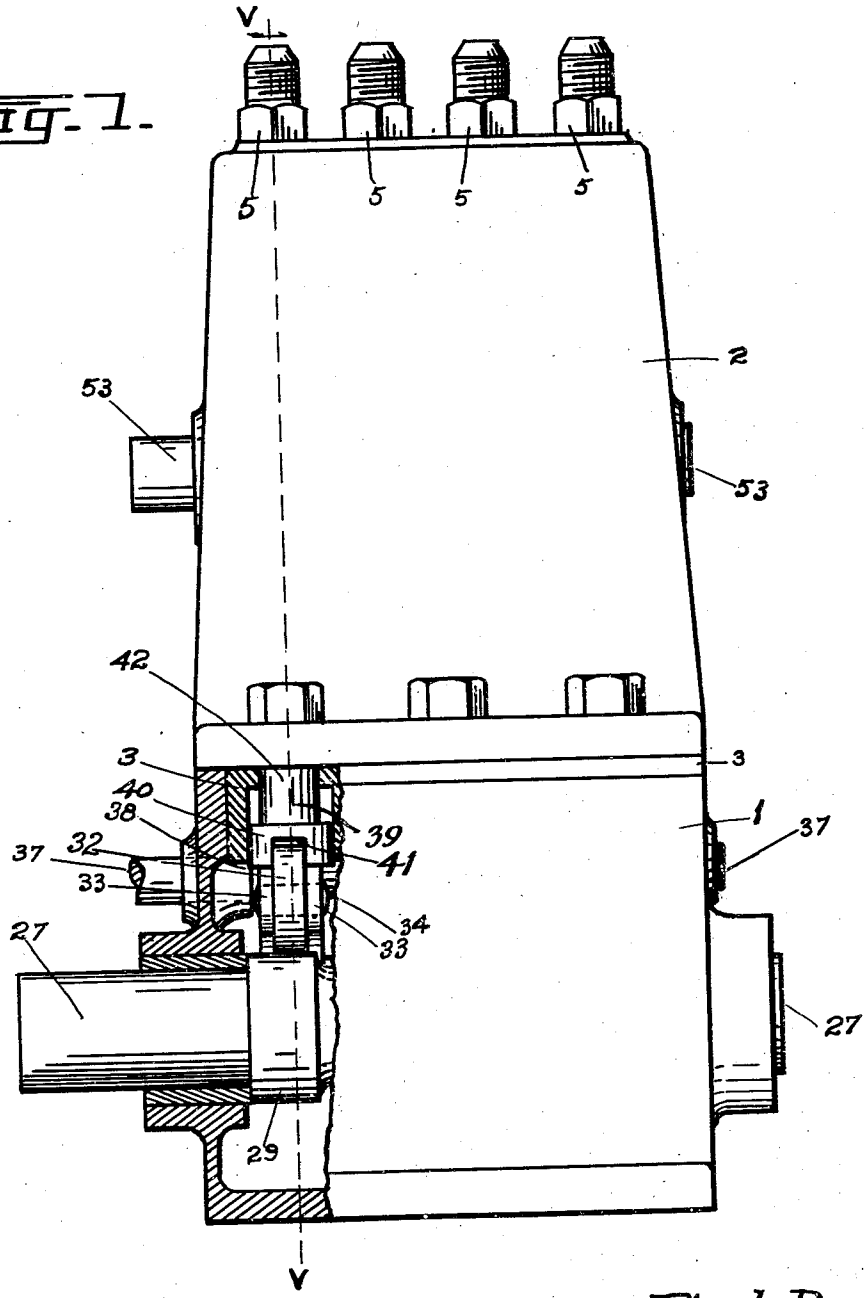
Aug. 5, 1941. F. DAVIS 2,251,783

FUEL PUMP FOR ENGINES

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Fig. 1.



Floyd Davis
INVENTOR

BY Charles W. Dake
ATTORNEY

Aug. 5, 1941. F. DAVIS 2,251,783

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Fig. 2.

