

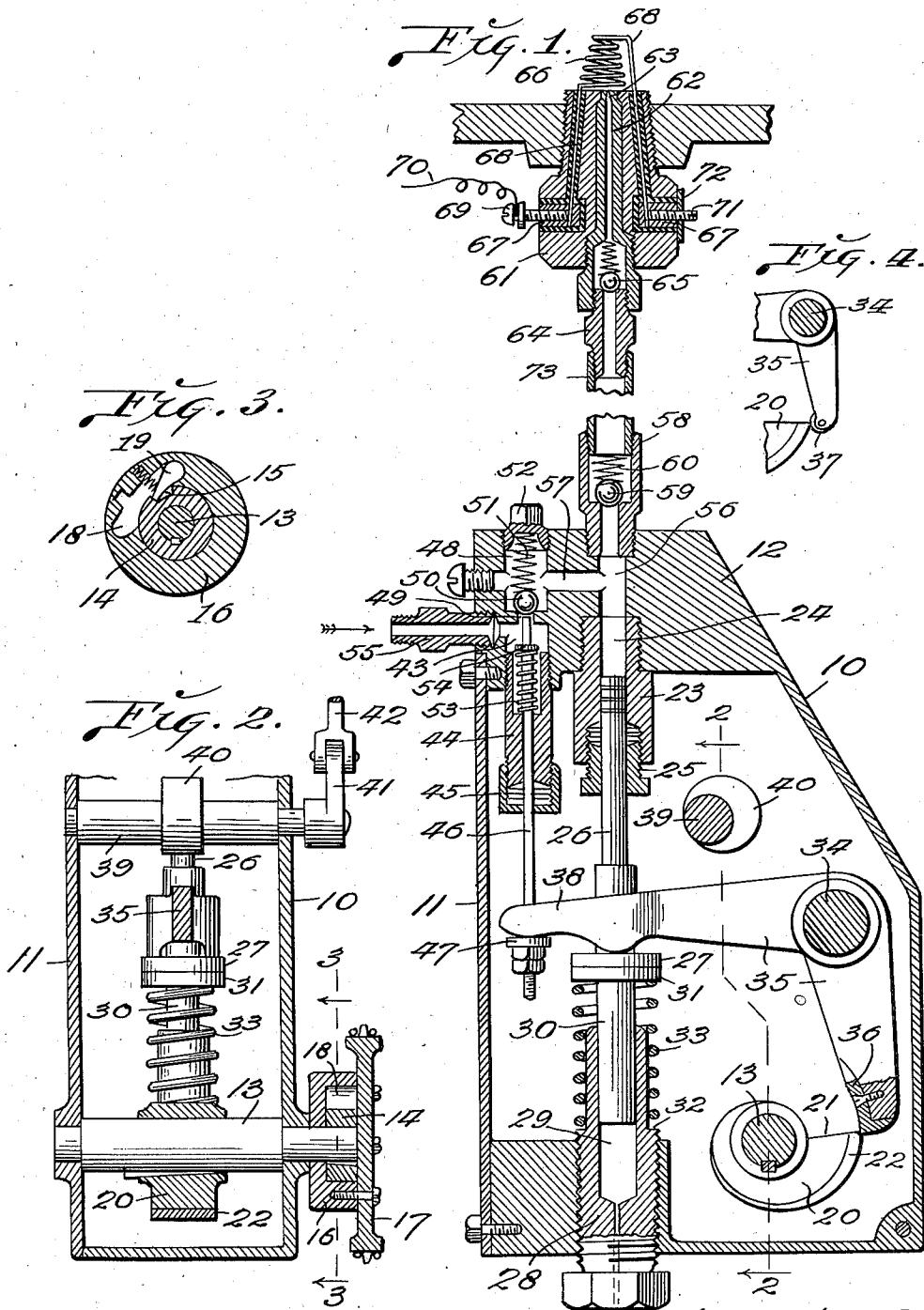
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PUMP AND INJECTOR NOZZLE FOR DIESEL ENGINES

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PUMP AND INJECTOR NOZZLE FOR
DIESEL ENGINES

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My invention relates to a pump and injector nozzle that is especially designed for use in connection with Diesel engines and the principal objects of my invention are, to generally improve upon and simplify the construction of the existing forms of Diesel engines, pumps and injector nozzles and to provide a relatively simple, practical and inexpensive pump and nozzle that will produce constant injection pressure during starting, idling or top speeds of engine operation and insuring an atomized fuel for perfect combustion and for smooth operation without excess pressure on the pump or the fuel lines leading thereto and therefrom.

