

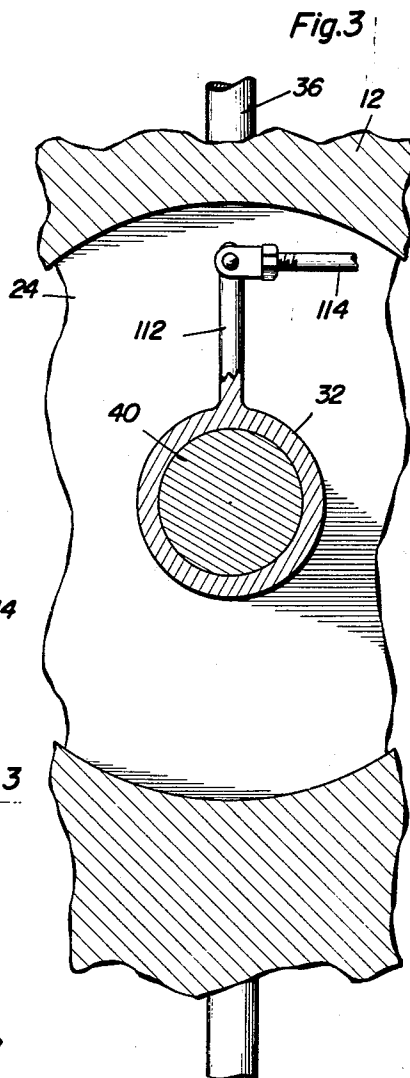
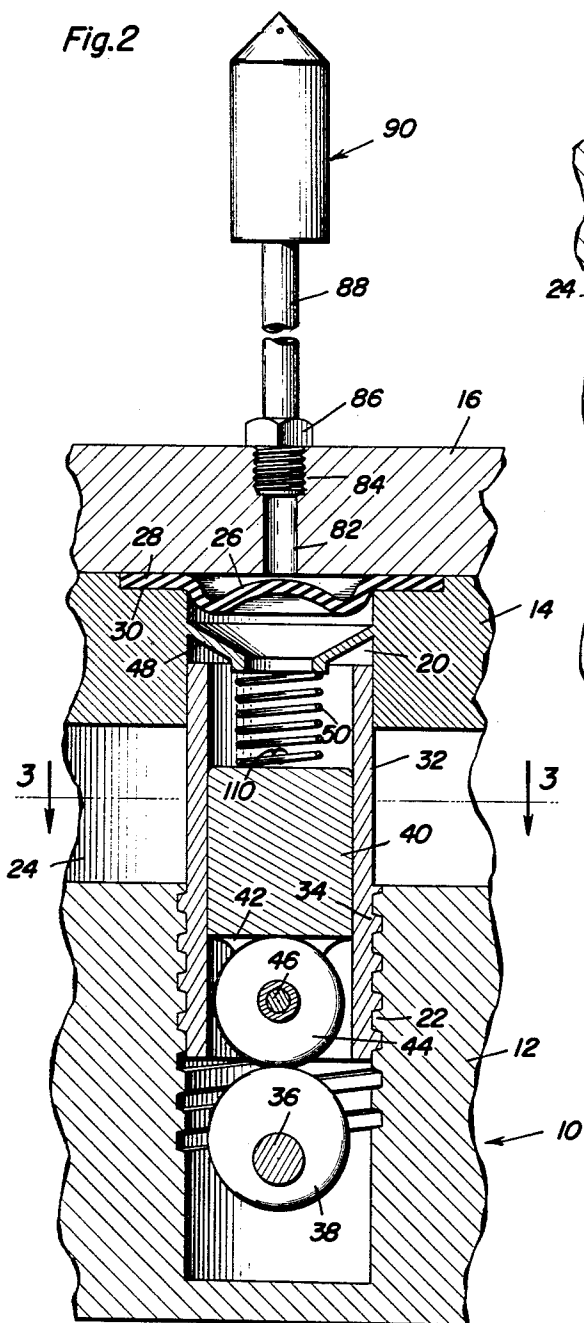
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FUEL INJECTION PUMP

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FUEL INJECTION PUMP

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This invention relates in general to new and useful improvements in pumps, and more specifically to a fuel injection pump.