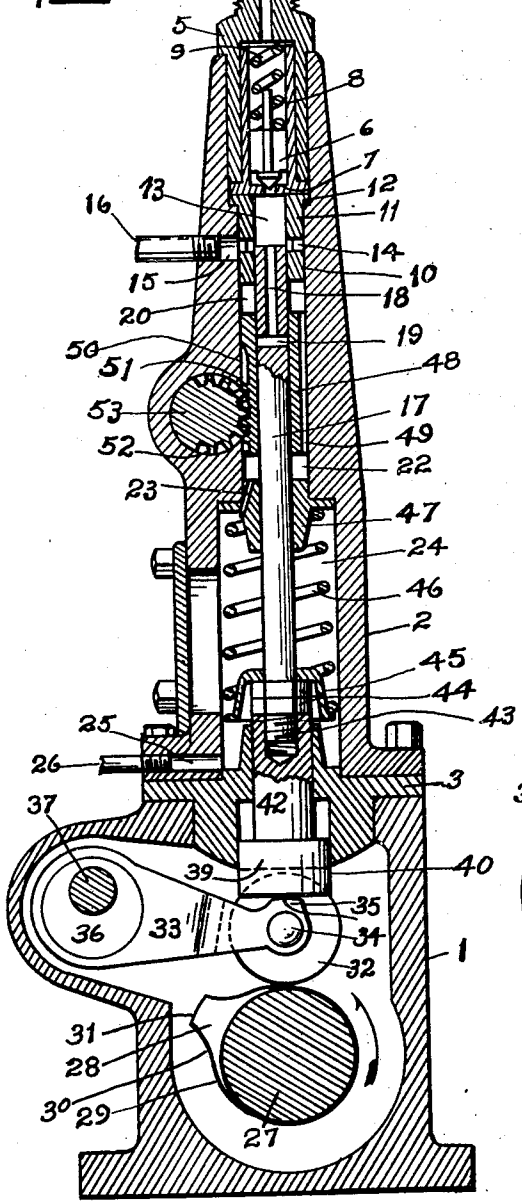
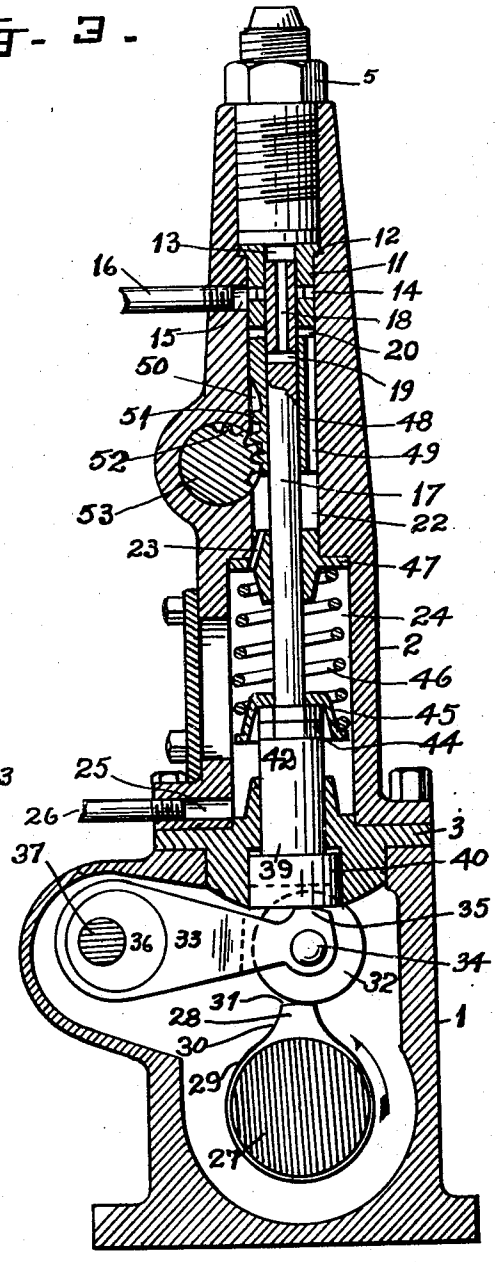


Fig. 3.



Floyd Davis
INVENTOR

BY Charles W. Dake
ATTORNEY

Aug. 5, 1941. F. DAVIS 2,251,783

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Fig. 4.

