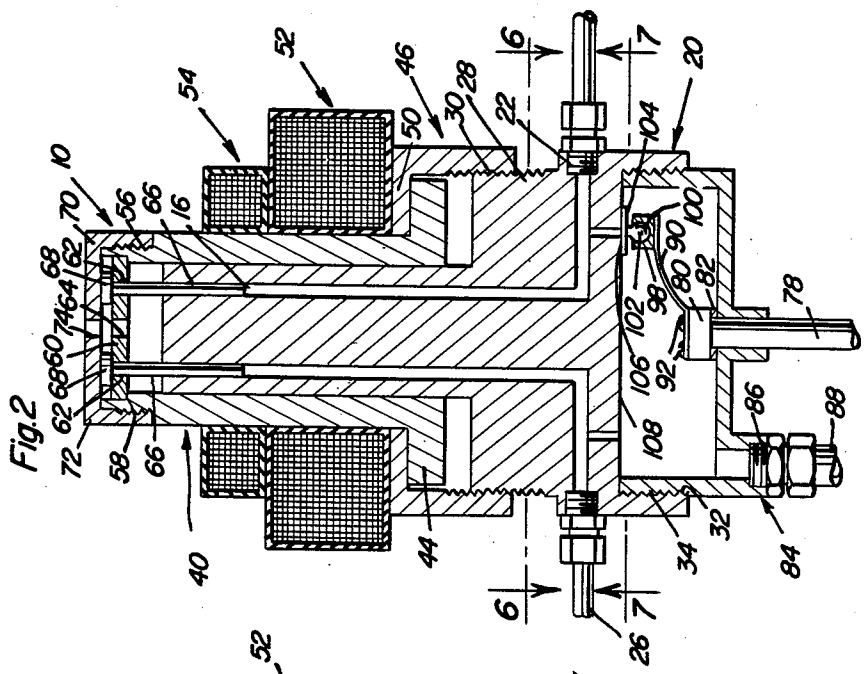
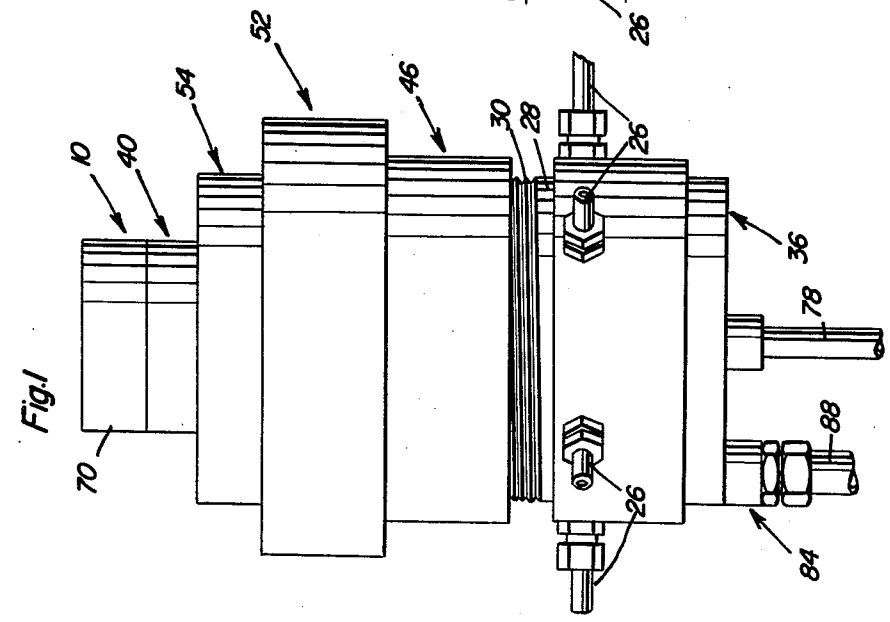
July 17, 1962 P. L. SAWYER 3,044,401

ELECTRIC INJECTION PUMP

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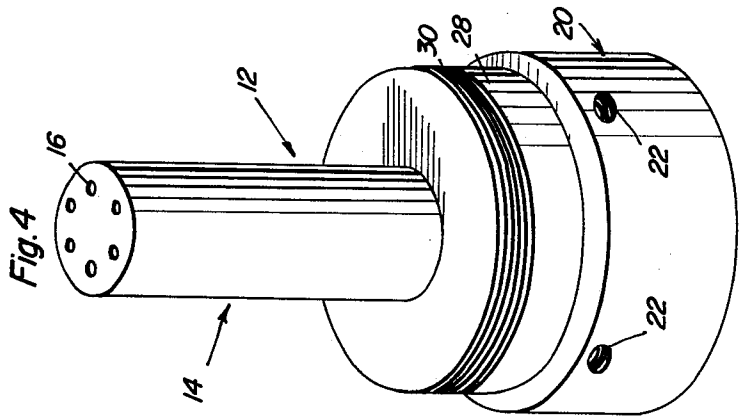

