May 19, 1936. H. I. GRUBBS 2,041,468

FUEL PUMP

Filed Nov. 15, 1934

Fig. 1.

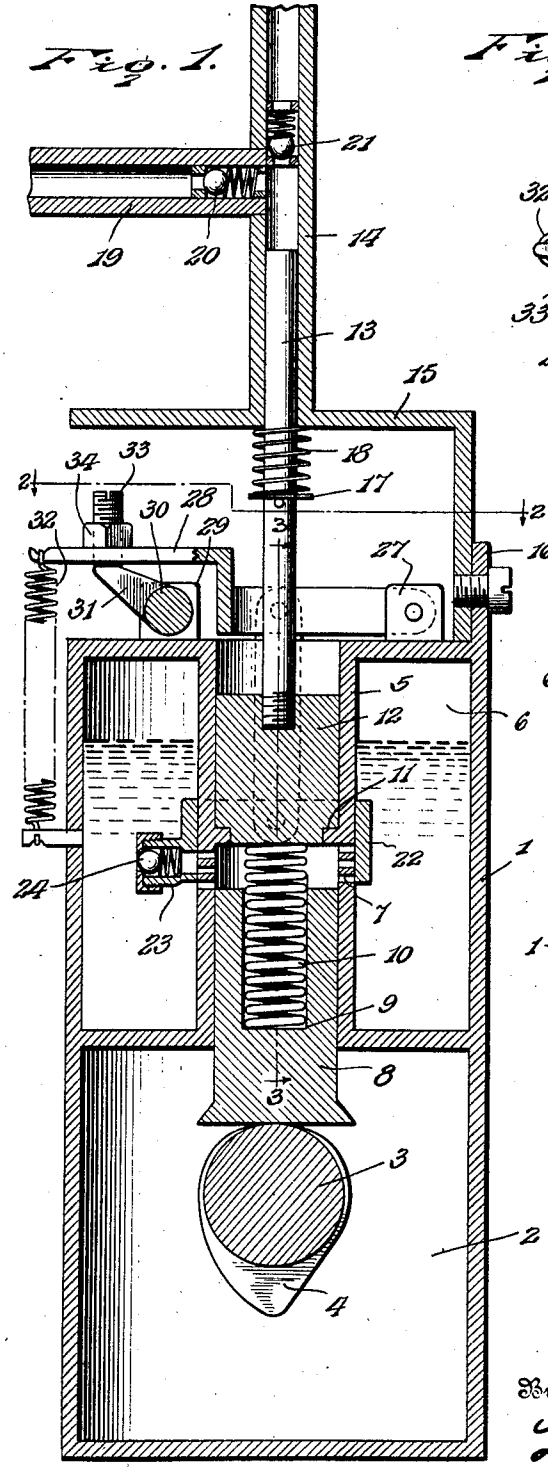


Fig. 2.

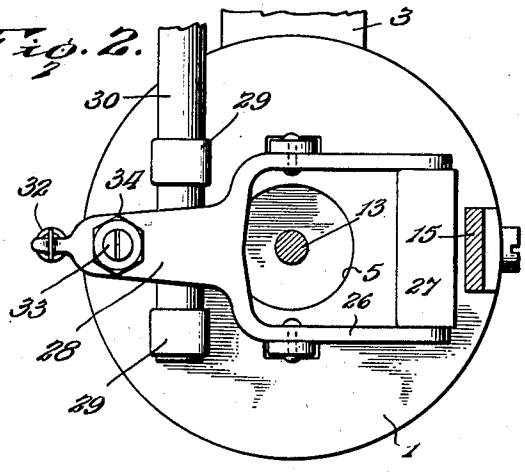
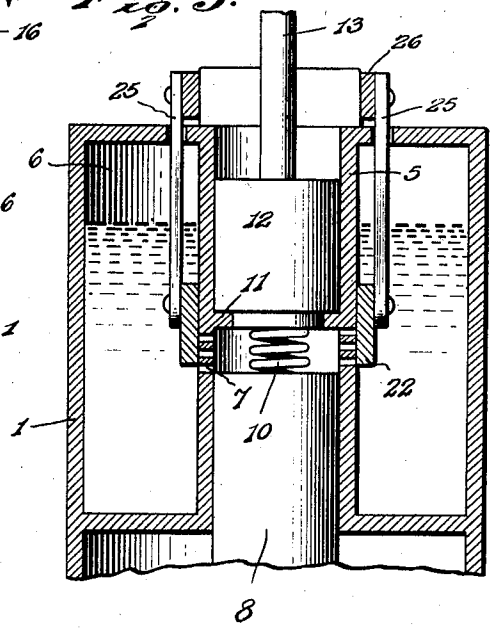


Fig. 3.