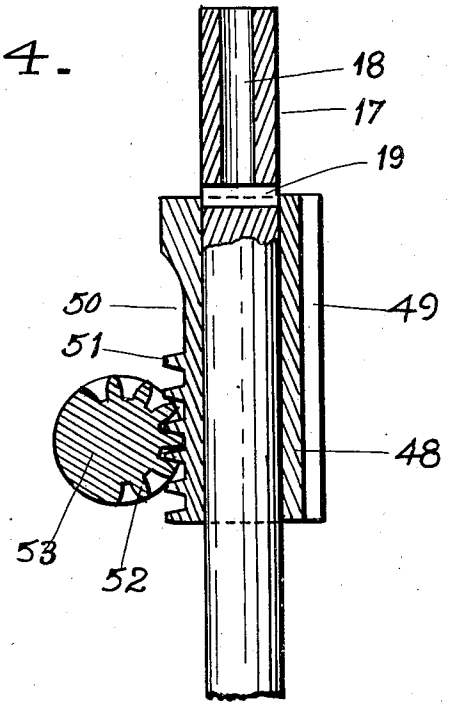
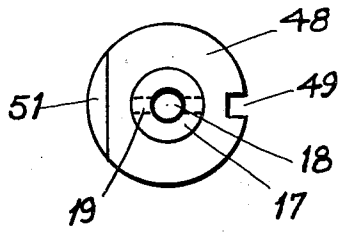


Fig. 5.



Floyd Davis
INVENTOR

BY

Charles W. Dake
ATTORNEY

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UNITED STATES PATENT OFFICE

2,251,783

FUEL PUMP FOR ENGINES

Floyd Davis, Norton Township, Muskegon County, Mich.

Application March 14, 1938, Serial No. 195,859

3 Claims. (Cl. 103—41)

My present invention relates to a fuel pump for engines, and particularly to those pumps of the type employed for injecting liquid fuel under heavy pressure into air highly compressed in the combustion chamber and space above the piston within the cylinder bore of internal combustion engines, such as the Diesel type engine, and the objects of improvement are, first, to provide a fuel pump that will be positive in its delivery of said fuel under extremely high pressures; second, to provide a fuel pump structure for multiple engine units wherein a plurality of pump units are provided, each individually adjustable to the fuel requirement of the particular engine unit it is pumping fuel to; third, to provide a fuel pump of rigid construction, not liable to disorder and cheap to manufacture.

The above named objects and other objects that will appear from a perusal of the following description are attained by the pump structure shown in the accompanying drawings, in which:

Figure 1 is a front elevation of my fuel pump of multiple unit structure in which one of the pump units is partly in section.

Figure 2 is a sectional view of my pump taken on line V. V. of Figure 1, with the fuel control sleeve adjusted to partial pumping operation.

Figure 3 is a similar sectional view to Figure 2 except the fuel control sleeve is adjusted to maximum fuel pumping operation.

Figure 4 is an enlarged view of the control sleeve and adjusting gear therefore as removed from the pump housing.

Figure 5 is an enlarged end view of the fuel control sleeve and transverse view of the sleeve adjusting gear and shaft thereof.

Throughout the several views of the drawings, similar reference numerals refer to similar parts, in which:

Numeral 1 refers to the base portion of the pump structure housing; 2, the upper portion of the housing and 3 an intermediate portion of the said housing. At the top of the portion 2 is union connector 5 to which is connected a metal tube extending to the particular engine unit to which the fuel pumped is delivered. Within the union connector 5 is fuel delivery valve 6 engaging seat 7 in valve cage 8, the valve 6 being pressed against its seat by helical spring 9. The union connector 5 is screw-threaded at its exterior to receive a connector nut on the fuel delivery tube and has its upper end of conical shape to fit into the belled-out end of the fuel delivery tube and to provide a flange whereby the belled-out end may be drawn against the conical end of the union connector by the union nut. Within the bore 10 is stationary sleeve 11 shouldered therein by flange 12 and having extending from its outer periphery to its interior bore 13 fuel inlet ports 14 in register with inlet port 15 extending through the wall of the housing portion 2 and having connected therewith tube 16 whereby the liquid fuel is delivered to the pump. Reciprocable within the bore 13 of the bushing 11 is pumping plunger 17 having axially extending fuel escape port 18 beginning at the upper end of the pumping plunger to the transverse sleeve ports 19 through which the excess fuel escapes to the chamber 20 and through the passage 49 to the chamber 22 and through hole 23 to the spring chamber 24 and back to the fuel container through hole 25 and tube 26 or to any other container as may be desired. Within the base portion 1 of the pump housing is the pumping plunger operating mechanism consisting of the drive shaft 27 provided with operating cam 28 having a convex lift portion 29, and concave flanks 30 and lift dwell extremity 31 of arc form having its radii emanating from the axis of the shaft 27. Engaging the cam 28 is plunger lift roller 32 pivotally connected to forked lifter arm 33 by pivotal pin 34, and which arm has upwardly extending bosses 35 at each side of the roller 32. The forked lever 33 at its opposite end from the said roller 32 encircles eccentric 36 carried by turnable shaft 37 mounted in suitable bearings 38 at each side of the base 1. The bosses 35 at each side of the roller 32 are arcked upward and engage the pumping plunger thrust plug 39 reciprocable in the thrust plug guide member 3 of the housing and consisting of a head 40 having slot 41 to provide clearance for the roller 32 and upwardly extending shank portion 42 having axially extending screw-threaded hole 43 into which is screwed the lower end of the pumping plunger having screw-threaded thereon lock nuts 44 whereby the pump plunger may be adjusted longitudinally for controlling the fuel pumped individually to the engine unit desired; resting on the lock nuts 44 is spring abutment collar 45 engaged by helical spring 46 which spring is engaged at its upper end by stationary abutment collar 47. Surrounding the pumping plunger 17 intermediate its ends is slidable fuel control sleeve 48 having slot or grooved 49 extending from end to end thereof, and in spaced relation to said slot, transverse slot 50 and adjacent thereto gear rack teeth 51 engaged by the teeth of sleeve sliding gear 52 on the turnable shaft 53 whereby the fuel control sleeve 48 can be either manually or mechanically

slid for controlling the amount of fuel pumped. The purpose of the transverse slot 50 is to provide clearance for allowing the removal or insertion of the sleeve sliding gear 52 and shaft 53.

In the operation of my improved fuel pump, tubular connection having been made between the fuel inlet port 15, the hole 25 and the source of fuel supply which may be in any suitable container and also between union connector 5 and the fuel injection valve of the particular engine cylinder it is desired to inject fuel into, and having provided suitable means for driving the pump in synchronism with the longitudinal excursion of the engine's piston, which preferably consists of a chain of gears between the engine's main shaft and the shaft of the fuel pump, and having provided the said connections, I start the engine by any one of the well known methods employed for starting Diesel engines. As the engine is started, the fuel pump is also started with the result that as the shaft 27 thereof, together with the cam 28, which in its rotation, lifts the friction reduction roller 32 and plunger guide 39 and through its connection with the pumping plunger 17 causes the pumping plunger to slide upwardly through the fuel control sleeve 48, closing the fuel inlet port 14, thus trapping any fuel above the pumping plunger in the bore portion 13 of the bushing 11, which trapped fuel as the pumping plunger continues to move upward is forced past the fuel delivery valve 6 through the union connector 5 and conductor tube which is connected therewith, and to the engine. The quantity of fuel pumped to the engine is controlled by the fuel control sleeve 48 which controls the radial ports 19 having communication with the bore 13 above the pumping plunger through fuel escape port 18. In Fig. 3, the fuel control sleeve is so adjusted that all of the fuel entering bore 18 through inlet ports 14 is forced past the discharge valve 6 by the pumping plunger, while as shown in Figs. 2 and 4, the fuel control sleeve is so adjusted that the ports 19 are partly uncovered, or open and when the fuel control sleeve is in the position shown in Fig. 4, a portion of the fuel escapes from the bore 13 and a lesser amount of the fuel is forced past the discharge valve 6 to the engine. Thus, the amount of fuel required by the engine to perform the desired work is controlled, as when the fuel control sleeve is adjusted to a position that will not allow the radial ports to be uncovered during the pumping plunger's reciprocable excursions, the full amount of fuel will be delivered to the engine, and when the fuel control sleeve is adjusted to a position where the radial ports are uncovered by the sleeve, or partly uncovered, during the pumping plunger's fuel forcing excursions, a lesser amount of fuel will be forced to the engine and the surplus fuel will flow into the chamber 20 and from thence through the slot 49 to the chamber 22 and through holes 23 to spring chamber 24 from where it is piped to the fuel supply. The sliding for adjustment of the fuel control sleeve is accomplished by the gear 52 in engagement with the gear rack teeth 51, at the side of the fuel control sleeve which has in circumferential relation to the said teeth, slot or groove 49 through which the surplus fuel escapes from the chamber 20 between the sleeves 11 and 48, to the chamber 22, from where it drains through the hole 23 to chamber 24 thereof through hole 25 and tube 26 back to the fuel container. In order that the pumping plunger may be adjusted longitudinally to cover or uncover the fuel inlet ports 14 more or less, I provide an adjustment therefor between the pumping plunger and the guide member 39 by threading the end of the pumping plunger into the guide member and lock the plunger in the guide member by nuts 44, against relative displacement, and in addition to the adjustment of the pumping plunger to properly cover and uncover the fuel inlet ports 14, I provide an adjustment for timing the stroke of the pumping plunger in relation to the movement of the engine's pistons position, whereby the time of fuel injection to the engine may be varied, and thereby bring about combustion in the several cylinders of a multiple cylinder engine at the exact desired instant which has been found contributes to a reduction of vibration and reduced fuel consumption. This adjustment of timing the instant of fuel injection is accomplished by eccentric 36 supporting one end of lifter arm 33, as by turning the eccentric from its position shown in Fig. 2, which is the fuel injection retarded position, to the position shown in Fig. 3. The fuel injection will be advanced and the injection of the fuel into the engine will be at an earlier stage of the engine pistons' compression excursion. Thus any degree of retardation or advancement of fuel injection may be had, because the roller 32 will be contacted by the cam 28 against the roller 32 in the cam's rotational movement and the roller together with the arm 33, guide 39 and pumping plunger forced upward on the discharge stroke, either earlier or later as may be desired, by the cam 28. The cam in order to overcome noise caused by knocking of the cam against the roller 32, is provided with convex lift portion 29 whereby play between the roller and the semi-circular portion of the cam is taken up before the cam proper contacts the roller, which lift is very rapid after it is started which is due to the concave formed flanks of the cam, which has at its extreme height, dwell portion at 31 whereby the fuel pumped by the pumping plunger is given time to somewhat settle to escape from the pump and through the delivery tube back to the fuel container.