Although for many years carburetors have been used in conjunction with gasoline engines, and the injection of fuel has been limited to diessel engines and similar oil burning engines, recent efforts to obtain maximum efficiency from gasoline engines in the automotive industry have turned to fuel injection systems. However, such fuel injection systems are extremely expensive because of the precision machining required. Also, the fuel injection system add to the cost of internal combustion engines in that as now manufactured it is a separate external accessory and thus requires a separate housing, separate mounting plate, and separate drive, etc., all of which are expensive.

It is therefore the primary object of this invention to provide a simple fuel injection pump intended primarily for use in conjunction with gasoline engines with the fuel injection pump being of such a construction whereby it may be incorporated in the engine construction as an integral part thereof thus utilizing the engine block or head as the support means and being of such a nature whereby an additional cam shaft may be placed in the block for driving the pump, the cam shaft being supported by the block and is readily adaptable to be driven through the regular drive train of the internal combustion engine.

Another object of this invention is to provide an improved fuel injection pump, the fuel injection pump being so constructed whereby it may be readily mounted in the block or head of an internal combustion engine the construction of the pump being of an extremely simple nature with the machined parts thereof being separately made and being readily insertable in the block whereby the manufacture of the pump may be carried out at a minimum of cost.

Another difficulty with fuel injection pumps is that it is absolutely necessary that each fuel injection pump of a multiple pump system pumps exactly the same amount of fuel on each stroke as all of the other pumps of the system. It is well known that gasoline has penetrating qualities and thus should there be any wear between a piston and a cylinder of a pump, gasoline will attempt to run past the piston. When this happens, the pump of course does not pump the desired amount of fuel. Furthermore, when the gasoline runs past the piston, it then enters the chamber of the drive components, which chamber must be lubricated in order to prevent excessive wear. The gasoline soon cuts the lubricating oil and as a result the lubrication is not that required and the pump requires replacement in a relatively short time. It is therefore another object of this invention to provide an improved fuel injection pump, which pump is so constructed whereby the piston thereof pumps a relatively heavy fluid such as lubricating oil, and the fuel, primarily gasoline, is pumped by means of a diaphragm, the diaphragm being actuated by the lubricating oil whereby the

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problem of the fluid being pumped escaping past the piston is greatly minimized.

A further object of this invention is to provide an improved pump of the fuel injection type, the pump including an elongated chamber which has one end thereof closed by a diaphragm, there being mounted in the chamber for longitudinal movement a cylinder, the cylinder having mounted therein for reciprocatory movement a piston, and there being control means for positioning the cylinder, the cylinder being provided with a support which communicates the interior of the cylinder with a first liquid reservoir whereby the effective stroke of the piston may be varied with the first liquid being pumped in the chamber by the piston and actuating the diaphragm which will in turn pump the second liquid which will be the fuel to be injected.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

Figure 1 is a fragmentary sectional view taken through an internal combustion engine and shows mounted therein the fuel injection pump which is the subject of this invention.

Figure 2 is a fragmentary sectional view taken substantially upon the plane indicated by the section line 2—2 of Figure 1 and shows further the details of the construction of the fuel injection pump, the drive cam for the fuel injection pump having been rotated so as to move the piston thereof to a pumping position; and

Figure 3 is a fragmentary sectional view taken substantially upon the plane indicated by the section line 3—3 of Figure 2 and shows the control means for positioning the cylinder.

Referring now to the drawings in detail, it will be seen that there is illustrated an engine component which is referred to by the reference numeral 10. The engine component 10, as illustrated, is the head of the internal combustion engine of which the fuel injection pump is to be a part. However, the engine component 10 may be the block or a composite of the block and head of the internal combustion engine. The engine component 10 includes a base portion 12, an intermediate plate 14 and an upper plate 16.

Carried by the engine component 10 is the fuel injection pump which is the subject of this invention, the fuel injection pump being referred to in general by the reference numeral 18.

The fuel injection pump 18 includes an elongated chamber 20 which extends through the base 12 and the plate 14. The chamber 20 is generally cylindrical in outline and the lower portion thereof is provided with internal threads 22. That portion of the chamber 20 disposed in the upper part of the base 12 is enlarged and provides a reservoir 24.

The upper end of the chamber 20 is closed by a diaphragm 26 which projects down into the chamber 20. The diaphragm 26 includes a mounting flange 28 which is seated in a recess 30 formed in the upper part of the plate 14 and clamped between the plates 14 and 16. The diaphragm 26 may be formed of any desirable material although materials, such as neoprene, will be required inasmuch as it is primarily intended that the fuel injection pump 18 pump gasoline or similar fuel. A flexible metal diaphragm may also be used.