A further object of my invention is, to provide a pump that will inject fuel only at the proper time, even though the engine throttle be rapidly reciprocated by hand, which is sometimes done in starting an internal combustion engine and further, to provide means whereby the pump will not inject the fuel if the engine rolls backward on compression.

With the foregoing and other objects in view my invention consists in certain novel features of construction and arrangements of parts that will be hereinafter more fully described and claimed and illustrated in the accompanying drawing in which:

Fig. 1 is a section taken on a medial line lengthwise through my improved pump and injector nozzle.

Fig. 2 is a vertical section taken on the line 2—2 of Fig. 1.

Fig. 3 is a detail section taken on the line 3—3 of Fig. 2.

Fig. 4 is a fragmentary detail section showing a modified form of the bell crank that is utilized for imparting reciprocatory movement to the pump piston.

Referring by numerals to the accompanying drawing which illustrates a preferred embodiment of my invention, 10 designates the pump housing having one or more removable walls, such as 11, and formed at the top of said housing is a block 12.

Located in the lower portion of housing 10, and journaled in the side walls thereof, is a shaft 13, one end of which projects beyond one of the walls of the housing, and rigidly fixed on said projecting end is a ring 14.

Formed in the periphery of this ring is a notch 15, provided with shoulders at both ends.

Loosely mounted on the projecting end of shaft 13 and enclosing ring 14, is a housing 16, that is positively driven from the engine with which

the pump is associated, in any suitable manner. In the present instance I have shown the driving means including a sprocket wheel 17 that is directly connected to housing 16.

Formed in housing 16, and communicating with the chamber occupied by ring 14, is a chamber 18, and adapted to occupy either end of said chamber is a spring pressed pawl 19, the point of which is adapted to engage one of the shoulders at the ends of notch 15 in ring 14.

The construction just described is employed in order that the shaft 13 may be driven in the proper direction from either side of the pump and to conform with the direction of travel of the driving means.

Rigidly secured to shaft 13, within the housing, is a cam 20 having an abrupt drop or shoulder 21, and in order to resist wear the greater portion of the curved face of this cam is provided with a layer 22 of hard tough wear resisting metal.

Seated in the underside of the head 12 is a tubular fitting 23, the interior of which provides a chamber 24 which functions as a piston chamber and arranged in the lower end of fitting 23 is a gland or stuffing box 25.

Mounted for reciprocatory movement through gland 25 and the piston chamber 24, is a piston 26, the lower end of which carries a disc 27.

Screw seated in the bottom of the housing 10 and in direct alignment with the fitting 23, is a plug 28 provided in its upper portion with an axial chamber 29.

Mounted for reciprocatory movement in chamber 29 is a plunger 30 carrying at its upper end a disc 31 that bears directly against the underside of disc 27.

Interposed between disc 31 and a shoulder 32 that is formed on the intermediate portion of plug 28 is an expansive coil spring 33.

Journaled in the side walls of housing 10 above shaft 13 are the ends of a shaft 34 and loosely mounted thereon is a rocker arm 35 in the form of a bell crank.

Removably mounted on the lower end of the vertical arm of this bell crank, is a wear resisting member 36, preferably formed of hard tough metal, and which member engages the irregular surface of cam 20.

In some instances it may be found desirable to utilize at the lower end of the vertical arm of the bell crank, a small anti-friction member, for instance, a roller such as 37, Fig. 4.

The outer portion of the horizontal member of the rocker arm 35 is bifurcated as designated by

38 and this portion of said arm rests directly on top of disc 27 that is carried by the pump plunger 26.

Journalled in the side walls of housing 10 above the horizontal member of rocker arm 35 are the ends of a shaft 39, and carried by said shaft and positioned directly above the horizontal member of the rocker arm, is an eccentric 40. This eccentric, which is shifted to different positions as shaft 39 is rotated, functions to limit the upward swinging movement of the horizontal member of the rocker arm and, consequently, controls the volume of fuel that is delivered by the pump piston on its injection stroke.

One end of shaft 39 extends beyond one side of the pump housing and carries a short crank arm 41, to which is connected one end of an operating lever 42, which latter is capable of manual manipulation so as to partially rotate shaft 39 and correspondingly change the position of the volume control eccentric 40.

