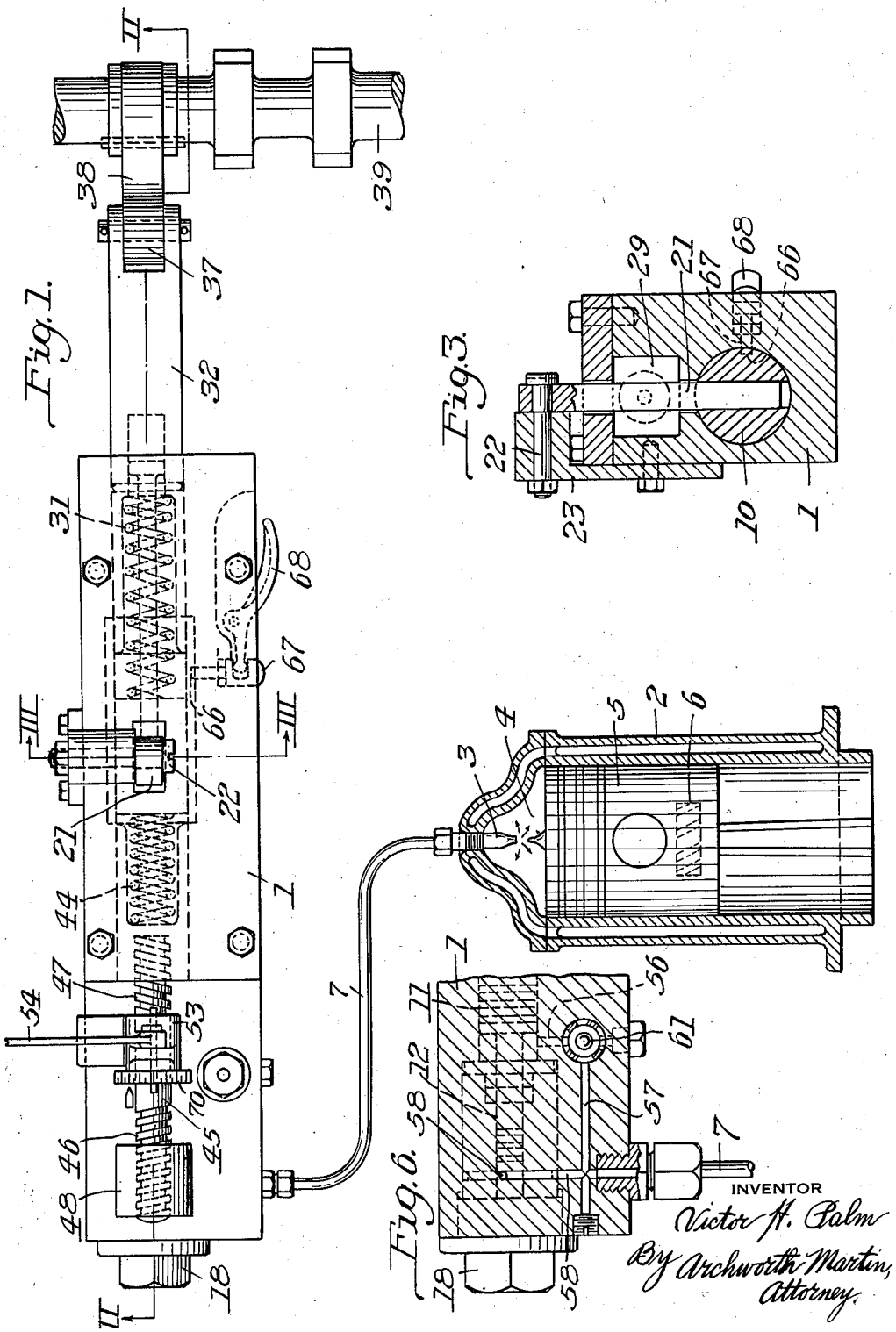
May 13, 1930. V. H. PALM 1,758,371

FUEL INJECTOR PUMP

Filed April 19, 1928 2 Sheets-Sheet 1



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