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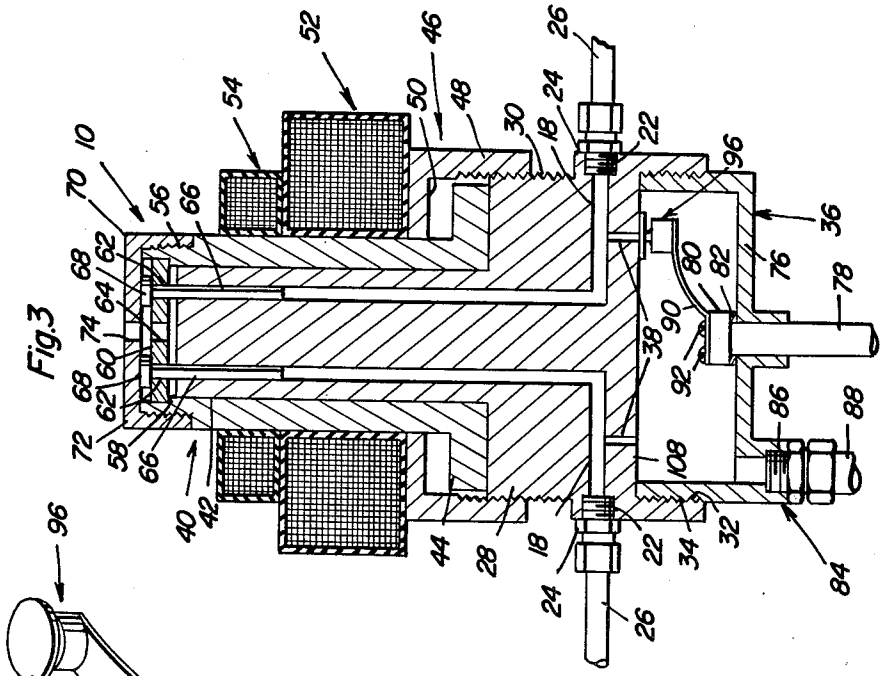
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ELECTRIC INJECTION PUMP

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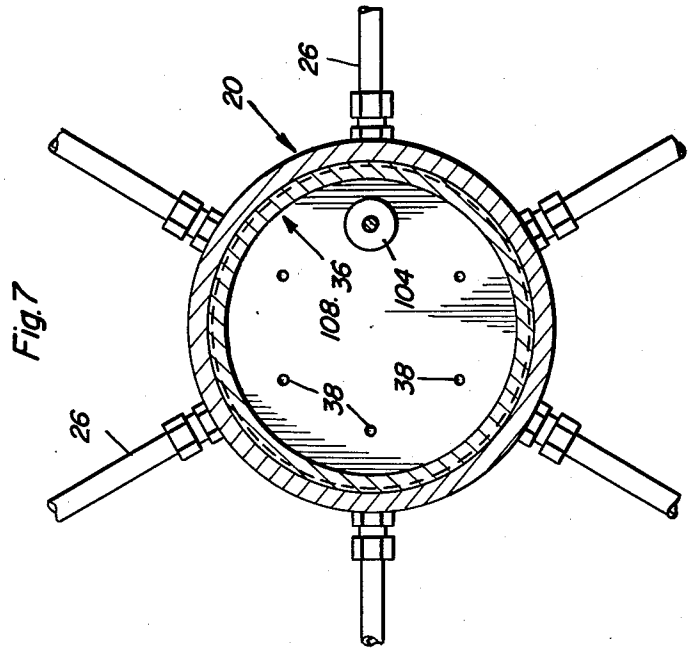