Having described my improved fuel pump for engines, the rights I desire to secure are set forth in the following claims.

I claim:

1. In a fuel pump for engines, a reciprocal pumping plunger having extending axially therein from is upper end an excess fuel port, and an excess fuel port extending transversely through the pumping plunger and open to the axially extending port a slidable fuel control sleeve surrounding the upper end portion of the pumping plunger and slidable in the pump housing and having its upper end registering with the transversely extending excess fuel port, a stationary fuel control sleeve having extending from therein the upper end of the pumping plunger, the said stationary sleeve having a port in register with the end of the pumping plunger and with the pump's fuel supply port, and a chamber between the upper end of the slidable sleeve and the lower end of the fixed sleeve for varying the capacity of the pump or amount of fuel pumped.

2. In an internal combustion engine fuel pump having a housing with a cylindrical bore and a reciprocal plunger in the bore, the said plunger having a free upper end with an excess fuel escape port extending axially of the plunger from the free end thereof and having com-

munication with an excess fuel escape port extending transversely through the pumping plunger, a stationary sleeve extending into the cylindrical bore of the housing, and having a port in registry with the free end of the pumping plunger that extends slidably in the said sleeve, the port being in registry with the free end of the pumping plunger having time registry with the fuel supply port of the pump, and a fuel control sleeve slidable in the cylindrical bore of the housing and surrounding the pumping plunger, intermediate the ends thereof, for controlling the escape of excess fuel from the excess fuel port that extends transversely through the pumping plunger, the said sleeve being slidable in the cylindrical bore of the housing, and having a slot at its periphery extending from end to end of the sleeve, for permitting escape of excess fuel from the chamber between the said stationary and slidable sleeves.

3. A structure containing the elements in combination defined in claim 2 and including, a cam shaft having thereon a cam comprising lift portion having two concave flanks and convex portions between the said concave flanks and the cam shaft, and means interposed between the cam and the pumping plunger for moving the plunger in response to rotation of the said cam.

FLOYD DAVIS.