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FUEL PUMP

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Application November 15, 1934, Serial No. 753,202

5 Claims. (Cl. 103—44)

This invention relates to fuel pumps, intended primarily for but, of course, not limited to use upon Diesel engines and has for its object the provision of means whereby the stroke of the pump may be varied to suit conditions. It is also an object of the invention to provide an apparatus which will be silent in operation and which will operate easily and smoothly at all times. It is also an object of the invention to provide simple means for regulating the stroke of the pump. One embodiment of the invention is illustrated in the accompanying drawing and will be hereinafter fully described, the novel features being particularly defined in the appended claims.

In the drawing:

Figure 1 is a vertical section through a fuel pump embodying the invention.

Figure 2 is a horizontal section on the line 2—2 of Figure 1.

Figure 3 is a vertical section on the line 3—3 of Figure 1.

In carrying out the present invention, there is provided a casing or fuel chamber 1, the sides of which are elongated to provide a crank chamber 2 in which the driving shaft 3 operates, said shaft having a cam 4 thereon which has a straight face and a curved face and which is slightly flattened at a point diametrically opposite its high part, as clearly shown, so that the upstroke of the plunger will be sharp, while the downstroke of the plunger will be more or less retarded, thereby avoiding shocks to the mechanism and noise in the operation. Within the casing 1 is a cylinder 5 defining, with the casing, a chamber 6 containing oil or some other non-compressible fluid. The oil chamber may be provided with a filling opening at any convenient point, and in the cylinder, intermediate the ends thereof, are ports 7 establishing communication between the oil chamber and the interior of the cylinder. A plunger 8 is mounted in the cylinder and rests upon the cam 4 to be operated thereby, and in said plunger 8 is an axial chamber 9 receiving an expansion coiled spring 10, as shown. Above the port 7, the cylinder is provided with an annular flange 11 constituting a stop for an upper plunger 12, the spring 10 bearing at its upper end against the lower end of said upper plunger. Secured to and rising from the upper plunger is a piston 13 which has its upper end working in a pump cylinder 14 which rises from and is supported by a frame 15 secured to a post or flange 16 on the casing 1. The pump piston 13 fits snugly but slidably within the cylinder 14 and below the frame 15 carries an abutment or washer 17 between which and said frame 15 is disposed a buffer spring 18. The pump cylinder 14 has an inlet pipe 19 fitted thereto and in said pipe, immediately adjacent its juncture with the cylinder, is a check valve 20 which will permit flow into the cylinder but prevent flow therefrom. The outlet for the fuel is furnished by the upper end of the cylinder 14 which leads to the cylinder of the engine and in said outlet, immediately above the inlet pipe 19, is a check valve 21 which will permit flow to the outlet but prevent flow therefrom.

Slidably but closely fitted upon the cylinder 5 is a collar 22 which is adapted to cover the ports 7 except the lowermost port which is always open. The ports are so arranged that the port on one side has its top wall alined with the bottom wall of the port on the opposite side, this arrangement obtaining the effect of a continuous opening or slot. The collar 22 is provided with a tubular offset 23 in which is mounted a check valve 24 which will permit flow into the tubular offset and the space between the plungers but will prevent flow therefrom. Pivoted to the collar 22 at diametrically opposite points thereof are links 25 which extend upwardly through the top of the oil chamber and are pivoted at their upper ends to a yoke or fork 26 fulcrumed upon a lug 27 on the top of the oil chamber. The fork or yoke 26 spans the pump piston 13, as clearly shown, and from its bridge an arm 28 projects over the oil chamber. Journaled in lugs or ears 29 on the top of the oil chamber is a governor rod or shaft 30 which may be connected in any approved manner with the governor of the engine or may be equipped with means whereby it may be set by hand. Immediately under the arm 28, a crank 31 is formed on or secured to the shaft and bears against the underside of the arm in opposition to a contractile spring 32 which is attached to the free end of the arm and to the wall of the casing 1, as shown in Figure 1. To obtain uniformity in the adjustment of the collars upon all the cylinders of a multiple cylinder engine, a set screw 33 is mounted in the arm 28 and bears against the end of the crank 31, as will be understood. Slight turning of this set screw may be readily accomplished by the use of a screw driver or other tool and the several set screws adjusted until the operation of the engine shows that the stroke in all the cylinders is the same. A lock nut 34 on the set screw turned home against the arm 28 will hold the screw in the position in which it may be set.