Fig.7

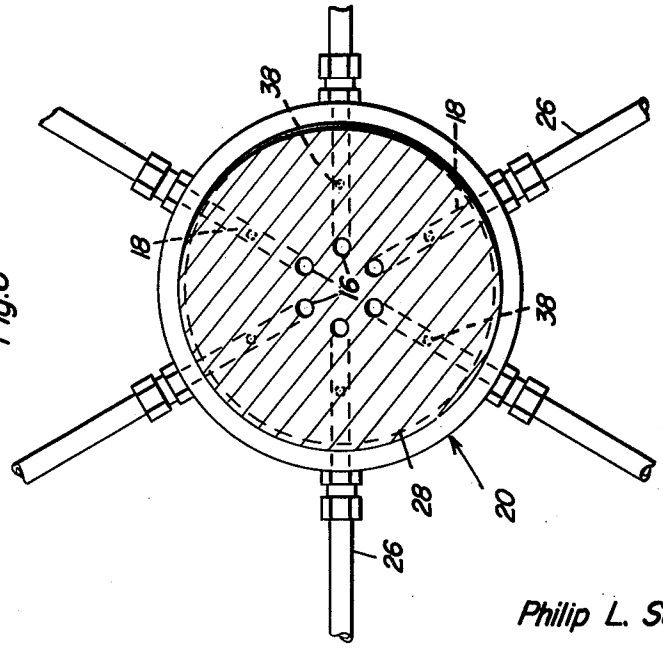



Fig.6

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United States Patent Office 3,044,401 Patented July 17, 1962



3,044,401

# ELECTRIC INJECTION PUMP

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Filed Nov. 3, 1960, Ser. No. 66,956
9 Claims. (Cl. 103—2)

This invention relates to a fluid injection pump specifically adapted for injecting fluid under pressure to a plurality of points of use.

Although it is to be appreciated that the injection pump of the instant invention may readily be used in other environments, the adaptability of the injection pump to a specific environment may be readily appreciated when considering the injection pump as a means for intermittently injecting liquid fuel under pressure in timed sequence to the cylinders of an internal combustion engine.

The injection pump of the instant invention is completely devoid of pressure operated valves which in many cases have proven to be undesirable as a component of an internal combustion fuel injection pump because of the tendency of pressure operated valves to malfunction unless the fuel being pumped is completely devoid of foreign matter. Accordingly, it may be considered the main object of this invention to provide an injection fuel pump which will be capable of constant and efficient operation under adverse conditions which normally tend to cause pressure operated valves to malfunction.

A further object of this invention, in accordance with the immediately preceding object, is to provide an electric injection pump having a minimum number of parts and a minimum number of moving parts which are subject to wear whereby the life expectancy of the injection pump will be substantially greater than that of some types of injection pumps now being commercially exploited.

Still another object of this invention is to provide an injection pump which will be capable of unerringly injecting equal predetermined amounts of fuel to various points of use in timed sequence.

Another object of this invention is to provide an injection pump which may readily be connected with existing automotive ignition components in a manner whereby the operation of the injection pump may be accurately timed with the operation of conventional types of automotive ignition systems.

Still another object of this invention is to provide an injection fuel pump which may readily be disassembled in order to repair the injection pump or to perform preventative maintenance thereon.

A further object of this invention is to provide an injection fuel pump which may readily be altered to deliver measured predetermined quantities of fuel to a different number of points of use.

A final object to be specifically enumerated herein is to provide an injection fuel pump which will conform to conventional forms of manufacture, be of simple construction and easy to install so as to provide a device that will be economically feasible, long lasting and require very little alterations of an existing internal combustion engine in order to operatively mount the fuel injection pump thereon.

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 side elevational view of the electric injection fuel pump of the instant invention;

FIGURE 2 is a vertical sectional view taken substantially upon a plane passing through the center of the injection pump illustrated in FIGURE 1;

FIGURE 3 is a vertical sectional view similar to that of FIGURE 2 but showing the actuator of the injection pump in an alternate position;

FIGURE 4 is a perspective view of the cylinder body of the injection pump;

FIGURE 5 is a perspective view of a portion of the valve means of the injection pump utilized to direct predetermined measured quantities of fuel to a plurality of points of use in timed sequence;

FIGURE 6 is a horizontal sectional view taken substantially upon the plane indicated by the section line 6—6 of FIGURE 2; and

FIGURE 7 is a horizontal sectional view taken substantially upon the plane indicated by the section line 7—7 of FIGURE 2.



Referring now more specifically to the drawings, the numeral 10 generally designates the injection pump of the instant invention which includes cylinder means in the form of an elongated cylinder body generally referred to by the reference numeral 12. The cylinder 12 is generally cylindrical in configuration and includes an upper cylindrical portion 14 which is reduced in diameter relative to the intermediate and lower portions of the cylinder body member. The upper portion 14 is actually in the form of a cylindrical piston and has a plurality of longitudinal bores 16 formed therein which are parallel to each other and extend longitudinally of the cylinder body member 12. The lower end of each of the bores 16 terminates in a radially extending transverse bore 18 whose outer end communicates with the outer surfaces of the lower portion 20 or base of the cylinder body member 12 and is provided with an internally threaded counterbore 22 for the reception of a fitting 24 carried by an associated fuel line 26.