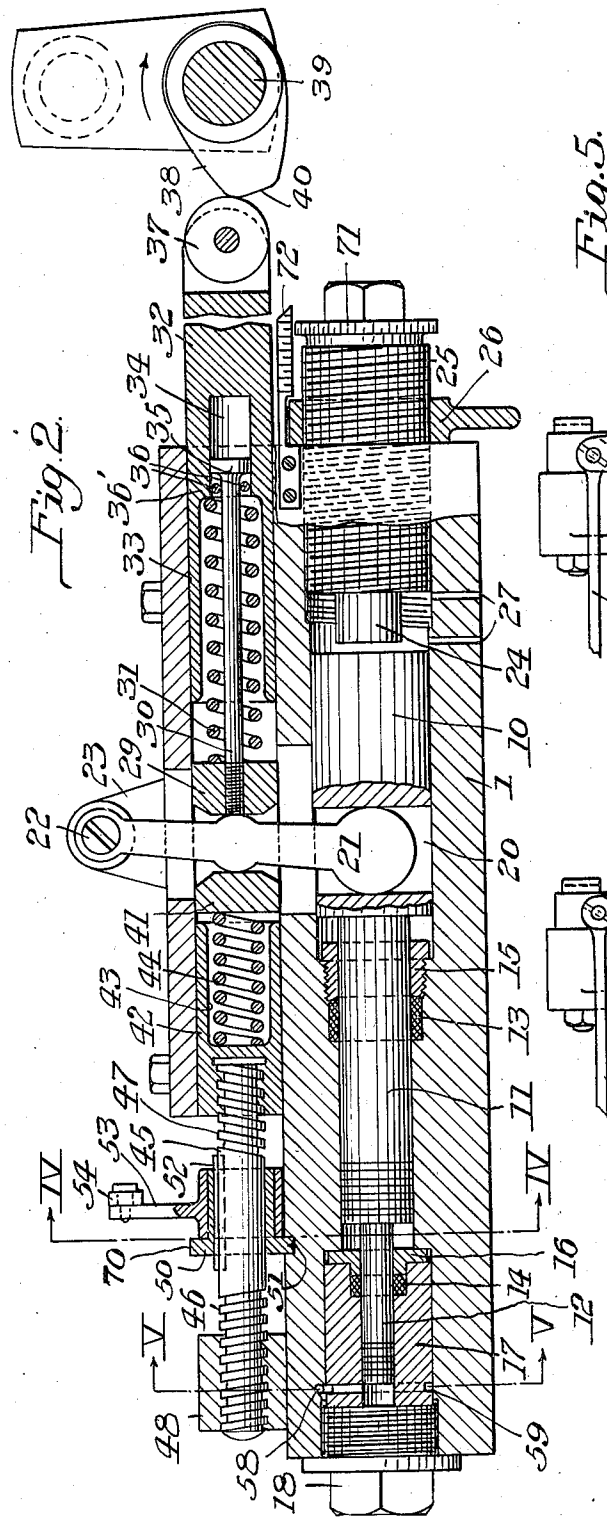


Fig. 2.

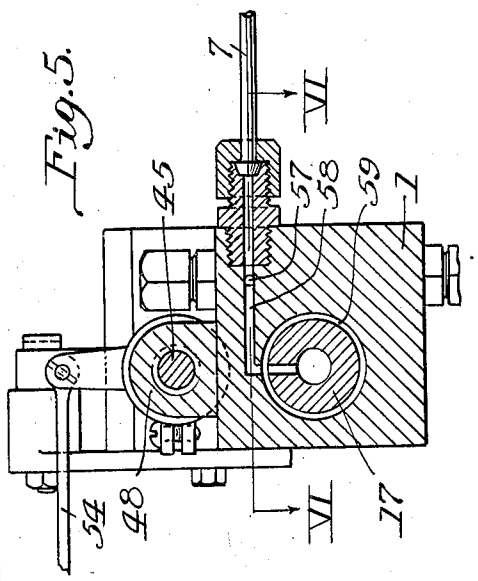


Fig. 5.

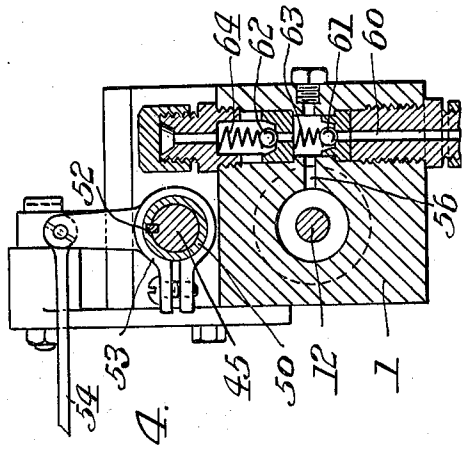


Fig. 4.

