine, such heaters must be supplied with fuel under a pressure of the order of fifteen pounds per square inch. Standard fuel pumps used to supply fuel to engine carburetors develop an outlet pressure of about three pounds per square inch.

One object of the invention is to provide for use in an automotive vehicle having a carburetor fed engine and a high pressure heater, a novel fuel system in which a high pressure fuel supply for the heater is provided by pumping apparatus driven from the engine through the actuating structure of the standard engine fuel pump without modification of the engine in any way or substantial structural alteration of the standard pump.

Another object is to provide for an economical, yet highly satisfactory, conversion of a standard fuel pump for a carburetor fed engine into a high and low pressure pump capable of supplying fuel to a vehicle heater under a relatively high pressure without any substantial structural modification of the standard fuel pump and without diminishing its ability to supply fuel to the engine carburetor.

A more specific object is to provide for a vehicle heater a high pressure fuel supply unit formed as a subassembly adapted to be interposed into the pumping structure of a standard fuel pump without substantial modification of the standard pump or interference with its capability to supply fuel to a carburetor at the usual low pressure.

Other objects and advantages will appear from the following description of the form of the invention illustrated in the drawing, in which:

Figure 1 is a side view of a fuel system embodying the invention, showing the engine driven pumping means in vertical section and illustrating schematically its interconnection with coacting units of the system; and

Fig. 2 is a fragmentary sectional view taken along the line 2—2 of Fig. 1.

As shown in the drawing, the pumping apparatus embodying the present invention comprises a central body or casing 10 adapted to be bolted between the upper casing section 12 and the lower casing section 14 of a standard engine driven fuel pump. The working parts contained within the upper casing section 12 and the lower casing section 14 are substantially the same as those used in the standard pump construction for supplying fuel to a carburetor 16 from a fuel tank 18.

A fuel line 20 leading from the tank 18 is threaded into the lower section 14 to communicate through an inlet check valve 22 with a fuel strainer bowl 24 screwed onto the underside of the casing section. A central bore 26 extends upwardly through the lower casing section 14 from the bowl 24 into a circular cavity 28 recessed into the upper side of the casing section. An outlet check valve 30 seated in the bottom of the cavity 28 communi-

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cates with a threaded boss 32 which receives a low pressure line 34 leading to the carburetor 16.

Flanges 36 formed on the lower end of the body 10 extend radially beyond the cavity 28 to mate with the upper side of the casing section 14. One or more axial bores 38 extend upwardly through the body 10 to connect the cavity 28 with a similarly shaped cavity 40 formed into the upper end of the body.

A peripheral flange 42 on the upper end of the body 10 is shaped to mate with a generally circular flange 44 on the lower side of the upper casing section 12. The upper casing section 12, body 10, and lower casing section 14 are secured together by a circumferentially spaced series of long bolts 46 extending downwardly through the upper casing section flange 44 and body flanges 42 and 36 to connect with underlying structure on the lower section 14.

The pumping diaphragm 48 of the standard pump is interposed between the upper casing section 12 and the body 10 to overlie the cavity 40. The low pressure pumping chamber 50 thus formed by the cavity 40 and the diaphragm 48 is generally similar in size and pumping capacity to that which would otherwise be formed by the diaphragm and the cavity 28 in the lower casing section.

The diaphragm 48 is urged downwardly to compress the pumping chamber 50 by a coiled compression spring 52 extending downwardly from the upper portion of the casing section 12 to engage a disc-like spring seat 54 resting on the top side of the diaphragm.

The seat 54, together with a reinforcing disc 56 of larger diameter engaging the underside of the diaphragm 48, is attached to the lower end of a reciprocable actuator 58. The actuator forms a part of a mechanical driving linkage contained in the upper casing section 12 and extending rearwardly through a bracket 60 on the upper casing section 12 used to mount the pumping assembly on an engine 62. This linkage, cam driven from the engine, is not specifically illustrated as it is merely the conventional linkage commonly used in a standard fuel pump for intermittently raising the pumping diaphragm 48 against the force of the spring 52.

An axial bore 64 extending downwardly into the body 10 from the bottom of the cavity 40 forms a high pressure pumping cylinder (also denoted by the numeral 64) aligned with the lower end of the actuator 58. A high pressure pumping piston 66 slidable in the cylinder 64 is biased downwardly by a compression spring 68 acting between the upper end of the piston and a snap ring 70 seated near the upper end of the cylinder.

