May 11, 1937. R. E. OLIN 2,079,660

FUEL INJECTION PUMP

Filed April 22, 1935

Fig. 1.

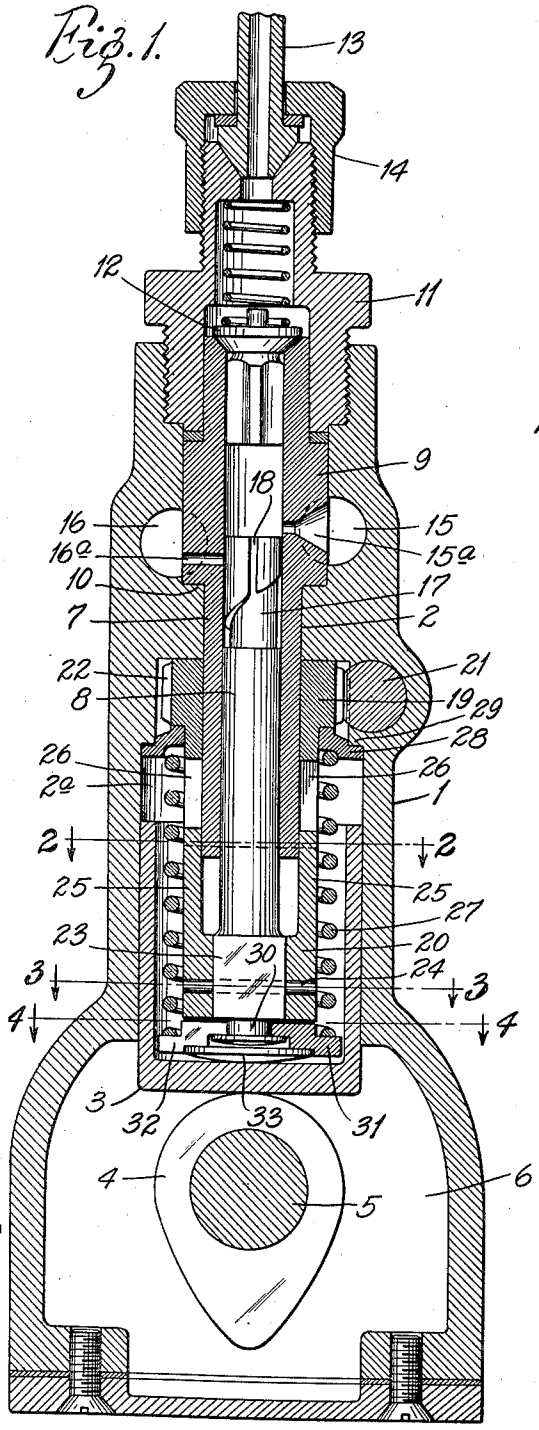


Fig. 2.

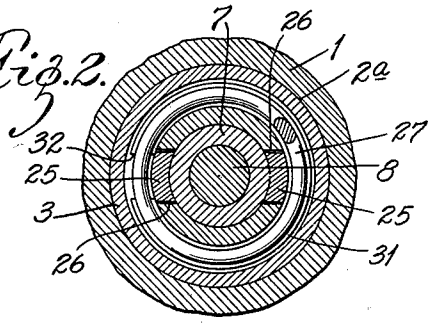


Fig. 3.

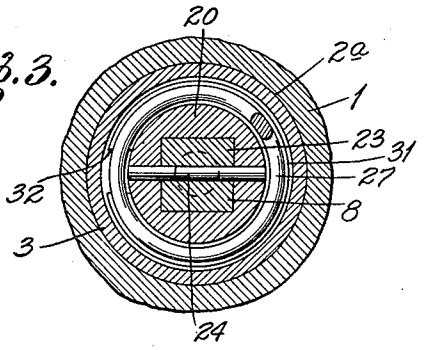


Fig. 4.