Formed in block 12, adjacent to fitting 23, is a vertically disposed chamber 43 and screw-seated in the lower portion of said chamber is a depending bearing 44, on the lower end of which is located a gland or stuffing box 45. A rod 46 extends axially through this bearing 44 and its gland, and adjustably carried by the lower end of said rod is a disc 47.

The bifurcated end of the horizontal member of rocker arm 35 bears on top of disc 47 at a point beyond the point where said bifurcated end bears on disc 27.

Formed in block 12, immediately above the chamber 43, is a chamber 48 and a port 49 connects the upper end of chamber 43 with the lower end of chamber 48.

Normally closing port 49 is a downwardly seating ball check valve 50 that is forced downward by a relative light coil spring 51, which latter extends upward through chamber 48 and bears against a plug 52 that is removably seated in the upper end of chamber 48.

Check valve 50 is adapted to be unseated as rod 46 moves to its upper limit of movement and which upward movement is effected by an expansive coil spring 53 that is arranged on the upper portion of rod 46 and which bears against the underside of a flange or collar 54 that is carried by said rod.

The inner end of a nipple or coupling 55 communicates with the upper portion of chamber 43 and said nipple or fitting is connected in any desired manner to a source of liquid hydrocarbon supply.

Formed through block 12 in direct alignment with the piston chamber 24, is a short vertically disposed duct 56 and connecting the intermediate portion of this duct and the intermediate portion of chamber 48, is a duct 57.

Seated in the top of block 12 and communicating with duct 57, is a nipple or fitting 58, within which is formed a valve seat, and normally resting thereupon is an upwardly opening ball check valve 59 that is forced downward under the influence of a light expansion spring 60.

The injection nozzle forming a part of my invention, comprises a plug 61, having a portion that is screw-seated in the wall or head of the engine cylinder and removably seated in said plug and extending axially therethrough, is a tubular member 62, provided at its distal end with a tapered nozzle 63 capable of converting liquid hydrocarbon into fine spray as it discharges from said nozzle.

Removably seated in the rear or lower end of the tubular member 62, is a nipple or fitting 64, the end of which within said tubular member provides a seat for a spring pressed ball check valve 65.

Located directly in front of the jet nozzle 63, is a heating element 66, preferably a coil of wire, and leading from both ends of said coil, through plug 61, to small plugs 67 that are located on the opposite sides of plug 61, are suitable electric conductors 68 that are suitably insulated from said plug 61.

One of the small plugs 67 is insulated from plug 61 and seated in said insulated plug, is a screw 69 that contacts with the corresponding conductor 68 and to which screw is connected a conductor 70 that leads from a battery or other source of electric current supply.

The opposite conductor 68 is secured to the opposite plug 67 by a screw 71, and carried by the latter, is a washer 72 that contacts with the body of plug 61, thereby grounding the current that is delivered to and passes through the heating element 66.

Leading from fitting 58 to fitting 64, is a suitable duct or conduit 73.

The operation of my improved pump and injector nozzle is as follows:

As housing 16 is rotated, pawl 19 engages one end of the notch 15 in ring 64, thereby imparting rotary motion to shaft 13, and the cam 20 carried by said shaft engages the lower portion of the vertical member of rocker arm 35 and swings the same outward. Such movement swings the horizontal member of the rocker arm downward, and the engagement of the bifurcated portion 38 of said horizontal member with disc 27 forces plunger 30 downward in plug 28 against the resistance offered by spring 33.

Thus piston 23 is drawn downward to its limit of movement and on such downward, or suction, stroke, liquid hydrocarbon will be drawn by suction from the source of supply through fitting 55, chamber 43, port 49, past upwardly opening check valve 50 into chamber 48, thence through duct 57 and duct 56 into the piston chamber 24.

As the lower end of the depending member of rocker arm 35 rides off the abrupt shoulder 21 on the cam, the rocker arm will be quickly swung on its axis under the influence of spring 33 so that the horizontal member of said rocker arm will move upward until it is stopped by the adjustable eccentric 40.

As piston 26 is moved upward or inward on the injection stroke, the liquid hydrocarbon trapped in the piston chamber and duct 56 will be forced through fitting 68 past check valve 59 and thence through connection 73 to and through fitting 64, past check valve 65 and through tubular member 62.

The liquid hydrocarbon in discharging from nozzle 63 will be in a finely divided spray form and in such condition it will strike against the heating element 66 to be vaporized and ignited.

It will be understood that heating element 66 is highly heated as a result of the electric current passing therethrough.