A lost motion connection between the piston 66 and the actuator 58 is formed by an upwardly open, hollow cup 72 (replacing the usual nut) threaded onto the lower end of the actuator and serving as a retaining nut for the reinforcing disc 56. A small cap screw 74 extends downwardly through an aperture in the bottom of the cup 72 and is threaded into the piston 68. The play of the head on the upper end of the screw 74 between the bottom of the cup 72 and the lower end of the actuator 58 provides the desired lost motion between the latter and the piston.

Fluid may flow from the low pressure pumping chamber 50 into the lower end of the high pressure cylinder 64 through a path which includes the clearance between the snap ring 70 and the cup 72, bores 76 extending through the piston 66, and a check valve 78 on the lower end of the piston.

An inclined outlet bore 80 extends upwardly and outwardly from the lower end of the cylinder 64 to connect with an outlet coupling 82 threaded into a boss 84 on the body 10 and containing an outlet check valve 86. The coupling 82 is connected to a nozzle type heater 88 by a line 90.

It will be readily appreciated that the capability of a

standard fuel pump to supply fuel to an engine carburetor under the usual low pressure is not adversely affected by the additional parts which enable the entire assembly to supply fuel under increased pressure for operation of a vehicle heater. Upward movement of the low pressure diaphragm 48 by the actuator 58 draws fuel from the inlet valve 22 up through the bore 38 into the low pressure pumping chamber 50. Downward movement of the diaphragm 48 by the spring 52 forces fluid from the pumping chamber 50 out through the bores 38 and the outlet valve 30 in the same manner as if the diaphragm 48 were coacting directly with the cavity 28 in the lower casing section 14. It will be noted that the lost motion connection between the actuator 58 and the high pressure piston 66 permits the low pressure diaphragm 48 to be moved downwardly by the spring 52 independently of the high pressure piston.

Upward movement of the pressure piston 66 draws fluid from the pumping chamber 50 into the lower end of the high pressure cylinder 64. The fuel drawn into the high pressure cylinder 64 from the low pressure pumping chamber 50 is replenished by additional fuel entering through the inlet valve 22, thus avoiding any interference with the low pressure pumping action.

The high pressure piston 66, lifted upwardly by the actuator 58, is moved downwardly by the spring 68. The designed strength of the spring 68 is correlated with the lower face area of the piston 66 to provide the desired output pressure for operation of the heater 88.

The high pressure pumping apparatus contained within the body 10 thus forms a subassembly which can be used to adapt a standard engine driven fuel pump to provide both a low pressure source of fuel suitable for supplying a carburetor and a high pressure fuel source suitable for operation of a nozzle type vehicle heater. Incorporation of the high pressure pumping apparatus into the standard fuel pump structure does not interfere with its continued operation as a low pressure pump. Moreover, the conventional components of the standard fuel pump are used substantially without change. The bolts 46 are of course longer than those used in a standard pump assembly. The lower end of actuator 58 is threaded for connection with the cup 72.

While we have shown and described a preferred embodiment of our invention, it will be apparent that variations and modifications thereof may be made without departing from the principles and scope of the invention. We therefore desire, by the following claims, to include all such variations and modifications by which substantially the results of our invention may be obtained through the use of substantially the same or equivalent means.

We claim:

1. A combined high and low pressure fuel pump comprising, in combination, two casing sections, a central body mounted between said sections and defining with one of said sections a low pressure pumping chamber, a low pressure pumping member coacting with said pumping chamber, a reciprocable actuator for said pumping member, fuel inlet means and low pressure outlet means on said other casing section communicating with said pumping chamber through said central body, a high pressure pumping chamber defined within said central body, means providing for a unidirectional flow of fluid into said high pressure chamber, a high pressure pumping member coacting with said high pressure chamber, means connecting said high pressure pumping member with said actuator, and means providing for the unidirectional outflow of fluid from said high pressure pumping chamber.

