Jan. 10, 1939. S. JENCICK 2,143,698

FUEL INJECTION PUMP FOR DIESEL MOTORS

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Fig. 1.

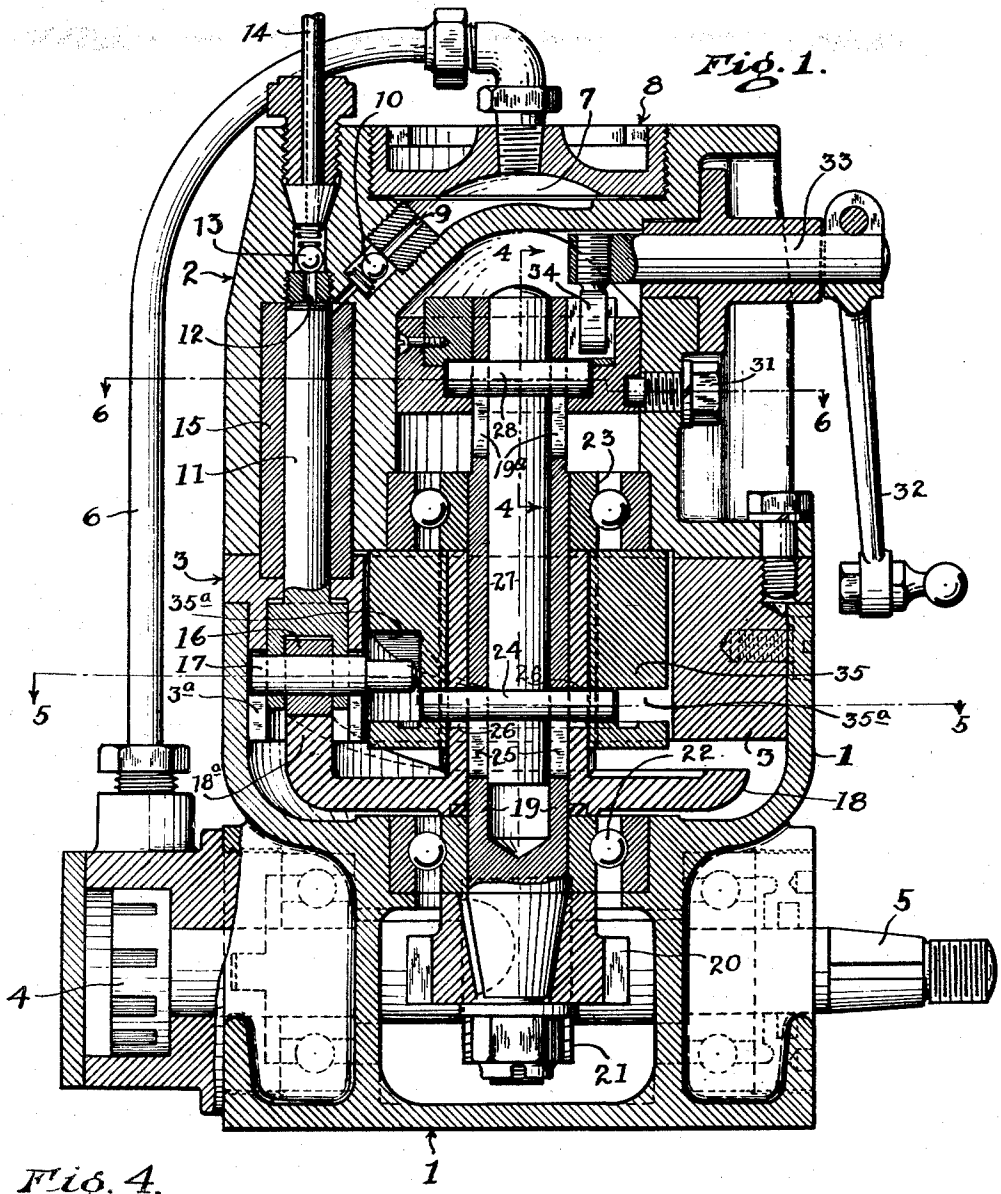
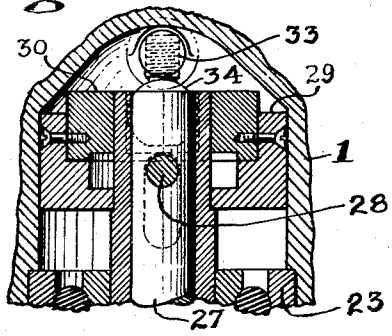


Fig. 4.