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FUEL-INJECTOR PUMP

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This invention relates to fuel injector pumps for internal combustion engines and it is among the objects of the invention to provide a pump for variable speed engines which is adapted to be advanced or retarded while the engine is running.

Another object of the invention is to provide a pump which shall be positive in its action of injecting fuel into the power cylinder in proper timing with the engine.

Still another object of the invention is to provide means for regulating the pump to retard the injection of the fuel in starting and to cut down to a minimum the cut-off of the fuel until the engine gradually warms up and its speed increases.

These and other objects will become more apparent from a consideration of the accompanying drawings in which like reference characters designate like parts and in which Fig. 1 is an elevational view of a fuel injector pump embodying the principles of the invention; Fig. 2 a longitudinal sectional view thereof taken along the line II—II, Fig. 1; Fig. 3 a transverse section taken along the line III—III, Fig. 1; Figs. 4 and 5 sectional elevational views taken along the lines IV—IV, and V—V, Fig. 2; and Fig. 6 a cross sectional view taken along the line VI—VI, Fig. 5.

Referring to Fig. 1 of the drawings, 1 designates the pump housing; 2 a power cylinder of an internal combustion engine; 3 an atomizing nozzle by means of which fuel is sprayed into the combustion chamber 4 of the cylinder; 5 designates the power piston; and 6 an exhaust port which is opened when the piston 5 is at the limit of its down stroke. The fuel nozzle is illustrated as connected by a feed line 7 to the housing 1 of the pump.

Referring to Fig. 2 of the drawings, the housing 1 is shown as provided with a central bore of different diameters for receiving a plunger generally designated at 10 and having pistons 11 and 12, of different diameters, in co-axial alinement, which are sealed by glands 13 and 14 in stuffing boxes provided in the pump housing. The gland 13 is packed and secured by a gland nut 15 and the gland 14 is held against a flanged washer 16 by means of a bushing 17 which is pressed against the member 16 by a screw plug 18. The enlarged portion of plunger 10 constitutes a guide and is provided with a slot 20 for receiving the enlarged end of a lever 21 which is pivoted at 22 to a bracket 23. The plunger is limited in its length of travel in one direction by a stop 24 which is adjusted axially by a screw plug 25 that is held in its adjusted position by a lock nut 26. Vent holes 27 are provided to permit the ready escape of air from behind the plunger 10.

The plunger operating lever 21 is actuated by a slide block 29 which is in screw thread engagement with a plunger 30 that is normally biased by a coil spring 31 to the position shown in Fig. 2 of the drawing; that is, with the block 29 pressed against the lever 21. A drive bar 32 is operatively disposed in a guide way 33 and is provided with an opening 34 for receiving the head 35 of the plunger 30. The head 35 is limited in its movement outward in the opening 34 by pins 36 but will recede into opening 34, when the cut-off will not let the cam make its full stroke without compressing spring 31. Drive bar 32 is extended outwardly by the coil spring 31 which rests against its shoulder 36′ and is provided at one end with a cam roller 37 that engages a cam 38 mounted on the engine shaft 39. This cam may be actuated by an auxiliary shaft which is operated through suitable gearing by the engine shaft.

The cam at the end of its extreme throw is provided with a land 40 which maintains the drive bar in its extended position during the portion of the time when the piston in cylinder 2 is on its expansion stroke, this being for the purpose of preventing the withdrawal of fuel from the cylinder and spray nozzle during the period of combustion. When the cam follower 37 is on the decline portion of the cam, the drive bar 32 will be extended in the direction of the engine shaft by the coil spring 44 which abuts against the nut 42 and plate 41.

A cut-off plate 41 is provided for engagement with the lever 21 on the side opposite the block 29 by spring 44, the position of the cut-off stop being determined by a movable nut

42 which is recessed at 43 to receive a coil spring 44 that acts against the plate 41 to hold it in engagement with the lever 21. The position of the screw nut 42 is regulated by a screw 45 having left and right hand threads 46 and 47, the threaded end 46 interacting with the threaded portion in a stationary nut member 48 so that the movable cut-off nut 42 is subjected to axial movement upon rotation of the screw, 45, for a distance equal to the sum of the pitches of the threads 46 and 47. The screw 45 is disposed in a sleeve 50 having a projection 51 fitting in a slot provided in the housing 1 to prevent axial movement thereof and sleeve 50 is keyed at 52 to the screw 45 to cause the latter to rotate with a longitudinal slidable movement when the sleeve is turned. A clamping sleeve bracket 53 is disposed around the sleeve 50 and is connected to a lever 54 operated by a governor which may be of any well known type and by means of which adjustment of the cut-off nut 42 is effected in the manner described.