Disposed between the upper and lower portions 14 and 20 is an intermediate portion 28 whose upper end is externally threaded as at 30 for a purpose to be hereinafter more fully set forth. The lower portion 20 has a downwardly opening blind bore 32 formed therein which is threaded as at 34 and has a cylindrical fuel supply reservoir generally referred to by the reference numeral 36 threadedly secured therein.

Each of the transverse bores 18 is provided with a longitudinally extending branch bore 38 which communicates that transverse bore 18 with the interior of the fuel supply reservoir 36 secured to the lower end of the lower portion or base 20 of the cylinder body member 12.

An actuator sleeve mechanism generally referred to by the reference numeral 40 is provided with a longitudinal opening 42 which snugly receives the upper portion 14 or piston of the cylinder body member 12. The lower end of the actuator sleeve mechanism 40 includes a radially projecting annular seating flange 44. A collar assembly generally referred to by the reference numeral 46 and including an internally threaded cylindrical portion 48 and an apertured top wall 50 is threadedly engaged on the threads 30 of the intermediate portion 28 and retains the flange 44 of the actuator sleeve mechanism 40 captive between the apertured end wall 50 and the intermediate portion 28 whereby the actuator sleeve mechanism 40 is mounted for rectilinear movement between the two limits established by the apertured end wall 50 and the intermediate portion 28 of the cylinder body member 12. A first electromagnet or solenoid generally referred to by the reference numeral 52 is carried by the collar 46 and a second smaller and less powerful electromagnet or solenoid generally referred to by the reference numeral 54 is also carried by the collar 46.

The upper end of the actuator sleeve mechanism 40 is

externally threaded as at 56 and is also provided with a counterbore 58 for the opening 42 extending longitudinally through the actuator sleeve 40. A retaining disk 60 is seatingly received within the counterbore 58 and is provided with a plurality of bores 62 circumferentially disposed about the longitudinal axis of the sleeve 40 and a central aperture 64. A plurality of pistons 66 having diametrically enlarged outer end portions 68 are slidably disposed in the bores 16 through the bores 62 formed in the disk 60 with the heads 68 of the pistons 66 being disposed on the outer side of the disk 60. A retaining cap 70 is threadedly engaged on the upper end of the actuator sleeve 40 and the diametrically enlarged heads 68 on the pistons 66 are held captive between the end wall 72 of the cap 70 and the disk 60. It will be noted that the end wall 72 is also apertured as at 74 whereby the area between the confronting surfaces of the disk 60 and the upper portion 14 of the cylinder body member 12 is communicated with the exterior of the injection pump 10.

It is to be noted that the electromagnet or solenoid 52 is actuated to effect downward movement of the actuator sleeve mechanism 40 and that the eletcromagnet or solenoid 54 is actuated to effect upward movement of the actuator sleeve mechanism 40.

The fuel supply reservoir 36 is provided with an apertured lower wall 76 through which the upper end of a valve member shaft 78 is rotatably journaled. The upper end of the shaft 78 is provided with a diametrically enlarged portion 80 and an annular sealing ring 82 is disposed between the confronting surfaces of the diametrically enlarged head portion 80 and the lower wall 76. The fuel supply reservoir is provided with a fuel inlet nipple 84 communicating with the interior thereof and provided with a threaded counterbore 86 in which the delivery end of a fuel supply line 88 is secured. A resilient spring arm 90 is fixedly secured to the diametrically enlarged upper end portion 80 of the shaft 78 by means of suitable fasteners 92 secured through the apertures 94 formed in the arm 90 and a closure valve member generally designated by the reference numeral 96 is fixedly secured to the free end of the arm 90 in any convenient manner. The closure valve member 96 includes a mounting base 98 having a generally spherical recess 100 formed in the upper end thereof and communicating with the upper surface thereof in which a generally spherical lower end 102 of the valve member element 104 is seatingly received whereby the valve member element 104 is swivelly and rotatably mounted on the base 98. The upper surface 106 of the valve member element 104 is substantially flat and is larger in plan area than the bores 38. It is to further be noted that the upper extremity of the recess formed in the lower portion 20 of the cylinder body member 12 is defined by a planar surface 108 through which the lower ends of the bores 38 open. It is to be further noted that the lower ends of the bores 38 are circumferentially disposed about the axis of rotation of the shaft 78 whereby it may readily be observed that upon rotation of the shaft 78 the flat upper surface 106 of the valve member element 104 will sequentially be moved into registry with the lower ends of the bores 38.