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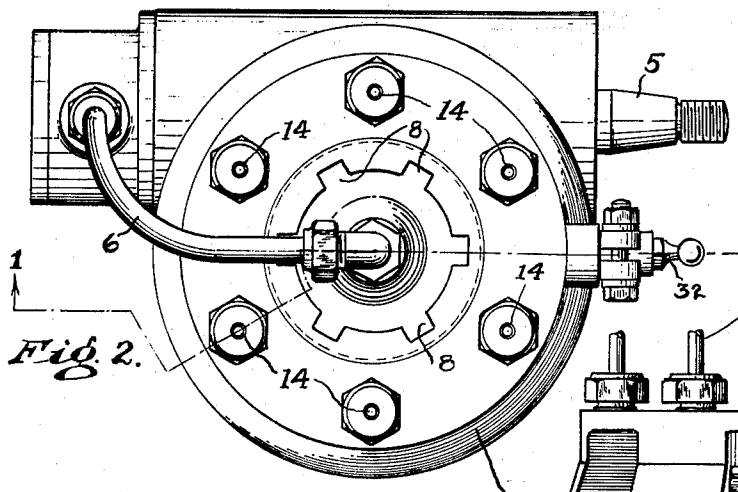


Fig. 2.

Fig. 3.

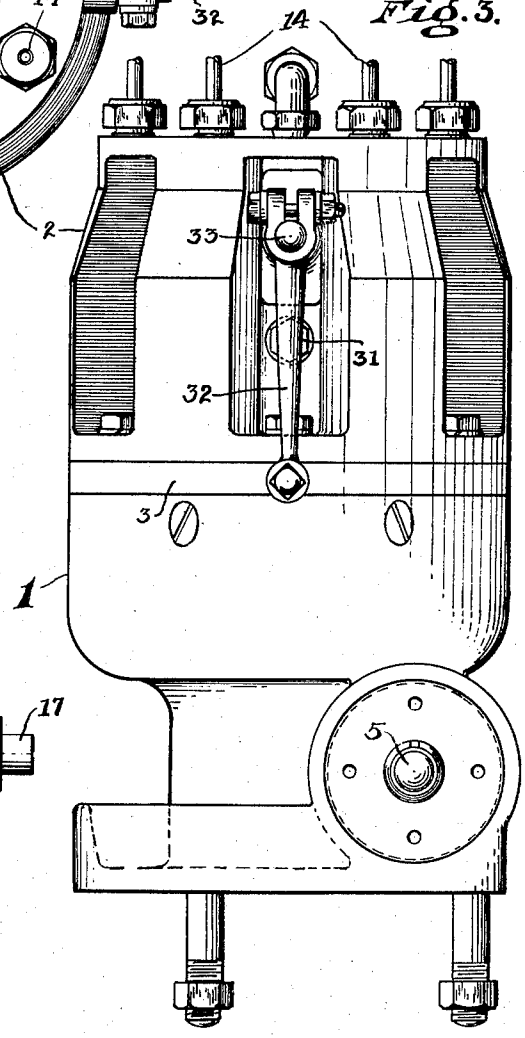


Fig. 7.

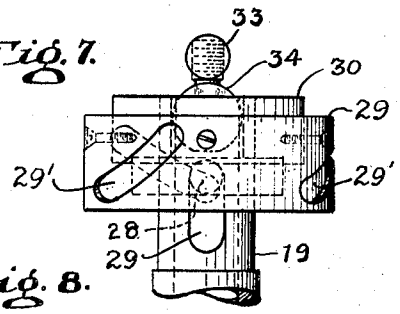


Fig. 8.

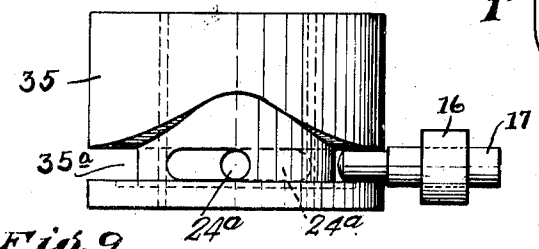
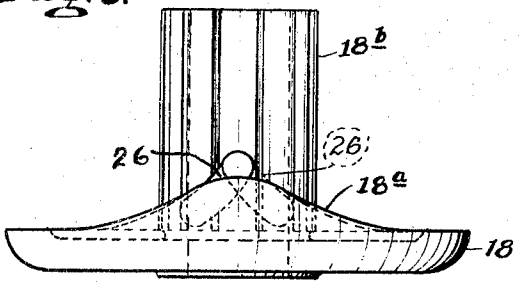


Fig. 9.