As shown in Figs. 4, 5 and 6 of the drawings, the large pumping barrel in which the piston 11 is operated and the small barrel in which piston 12 operates are provided with communicating ports 56. Figs. 4 and 6; 57, Figs. 5 and 6; and 58 Figs. 5 and 6, the latter port communicating with a peripheral groove 59, Figs. 2 and 5, formed in the bushing 17. The port 58 is connected to the feed line 7 leading to the atomizer nozzle 3 of the power cylinder. The pumping barrel is connected through passage 60 to a source of fuel said passage being controlled by a ball valve 61. A ball valve 62 controls the passage leading to the port 58. The balls 61 and 62 are biased by coil springs 63—64 against their seats and are displaced by the suction and oil pressure produced by the pump piston 11.

As shown in Figs. 1 and 3, the plunger 10 is provided with an opening 66 for receiving a pin 67 which is operated by a lever 68 in a manner and for a purpose to be hereinafter explained.

As shown in Fig. 2 the sleeve 50 which is attached to rotate with the screw 45 is provided with a calibrated collar 70 to indicate the adjustment, with respect to the crank 38, of the cut-off stop nut 42 by the movement of member 42. The adjusting nut 25 regulating the position of stop 24 of the plunger is also provided with a calibrated shoulder 71 which is in co-operative alinement with a calibrated finger 72 to indicate the position of the stop 24 which determines the length of travel of the plunger 10.

The operation of the fuel injector pump is briefly as follows:—

To start the engine the plunger 10 is secured against movement by the pin 67 which fits into the opening 66 of the plunger to hold the same against movement. The graduated sleeve 50 controlling the movable nut 42, whose position determines its point of cut-off, is then turned to retard the cut-off stop 42, the screw plug 25 is then screwed in the direction of the plunger so that the latter will have just enough travel to give a light fuel charge.

The engine is brought to the position just over center at which time the cam 38 has compressed spring 31 with head 29 to press against the lever 21 and the plunger head 35 back into depression 34. The pin 67 is then withdrawn from the plunger by tripping the lever 68 and when released the spring 31 will move the plunger 10 through the lever 21 until spring 44 is compressed and let 41 come against stop nut 42 to inject oil into cylinder 2 through the atomizing nozzle 3. Spring 31 must overcome the tension of spring 44 and the injector oil pressure.

The adjusting screw 25 is then screwed out of the housing to increase the stroke of the plunger 10 to pump more fuel and as the engine gains speed the cut-off stop 42 is also adjusted by turning the calibrated sleeve 50 to limit the travel of the plunger 10. After the proper speed has been obtained the sleeve 50 is clamped to sleeve bracket 53, and through its connection 54 with the governor will further regulate the engine speed by changing the cut-off stop. By means of the calibrated sleeve 50 and the calibrations on the screw plug 25 and finger 72, adjustments may be made for different fuels to secure economy of operation.

In the operation of the pump the fuel is pumped by the piston 11 and drawn into the valve chamber by raising the ball 61 on the suction stroke of the piston; on the return or pressure stroke the oil is forced past ball 62 and through the passage 57 raising ball 62 from its seat, and flows through the line 7 leading to the atomizing nozzle 3 of the cylinder. At the next suction stroke of the engine, any oil remaining in the feed line 7 will be drawn into the small barrel by the piston 12, without interfering with the pumping action of the pump piston 11. On the next discharge stroke of piston 11, the piston 12 will replace the fuel in the nozzle line, and on the next suction stroke of plunger 11, plunger 12 will again draw the oil out of the nozzle, or at least draw it back somewhat.

In this manner there will be no dripping of fuel in the combustion chamber after combustion has taken place and as previously explained the land 40 on the cam 38 will hold the pumping piston in its charging position during a portion of the expansion stroke of the power piston for the purpose of preventing any back-firing into the fuel line.

The type of injector pump herein described is particularly adapted as an oil injector pump in internal combustion engines operating under high compression without the use

of ignition systems, the heat of compression being sufficient to ignite the fuel.

Although one embodiment of the invention has been herein illustrated and described, it will be obvious to those skilled in the art that various modifications may be made in the details of construction without departing from the principles herein set forth.

I claim herein as my invention:

1. An injector pump for internal combustion engines comprising a housing, a plunger having a plurality of pistons in coaxial alinement, a lever for actuating said plunger, a drive bar in operative yieldable engagement with said lever, a cam operatively associated with the engine shaft for actuating said drive bar, and a yieldable device for taking up the lost motion that is permitted by said yieldable engagement.