It is thought the operation will be readily understood from what has been said. On the upstroke of the lower plunger oil in the space between the two plungers will be trapped and the movement of the lower plunger will, therefore, be transmitted to the upper plunger so that the pump piston 13 will be raised and any fuel that may be in the cylinder 14 above said piston will be driven past the check valve 21 to the engine cylinder. Upon the downstroke, the weight of the upper plunger 12, together with the expansion of the spring 18, will cause the same to descend and the expansion of the spring 10 will cause the lower plunger to follow the movement of the cam 4 so that it will also be lowered. Upon the downstroke of the piston 13, another charge of fuel will be drawn through the fuel inlet pipe 19 past the check valve 20 to be driven to the engine cylinder upon the ensuing upstroke of the pump piston. If the controlling collar 22 be set as shown in the drawing so that only the lowermost port 7 is open, the trapping of the oil between the two plungers will occur at the beginning of the upstroke of said plunger so that the upper plunger 12 will be moved at once and its stroke will be approximately the same as the stroke of the lower plunger and a full charge of fuel will be driven to the engine cylinder. Should the engine be idling or running at a very slow speed, the collar 22 will be raised so that one or more additional ports 7 will be uncovered and, consequently, as the lower plunger moves upwardly some of the oil above it will be driven out through the open ports and trapping will occur at a later point in the stroke so that the stroke of the upper plunger will be relatively shortened and less fuel will be driven into the engine cylinders and at a longer interval. The feeding of the fuel may be thus advanced or retarded. The check valve 24, mounted upon the cutoff or regulating collar, serves to break any vacuum that may possibly be formed between the plungers on the downstroke so that the space between the plungers will always be filled with oil, although, as just explained, the trapping of the oil will occur sooner or later in the stroke of the lower plunger according to the adjustment of the collar and, consequently, the stroke of the fuel pump will be varied. The mechanism is compact, simple and easily manipulated so that it is not apt to get out of order and will operate efficiently to regulate the stroke of the pump.

Having thus described the invention, what is claimed as new is:

1. A device of the class described comprising a chamber to hold a non-compressible fluid, a cylinder in the chamber provided with a series of ports between its ends to establish communication with the chamber, a lower plunger in the cylinder, means for raising and lowering said plunger, an upper plunger in the cylinder, means for limiting the downstroke of the upper plunger whereby it will be supported above the ports in the cylinder, a cut-off slidably mounted on the cylinder to cover and uncover the ports, a check valve mounted on said cut-off and permitting flow into the same, and means for adjusting said cut-off, said ports permitting entry of fluid between the plungers to establish an hydraulic connection therebetween.

2. A device of the class described comprising a fluid containing chamber having an inner cylindrical wall, a series of ports in the inner cylindrical wall of said chamber, said ports being arranged to, in effect, form a continuous opening, upper and lower plungers mounted within the inner cylindrical wall of the fluid chamber, an expansion spring between the plungers, means for raising the lower plunger to ride past the ports in the cylindrical wall, a cut-off slidably mounted on said wall in the fluid chamber and adapted to cover or uncover said ports, a check valve mounted on said cut-off to admit flow thereinto, and means for vertically adjusting said cut-off, said ports permitting entry of a non-compressible fluid between the plungers for cooperating with the spring and connecting the plungers.

3. A device of the class described comprising a fluid chamber having an inner cylindrical wall and ports in said wall between the upper and lower ends of the same, upper and lower plungers mounted in the cylindrical wall of the chamber, respectively above and below said ports, an operating cam engaging the lower end of the lower plunger, an expansion spring between the plungers, a cut-off slidably mounted on the cylindrical wall of the fluid chamber and adapted to cover or uncover the ports therein, a pivoted arm on the top of the fluid chamber, links connecting said arm with the cut-off, and means for setting said arm whereby to adjust the regulating cut-off, said ports permitting entry of a non-compressible fluid between the plungers for providing an hydraulic connection between said plungers.

4. A device of the class described comprising a fluid chamber, a cylinder extending through said chamber and having ports between its ends, upper and lower plungers working in said cylinder above and below the ports, respectively, means for operating the lower plunger, a regulating cut-off mounted on the cylinder to cover or uncover the ports, an arm pivoted on the top of the fluid chamber and extending beyond the same, links connecting said arm with the cut-off, a governor shaft journaled on the top of the fluid chamber, a crank on said shaft bearing against the underside of the pivoted arm adjacent the free end of the same, and yieldable means connected with the free end of the arm to maintain it in engagement with the crank, said ports permitting entry of carrying amounts of a non-compressible fluid between the plungers for providing a variable hydraulic connection therebetween.

5. A device of the class described including a fluid chamber having a cylindrical wall and ports in said wall, plungers mounted in the chamber respectively above and below said ports, operating means for one of the plungers, tensioning means between the plungers, slidable means mounted on the chamber and adapted for covering or uncovering the ports, means for operating said slidable means, and a set screw for adjusting the last mentioned means, said ports permitting entry of fluid between the plungers for providing an hydraulic connection therebetween.

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