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Fig. 5.

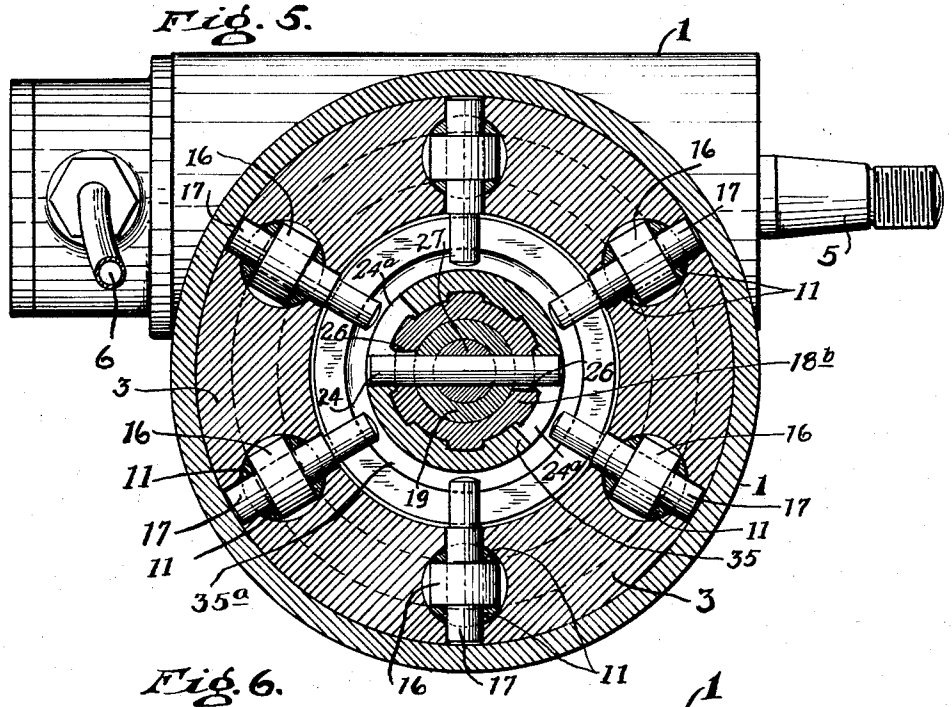
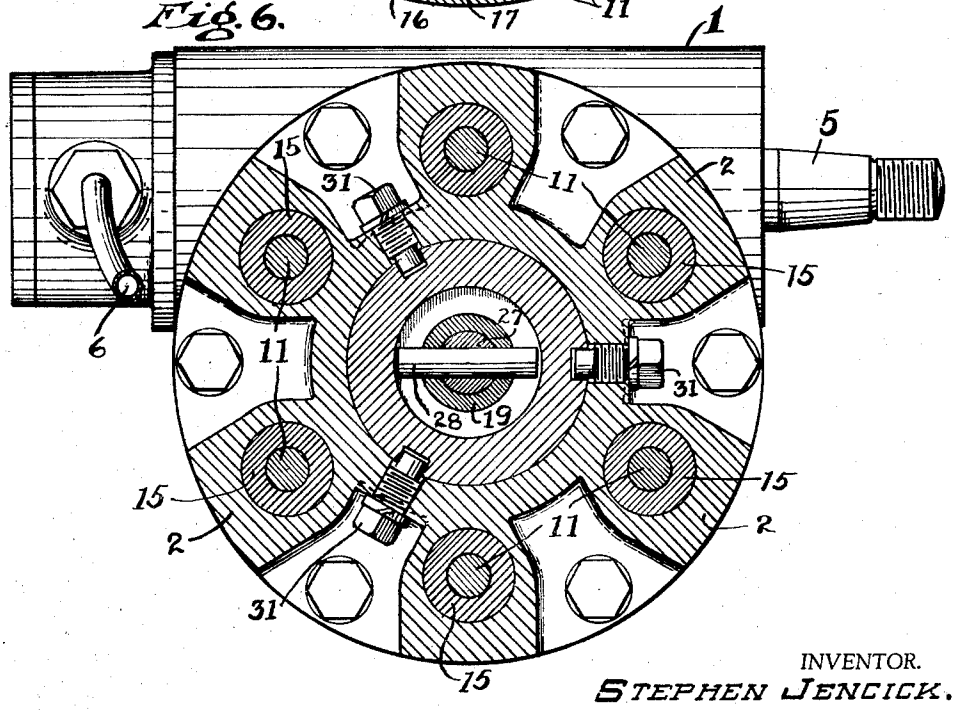


Fig. 6.