2. An injector pump for internal combustion engines comprising a housing, a plunger having a plurality of pistons in coaxial alinement, a lever for actuating said plunger, a drive bar in operative engagement with said lever, a cam operatively associated with the engine shaft for actuating said drive bar, said cam having a dwell portion on its outermost camming surface to hold the plunger stationary at the end of the feeding stroke of the piston.

3. An injector pump for internal combustion engines, comprising in combination a housing having a plurality of pumping barrels, and a plunger having a plurality of pistons in coaxial alinement, said barrels having connecting ports, and connections with a source of fuel supply and an atomizing nozzle in a power cylinder, means for operating said plunger to pump oil to said atomizer, means for holding said plunger during a portion of the expansion stroke of the power piston, and means for withdrawing the fuel from the atomizer when combustion takes place in the power cylinder.

4. A fuel pump for internal combustion engines comprising, a housing having a plurality of pumping barrels, pistons in said barrels operative as a unitary member, actuating mechanisms for said pistons operated by the engine shaft, an adjustable stop for regulating the stroke of said pistons and an adjustable cut-off block for regulating the fuel charge delivered by said barrels.

5. A fuel injector pump for internal combustion engines comprising a housing having a plurality of pumping barrels communicating with the combustion chamber of said engine, a pair of pistons in coaxial alinement with and adapted to be jointly operated by a reciprocatory plunger, actuating mechanism for said plunger operatively connected to the engine shaft, means rendering said pump operative to inject a fuel charge to the combustion chamber, means for rendering the charging pump inoperative for an appreciable period following the expansion stroke of the engine and means for establishing negative pressure in the fuel charging line after the fuel is ignited in the combustion chamber.

6. A fuel injector pump as set forth in claim 5 in which the travel of the plunger is regulated to control the fuel supply to the engine cylinder and which is provided with adjustable calibrated means for advancing and retarding the fuel cut-off

7. A fuel injector pump comprising a housing having a pair of pumping barrels in coaxial alinement, a plunger having a pair of pistons disposed within said barrels, a lever pivotally mounted on said housing and being in sliding engagement with said plunger, an operating bar for actuating said lever, an adjustable stop for regulating the distance of travel of said plunger, and a cut-off block for controlling the movement of said lever whereby the charging stroke of said plunger pistons is regulated.

8. A fuel injector pump as set forth in claim 7 in which the cut-off block is adjusted by a screw nut which is adapted for regulation by the engine governor.

9. A fuel injector pump for internal combustion engines, comprising a housing having a pair of pumping barrels of different diameters in coaxial alinement, a spray nozzle leading into the cylinder of the engine, a plunger adapted for reciprocatory movement in said housing and having a pair of pistons operatively disposed in said barrels, said pumping barrels having communicating ports and a connection with the said spray nozzle, and said plunger being adapted for operation by the engine shaft whereby fuel is charged to the engine cylinder by the advance stroke of the plunger and withdrawn from the spray nozzle of the cylinder by the reverse stroke of said plungers.

10. A fuel injector pump for internal combustion engines comprising a housing having a pair of pumping barrels of different diameters in coaxial alinement, a plunger adapted for reciprocatory movement in said housing and having a pair of pistons operatively disposed in said barrels, said pumping barrels having communicating ports and a connection with the combustion chamber of the engine cylinder, and said plunger being adapted for operation by the engine shaft whereby fuel is charged to the engine cylinder by one piston and surplus fuel drawn back by the other piston in timed relation with the engine shaft.

11. Injector pump mechanism for internal combustion engines, comprising a pumping piston, means operating in predetermined relation to movement of the engine for actuating said piston and adjustable stop device for regulating the point at which the feeding stroke of the piston ends and an ad-

justable device for limiting the suction stroke of the piston.

12. An injector pump for internal combustion engines comprising a main piston for feeding fuel to an engine through a fuel supply line, and means apart from said main piston for retracting fuel in the supply line upon beginning of return movement of said piston.

13. An injector pump for internal combustion engines, comprising piston means for feeding fuel to an engine through a fuel supply line, and means apart from said piston for retracting fuel in the supply line during retractive movement of said piston and for returning the withdrawn fuel to the supply line during feeding movement of the piston.

In testimony whereof I, the said VICTOR H. PALM, have hereunto set my hand.

VICTOR H. PALM.