During the downward or suction stroke of piston 26, rod 46, which is forced upward with respect to the bifurcated end of the rocker arm 35 by spring 53, holds ball check valve 50 off its seat so as to insure free flow of liquid hydrocarbon from the source of supply into the piston chamber 24 and just before rod 46 reaches the end of its downward travel as a result of pressure

applied by the bifurcated end of the rocker arm, the upper end of said rod 46 leaves ball check valve 50 so that the same is permitted to seat under the influence of spring 51 just before the depending member of rocker arm rides off the high point of cam 20.

The gland or stuffing box 25 effectually prevents the leakage of air or oil between piston 26 and fitting 23 and gland 45 effectually prevents leakage of air or oil between fitting 44 and rod 46.

The housing 10 is filled or partially filled with liquid lubricant so as to provide an oil bath for the cam 20, rocker arm 35 and other operating parts within said housing.

The clearance between the upper end of rod 46 and the ball check valve 50 may be accurately regulated by adjustment of the disc 47 on the lower end of said rod 46.

When arm 36 drops off shoulder 21, spring 53 is not strong enough to overcome the inertia of the bell crank 35 and the latter is swung upon its fulcrum 34 by the expansive power of the relatively heavy spring 33. As piston 26 moves upward in chamber 24, pressure is built up in said chamber and the chambers 56 and 57 and this pressure being relatively heavy, for instance, from 1,000 to 6,000 pounds maintains ball check 50 upon its seat.

Spring 53 functions only to overcome the friction between rod 46 and sleeve 44 and to overcome the tension of the lighter spring 51.

Thus in operation, valve 50, in addition to serving as an ordinary check valve, functions to prevent the engine from receiving an injection when not needed or at the wrong period. In other words, the injection of fuel takes place only at the proper time in the cycle of operations. Valve 50 is held open by rod 46 during an indefinite period before arm 36 contacts with the surface of cam 20, and this period is variable under different speeds of the engine.

The parts of the injector nozzle must be arranged and adjusted so that pressure is built up in chambers 24, 56, 57, and 48, before the upper end of rod 46 contacts with ball check 50, which latter is under heavy pressure. When this heavy pressure is relieved due to the fuel charge being forced into the engine cylinder, rod 46 unseats valve 50, thereby permitting variation of the eccentric 40 without injecting fuel into the engine cylinder.

The adjustable eccentric 40 provides simple and effective means for controlling the stroke of the rocker arm and consequently controlling the volume of liquid hydrocarbon that is delivered to and through the injector nozzle by the pump.

The provision of the pawl between the housing 16 and ring 14 prevents injury or breakage of any

of the parts of the pump in the event that the engine should for any reason turn backward while in operation.

The liquid hydrocarbon delivered to the pump may be under pressure or it may flow by gravity.

Thus it will be seen that I have provided a pump and injector nozzle for Diesel engines that is relatively simple in construction, inexpensive of manufacture and very effective in performing the functions for which it is intended.

My improved pump insures constant injection pressure during starting, idling and top speed of engine operation and the injection nozzle insures an atomized fuel for proper combustion and smooth operation without excess pressure on the pump or the connections between the pump and nozzle.

The pump operates so as to inject fuel only at the proper time and the fuel will not be injected if the engine rolls backward during compression stroke.

It will be understood that minor changes in the size, form and construction of the various parts of my improved pump and injector nozzle for Diesel engines may be made and substituted for those herein shown and described without departing from the spirit of the invention, the scope of which is set forth in the appended claims.

I claim as my invention:

1. In a liquid hydrocarbon fuel pump, a housing provided with a piston chamber, a fuel inlet duct leading to said chamber, a spring pressed check valve located in said duct for preventing rearward flow of liquid fuel through said duct, a spring pressed rod for normally holding said check valve off its seat, a piston arranged for reciprocatory movement in the piston chamber, a spring for yieldingly resisting the suction stroke of the piston, a fulcrumed rocker arm for moving the piston against the resistance of the last-mentioned spring, a cam for actuating said rocker arm, adjustable means carried by said spring pressed valve unseating rod and adapted to be engaged by the rocker arm for moving said spring pressed rod lengthwise only in the direction permitting the check valve to rest on its seat, said check valve seating as said rocker arm approaches the limit of its movement in imparting suction movement to the piston, the spring associated with said rod being stronger than the spring associated with said check valve, and weaker than the spring associated with said piston.

2. In a liquid hydrocarbon fuel pump, as set forth in claim 1, a rotary adjustable member for controlling the swinging movement of said rocker arm in one direction.

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