It is to be understood that the shaft 78 may be geared or otherwise directly connected with the shaft of a conventional automotive distributor and that the field coils of the electromagnets 52 and 54 may be electrically connected with the ignition system of a motor vehicle so as to be energized in timed relation with the operation of the internal combustion engine and the rotation of the shaft 78.

In operation, the internal combustion engine or the distributor shaft of the engine is utilized to rotate the shaft 78. The distributor of the internal combustion engine or a separate distributor may be connected with the shaft 78 and utilized to energize the electromagnets or solenoids 52 and 54 so that the actuating sleeve mechanism 40 is moved sharply downwardly when the closure valve member element 104 is in registry with one of the bores 38. The downward movement of the actuator sleeve mechanism 40 will effect downward movement of the pistons 66 and downward movement of the column of fluid disposed in the bores 16. The one bore 16 which is not communicated with the fuel supply reservoir 36, by movement of the associated piston 66 downwardly therein, injects a measured quantity of fuel through the associated fuel line 26. The fuel displaced by the other pistons 66 is allowed to move through the associated bores 38 and into the fuel supply reservoir 36. Further movement of the shaft 78 to uncover the bore 38 last covered by the closure valve member element 104 will also effect energizing of the electromagnet or solenoid 54 in order to raise the actuator sleeve mechanism 40 and the pistons 66 therewith in readiness for the closure valve member element 104 to register with the lower end of the next adjacent bore 38 and the subsequent actuation of the actuator sleeve mechanism 40 downwardly to discharge the next measured quantity of fuel.



Thus, it may be observed that the injection pump 10 is capable of delivering predetermined measured quantities of fuel to a plurality of points of use in timed sequence without the use of spring actuated or pressure actuated stop valves.

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. A fluid injection pump for injecting fluid under pressure to a plurality of points of use in timed sequence, said injection pump comprising cylinder means having a plurality of bores formed therein, a piston for each of said bores, actuator means for said pistons for effecting reciprocating movement of said pistons in said bores, a source of fluid supply, individual means communicating each of said bores with a point of use and including passage means for communicating each of said bores with said source of fluid supply, and valve means for sequentially blocking said passage means and including valve actuating means for actuating said valve means in timed sequence with said actuating means, said actuating means including means for effecting simultaneous reciprocation of said pistons.

2. The combination of claim 1, wherein said fluid supply source includes a planar inner surface, said passage means comprising bores having ends opening through said planar surface and disposed in a given path relative to said surface, said valve means including a closure valve member having a sealing face having a plan area larger than said ends of said bores, and means mounting said closure valve member for movement with its face in sliding contacting relation with said surface and through the path defined by the ends of said bores opening through said surface whereby said closure valve member will sequentially comprise a closure for said ends of said bores.

3. The combination of claim 2, wherein said path defines a circle on said surface, said mounting means including a shaft, means journalling said shaft for rotation about an axis extending at substantially right angles to said surface and alined with the center of said circular path, a laterally projecting arm carried by said shaft, and means mounting said closure valve member on said arm a spaced distance from the axis of rotation of said shaft equal to the radius of said circular path.

4. The combination of claim 3, wherein said arm includes resilient means normally urging said closure valve into tight frictional sliding engagement with said surface.

5. The combination of claim 1, wherein said piston bores are parallel and said actuator comprises a slide mounted for sliding rectilinear movement on said cylinder means paralleling said bores, said pistons being carried by said actuator for movement therewith.

6. The combination of claim 5, wherein said cylinder means comprises an elongated body, said piston bores equally spaced apart and disposed in a circle concentric with the longitudinal axis of said body.

7. The combination of claim 6, wherein said slide comprises a sleeve having a longitudinal opening formed therethrough, said sleeve snugly and slidably receiving said elongated body, an end wall on said sleeve, and means securing one end of each of said pistons to said end wall for movement therewith.



8. The combination of claim 7, including vent means in said end wall communicating the interior of said sleeve with the exterior surfaces thereof.

9. The combination of claim 8 wherein said actuator includes electromagnetic means for effecting reciprocation of said sleeve.

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