Mounted within the chamber 20 for longitudinal movement is an elongated cylinder 32. The cylinder 32 has external threads 34 formed in the lower part thereof, which threads are engaged with the threads 22 so that

rotation of the cylinder 32 relative to the engine component 10 will result in the movement of the cylinder 32 towards or away from the diaphragm 26. The threads 22 and 34 are of the well-known Acme type and a minor rotational movement of the cylinder 32 will produce a relatively great longitudinal movement of the cylinder as compared to the use of regular threads.

Extending through the base 12 and suitably journaled therein for rotation is a cam shaft 36. The cam shaft 36 is provided with one cam lobe 38 for each of the fuel injection pumps 18. It is to be understood that there will be one fuel injection pump 18 for each cylinder of the internal combustion engine of which the engine component 10 is a part. The cam lobe 38 is disposed in the lower part of the chamber 20.

Positioned within the cylinder 32 for reciprocatory movement towards and away from the diaphragm 26 is a piston 40. The piston 40 has the lower end thereof recessed as at 42 and carries a roller type follower 44 which is mounted on a pin 46. The follower 44 engages the cam lobe 38, and thus transmits the motion of the cam 38 to the piston 40.

In order that the piston 40 may automatically return to its lowermost position, mounted in the upper part of the chamber 20 immediately below the diaphragm 26 is a stop member 48. The stop member 48 provides a seat for a spring 50 whose lower end engages the upper end of the piston 40. It is to be understood that the stop member 48 will have a sufficient opening therethrough to permit the passage of the liquid pumped by the piston 40.

In order that movement of the piston 40 will cause a like movement to the diaphragm 26, the reservoir 24 will be filled with a first liquid to be pumped, the first liquid being preferably lubricating oil of the same type which will be used in the crankcase of the internal combustion engine of which the engine component 10 is a part. Thus should there be any leakage of the first liquid into the crankcase of the internal combustion engine, this would in no way dilute the lubricating oil and have an ill effect on the parts of the internal combustion engine. In order that the reservoir 24 may remain filled at all times, there is formed in the plates 14 and 16 aligned passages 52 and 54 which open into the reservoir 24. The passage 54 has an enlarged internally threaded upper part 56 in which there is threadedly engaged a fitting 58 carrying a first liquid supply pipe 60. It is desirable that the level of the first liquid be maintained well above the reservoir 24, as is shown by the line 62 in Figure 1.

The plate 16 has a second liquid inlet passage 64 extending therethrough and opening into the upper end of the chamber 20 above the diaphragm 26. The upper end of the passage 24 is in the form of an enlarged bore 66 which terminates in an upper internally threaded portion 68. The lower end of the bore 66 defines a seat 70 on which there is seated a spring 72 for a check valve 74. The check valve 74 is retained against upward movement by means of a spacer ring 76 which also functions as the valve seat for the check valve member 74. Threadedly engaged with the internally threaded portion 68 to retain the spacer ring 76 in place is a fitting 78 to which there is connected a supply line 80 for the second liquid.

Also opening into the chamber 20 above the diaphragm 24 is a second liquid outlet passage 82. The outlet passage 82 includes an enlarged internally threaded upper portion 84 in which there is threadedly engaged in fitting 86 which in turn carries an outlet pipe 88 for the second liquid. The outlet pipe 88 has connected thereto an injection nozzle 90 which may be any desired construction. The injection nozzle 90 will be so mounted in the cylinder head of the internal combustion engine so as to spray the fuel being pumped directly into the combustion chamber.

The plate 16 is also provided with a relief passage 92 which opens into the chamber 20 above the diaphragm 26. The upper portion of the relief passage 92 is in the

form of an enlarged bore 94 which terminates in an internally threaded upper portion 96. The lower end of the bore 94 defines a shoulder 98 on which there is seated a check valve member 100. Engaging the check valve member 100 and resisting the upward movement thereof is a spring 102. The spring 102 bears against the spacer ring 104 which is retained in place by a fitting 106 threadedly engaged with the threaded portion 96. Fitting 106 carries a return line 108. The purpose of the return line 108 is only that in the event the injection nozzle 90 should be clogged or for some other reason fuel cannot be pumped therethrough, then the fuel will be pumped through the relief line 108 back to the reservoir for the fuel.