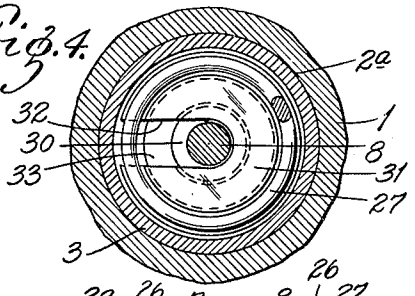
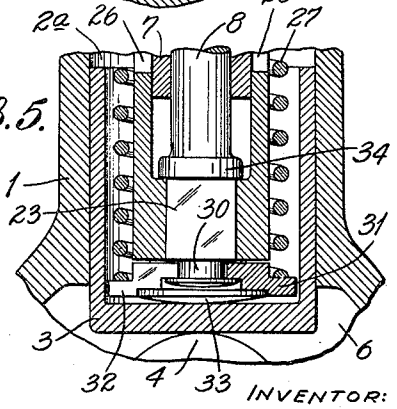


Fig. 5.



INVENTOR:

Robert E. Olin,

by Cantlon Fravely.

HIS ATTORNEYS.

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2,079,660

FUEL INJECTION PUMP

Robert E. Olin, Canton, Ohio, assignor to The Timken Roller Bearing Company, Canton, Ohio, a corporation of Ohio

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4 Claims. (Cl. 103—41)

This invention relates to fuel injection pumps of the kind having a reciprocating piston that is angularly adjustable in its cylinder to regulate the quantity of fuel delivered. The invention has for its principal object to provide a simple, economical, compact and easy operable arrangement for angularly adjusting the reciprocating piston. The invention consists in the piston turning arrangement and in the construction, combinations and arrangements of parts hereinafter described and claimed.

In the accompanying drawing, which forms part of this specification and wherein like symbols refer to like parts wherever they occur.

Fig. 1 is a vertical central section through a cylinder of a fuel injection pump provided with a piston turning mechanism embodying my invention,

Figs. 2, 3 and 4 are horizontal sections on the lines 2—2, 3—3 and 4—4, respectively, in Fig. 1; and

Fig. 5 is a fragmentary section, similar to Fig. 1, showing a modified arrangement for securing the driven sleeve to the piston.

In the accompanying drawing, my invention is shown embodied in a fuel injection pump comprising a housing 1 provided with a vertical bore 2 having an enlarged lower end portion 2a adapted to slidably receive a tappet sleeve or cup 3 engaged at its lower end by a cam or tappet 4 on a cam shaft 5 located in a chamber 6 in the bottom of said housing. A pump cylinder 7, which contains a piston or plunger 8, has an enlarged collar portion 9 that is held down on an annular seat 10 provided therefor in the upper portion of the bore 7 by means of a cylindrical shell 11 threaded into the upper end of said bore.

A spring-loaded fuel discharge or outlet valve 12 is mounted on the upper end of the pump cylinder 7; and a fuel delivery pipe or line 13 is secured to the upper end of the shell 11 by means of a cap nut 14 threaded thereon. Inlet and overflow passageways 15 and 16, respectively, are located in the pump housing on opposite sides of the cylinder 7. The inlet passageway 15 is supplied with liquid fuel by the usual feed pump (not shown) and communicates with an inlet port 15a in the wall of said cylinder. The overflow or by-pass passageway 16 communicates with an overflow port 16a in said cylinder opposite the inlet port 15a.

The piston 8 is provided with an annular groove 17 that communicates through a longitudinal peripheral groove 18 with the pressure space above the piston and has an inclined or helical upper edge whereby the effective delivery stroke of the piston may be regulated by turning the piston in its cylinder to vary the point in the delivery stroke of the piston in which the overflow port 16 is placed in communication with said pressure space through the grooves 17 and 18. By this arrangement, delivery of the fuel begins as soon as the piston on its way up covers the ports 15a and 16a and ends as soon as the helical upper edge of the annular groove 17 in the piston opens the overflow or by-pass port 16a and relieves the pressure in the space above the piston.

The mechanism for rotatably adjusting the reciprocating piston, to vary the point in which the helical edge of the annular groove 17 in the piston opens the overflow port, comprises axially alined upper and lower driving and driven sleeves 19 and 20 mounted on the lower end portions of the cylinder 7 and piston 8, respectively, and a rack bar 21 mounted in a horizontal slideway in the pump housing and cooperating with a gear 22 formed on the upper end of said upper or driving sleeve. The upper or driving sleeve 19 is rotatably mounted on the lower end of the cylinder; and the lower or driven sleeve 20 has a rigid connection with the lower end of the piston comprising a square or flatsided portion 23 on the piston that fits a similarly shaped opening in the lower sleeve and a pin 24 that extends transversely through said lower sleeve and the squared portion of said piston. The driving connection between the driving sleeve 19 and the driven sleeve 20 preferably comprises upwardly extending tongues 25 on the driven sleeve that fit within downwardly opening notches 26 provided therefor in the driving sleeve, thereby permitting relative axial movement of the two sleeves but preventing relative rotary movement thereof.