2. An engine driven pump for delivering fuel to a carburetor at a relatively low pressure and to a combustion heater at a relatively high pressure, comprising, in combination, an upper casing section, a lower casing section, a central body mounted between said upper and lower casing sections, a low pressure pumping diaphragm interposed between said upper casing section and the upper

end of said body, the upper end of said body being shaped to define with said diaphragm a low pressure pumping chamber, a pumping spring mounted to urge said diaphragm toward said body, a reciprocal actuator mounted in said upper casing section and connected to said diaphragm for intermittently moving the latter away from said body, flow control means including an inlet check valve and a low pressure outlet check valve mounted in said lower casing section and communicating with said pumping chamber, a high pressure pumping cylinder formed within said central body, a piston in said cylinder, means forming a lost motion connection between said piston and said actuator, a spring mounted to urge said piston to one end of said cylinder, means providing for one-way flow of fluid from said low pressure pumping chamber to said one end of said cylinder, and said body forming an outlet passage from said one end of said cylinder.

3. A subassembly adapted for converting an engine driven, low pressure fuel pump including a pair of casing sections and having a reciprocating actuator therein into a dual pressure pump capable of providing a supply of fluid under a relatively high pressure without interfering with the capability of the pump to supply fluid under the usual low pressure, comprising, in combination, a body member adapted to be inserted between the casing sections of an engine driven fuel pump, one end of said body member being recessed to form a low pressure pumping cavity, a fluid passageway formed in said body member between said cavity and the opposite side of said body member, a central bore formed in said body member and extending inwardly from said cavity to define a high pressure pump cylinder, a piston reciprocable within said cylinder, reciprocable actuating means connected to said piston and adapted to be connected to the low pressure pump actuator, said actuating means including lost motion components providing for substantial axial play between the actuating means and said piston, spring means mounted in said bore to urge said piston to the inner end thereof, means providing for a unidirectional flow of fluid from said cavity to the inner end of said cylinder, and means providing for a unidirectional flow of fluid outwardly from the inner end of said cylinder.

4. A combined high and low pressure fuel pump comprising, in combination, a casing section, a body member connected to one side of said casing section, a low pressure pumping diaphragm interposed between said casing section and said body member, the portion of said body member adjacent said diaphragm being shaped to define with the latter a low pressure pumping chamber, a pumping spring mounted to urge said diaphragm in a direction for compressing the effective volume of said pumping chamber, a reciprocable actuator mounted in said casing section and coacting with said pumping diaphragm for moving the latter in a direction for expanding said pumping chamber, said body member defining therein a pumping cylinder open at one end into said pumping chamber, a piston reciprocable in said chamber, means forming a lost motion connection between said piston and said actuator, a spring mounted to urge said piston toward the end of said cylinder remote from said pumping chamber, means on said piston providing for one-way flow of fuel therethrough from said pumping chamber to said cylinder end remote from said chamber, said body forming an outlet passage from said last mentioned cylinder end, a check valve connected to said passage to prevent return flow of fuel therethrough to said cylinder, fuel inlet means communicating with said pumping chamber and including check valve means for preventing a reverse flow of fuel therethrough from the chamber, and fuel outlet means communicating with said chamber and including check valve means for preventing reverse flow of fuel back into said chamber.

5. A pump conversion unit adapted for converting an engine driven low pressure fuel pump, including a pair

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of separable casing sections in one of which is mounted a reciprocable pump actuator, into a dual pressure pump capable of providing a supply of fluid under a relatively high pressure without interfering with the capability of the pump to supply fluid under the usual low pressure, comprising, in combination, a body member adapted to be inserted and secured between two casing sections of an engine driven fuel pump, said body member having an actuator casing section end recessed to form a low pressure pumping cavity, said body member defining therein an auxiliary pumping recess extending into the body member from said pumping cavity, a reciprocable pumping member mounted in said body member in spanning relation to said auxiliary recess to define in the inner portion thereof a high pressure pumping chamber, spring means connected between said body member and said pumping member to urge the latter in a direction to contract the effective volume of said high pressure pumping chamber, reciprocable actuating means connected to said pumping member and adapted to be connected to

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a low pressure pump actuator, said actuating means including lost motion components providing for substantial play between the actuator end of actuating means and said pumping member, passageway means including an inlet check valve connecting said cavity to said high pressure pumping chamber to supply fluid to the latter, said body member defining an outlet bore extending outwardly through the body member from said high pressure pumping chamber, and an outlet check valve mounted on said body member in coacting relation to said outlet bore to prevent reverse flow of fluid through the latter.

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