It is to be understood that the movement of the piston 40 will be the same for each stroke. In order to control the movement of the diaphragm 26 and thus control the amount of fuel being pumped, the cylinder 32 is provided with a port 110. The port 110 opens through the cylinder into the reservoir 24. The cylinder 32 is also provided with a control arm 112 to which there is connected suitable linkage 114 which may be remotely actuated. By turning the control arm 112 the cylinder 32 may be turned and thus moved towards or away from the diaphragm 26. By shifting the port 110 towards the diaphragm 26, the effective stroke of the piston 40 will be lessened. On the other hand, if the port 110 is moved away from the diaphragm 26, the effective stroke of the piston 40 will be increased.

Inasmuch as the first liquid is being compressed between the piston 40 and the diaphragm 26, there is always the possibility that the small amount of the first liquid may pass between the piston 40 and cylinder 32. Thus when this happens and the piston 40 moves downwardly, a vacuum will be created between the piston 40 and the diaphragm 26. In order to prevent this, there is provided a relief passage 116 which extends from the upper part of the chamber 20 down into the reservoir 24. The relief passage 116 has mounted in the lower end thereof a check valve assembly which is referred to in general by the reference numeral 118. Thus, the liquid from the reservoir 20 may be only drawn into the chamber 20 and not forced there out of.

From the foregoing, it will be readily apparent that there has been devised an extremely simple pump of the fuel injection type, which pump is so constructed whereby it may be incorporated in an engine as a part thereof thus eliminating the necessity for a separate housing and separate drive rather than the conventional cam shaft disclosed. Furthermore, by utilizing a first liquid to pump the second liquid, which second liquid is the fuel injector, there can be no dilution of the lubrication system for either the pump or the internal combustion engine. Furthermore, by using a relatively heavy liquid as the initial pumping agent, the escape of the liquid past the piston is substantially prevented and thus accurate amount of fuel is injected on each stroke of the piston.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. An injection type pump for fuel and the like, said pump comprising a housing defining an elongated pulsator chamber, a diaphragm closing one end of said chamber, said diaphragm projecting into said chamber, a cylinder, cooperating means on said cylinder and said housing for moving said cylinder longitudinally of said chamber toward and away from said diaphragm, a reservoir surrounding said cylinder, a piston disposed in said cylinder in spaced relation to said diaphragm, means carried by said housing and engaging said piston for effecting re-

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ciprocation of said piston, an inlet passage in said housing in communication with said diaphragm remote from said chamber for admitting a first liquid, a first liquid outlet passage in said housing in communication with said diaphragm remote from said chamber, a second liquid disposed within said reservoir, a port through said cylinder communicating the interior of said cylinder intermediate said piston and said diaphragm with said reservoir, whereby said piston pumps said second liquid which in turn actuates said diaphragm to pump said first liquid with the position of said port relative to said piston controlling the volume of pumping of said first liquid, a stop member fixed in said chamber between the piston and the diaphragm, a return spring in said chamber in contact with said piston and said stop member.

2. An injection type pump for fuel and the like, said pump comprising a housing defining an elongated pulsator chamber, a diaphragm closing one end of said chamber, said diaphragm projecting into said chamber, a cylinder, cooperating means on said cylinder and said housing for moving said cylinder longitudinally of said chamber toward and away from said diaphragm, a reservoir surrounding said cylinder, a piston disposed in said cylinder in spaced relation to said diaphragm, means carried by said housing and engaging said piston for effecting reciprocation of said piston, an inlet passage in said housing in communication with said diaphragm remote from said chamber for admitting a first liquid, a first liquid outlet passage in said housing in communication with said diaphragm remote from said chamber, a second liquid disposed within said reservoir, a port through

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said cylinder communicating the interior of said cylinder intermediate said piston and said diaphragm with said reservoir, whereby said piston pumps said second liquid which in turn actuates said diaphragm to pump said first liquid with the position of said port relative to said piston controlling the volume of pumping of said first liquid, a stop member fixed in said chamber between the piston and the diaphragm, a return spring in said chamber in contact with said piston and said stop member, a vacuum relief line communicating said reservoir with said chamber intermediate said piston and said stop member to compensate for the leakage of said second liquid past said piston.

3. The combination of claim 2 wherein said cylinder is threadedly engaged in said housing, and a control arm eccentrically secured to said cylinder depending from said housing.

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