Surrounding the driving and driven sleeves 19 and 20 is a helical spring 27 that serves to retract the piston 8 and to hold the driving sleeve upwardly in the enlarged portion 2a of the vertical bore in the pump housing. The tappet cup 3 surrounds the driven sleeve 20 but is spaced therefrom far enough to accommodate the spring 27. A washer 28 surrounds and supports the driving sleeve 19 below the gear 22 thereon and is held against the underside of an annular shoulder 29 provided therefor in said bore by means of the spring 27. The piston is provided below the bottom of the lower or driven sleeve 20 with an annular groove 30; and a C-washer 31 is mounted on the lower end of said piston with its laterally opening notch 32 loosely fitting in said annular

groove. The C-washer 31 is of large enough diameter to form a seat for the lower end of the helical spring 27; and said washer is provided on its underside with an annular recess adapted to accommodate a replaceable hardened steel button 33 having a convex spherical underside adapted to be engaged by the bottom of the tappet cup 3.

In the modification shown in Fig. 5, the piston is provided at the upper end of its squared driven sleeve engaging portion with a shoulder 34. This arrangement dispenses with the sleeve retaining pin 24, relative axial sliding movement of the piston and sleeve being prevented in one direction by the shoulder 34 and in the other direction by the C-washer 31.

The above described invention provides a very simple, economical, compact and effective drive for rotating the reciprocating piston; and it permits the parts to be readily assembled and disassembled. The tappet cup prevents the C-washer from being disengaged from the piston; and the spherical tappet cup engaging button cuts down friction between the button and cup and constitutes a wear member that may be easily renewed.

The construction also provides a bearing for both the driving and driven sleeves on the lower end portion of the cylinder so that the cooperating sleeve ends are held in proper alinement; and it also prevents the tappet cup or the piston retracting spring from interfering with the rotation of said driving and driven sleeves.

What I claim is:

1. A fuel injection pump comprising a cylinder, a piston reciprocable in said cylinder and projecting from one end thereof, a sleeve rotatably supported throughout its entire length on said cylinder, and a member fixed to the projecting end of said piston and having a portion overlapping and supported on said end of said cylinder and having a connection with said sleeve permitting relative axial movement but preventing relative rotary movement of said sleeve and said member.

2. A fuel injection pump comprising a cylinder, a piston reciprocable in said cylinder and projecting from one end thereof, a sleeve rotatably supported throughout its entire length on said cylinder, and a second sleeve surrounding and fixed to the projecting end of said piston, said second sleeve overlapping and being supported on said end of said cylinder in all positions of the sliding movement of said piston and having a connection with said first mentioned sleeve permitting relative axial movement but preventing relative rotary movement of said sleeves.

3. A fuel injection pump comprising a cylinder, a piston reciprocable in said cylinder and projecting from one end thereof, a sleeve rotatably supported throughout its entire length on said cylinder, and a second sleeve surounding and fixed to the projecting end of said piston in endwise alinement with said first mentioned sleeve and having a connection with said first mentioned sleeve permitting axial movement but preventing relative rotary movement of said sleeves, said connection comprising circumferentially spaced extensions on the cylinder opposing end of said second sleeve that overlap and are supported on and guided by said end of said cylinder in all positions of said plunger and said second sleeve and slidably engage correspondingly spaced recesses in the adjacent end of said first mentioned sleeve.

4. A fuel injection pump comprising a cylinder, a piston reciprocable in said cylinder and projecting from one end thereof, a sleeve rotatably supported throughout its entire length on said cylinder, a second sleeve surrounding and fixed to the projecting end of said piston, said second sleeve overlapping and being supported on said end of said cylinder in all positions of the sliding movement of said piston and having a connection with said first mentioned sleeve permitting relative axial movement but preventing relative rotary movement of said sleeves, and a piston retracting coil spring surrounding said sleeves and supported thereby against bowing and buckling.

ROBERT E. OLIN.