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FUEL INJECTION PUMP FOR DIESEL MOTORS

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Fig. 10.

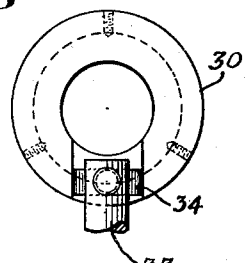


Fig. 11.

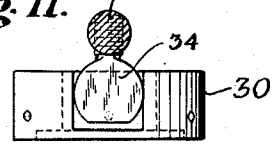


Fig. 12.

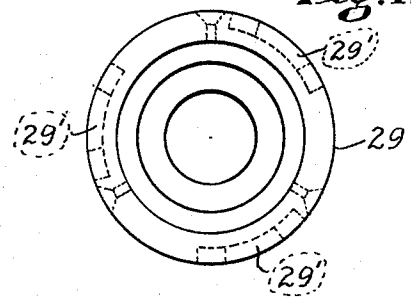


Fig. 13.

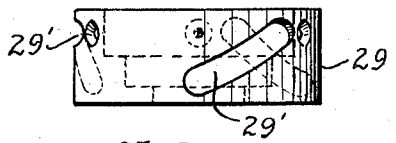


Fig. 14.

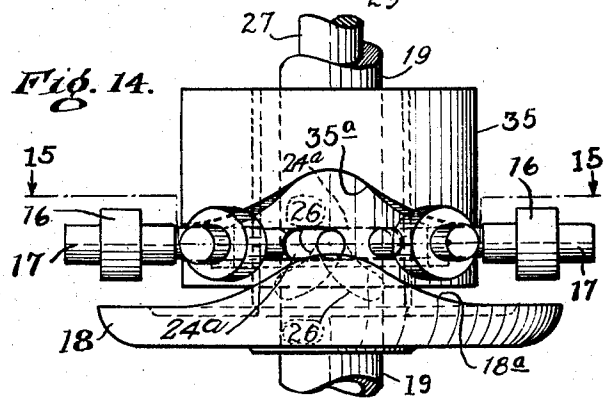
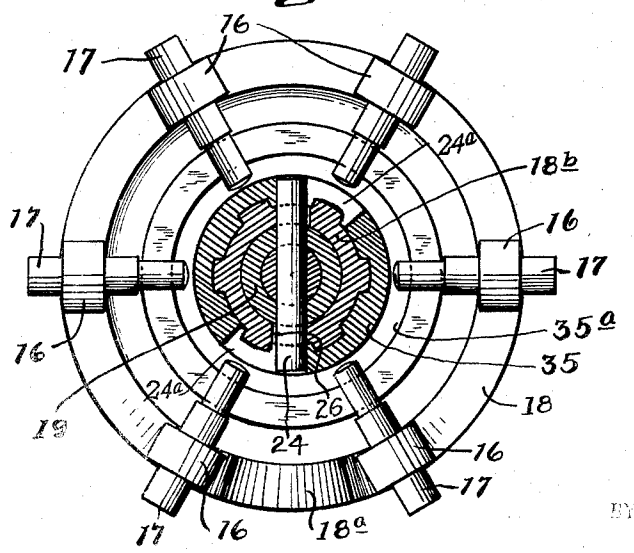


Fig. 15.



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UNITED STATES PATENT OFFICE

2,143,698

FUEL INJECTION PUMP FOR DIESEL MOTORS

Stephen Jencick, Chagrin Falls, Ohio

Application February 18, 1935, Serial No. 7,018

6 Claims. (Cl. 123—139)

This invention relates to an improved fuel injection pump for a Diesel motor.

The object of this invention is to devise a fuel injection pump that has a simple, compact and efficient structure and arrangement of operating parts including an improved means for varying the quantity of fuel injected and for adjusting the timing in conjunction therewith.

Other and more specific objects will appear from the following description and claims when considered together with the accompanying drawings.

Fig. 1 is a vertical sectional view of my improved device, taken on line 1—1 of Fig. 2;

Fig. 2 is a top plan view thereof;

Fig. 3 is an elevation thereof;

Figs. 4, 5, and 6 are views taken on lines 4—4, 5—5, and 6—6, respectively, of Fig. 1;

Fig. 7 shows in elevation some of the parts, including the metering cam, shown in section in Fig. 4;

Fig. 8 is an elevation of the cam for varying the length of stroke of the plungers and for ensuring their return movement;

Fig. 9 is an elevation of the injection cam;

Fig. 10 is a plan view of the adjusting means for the metering cam;

Fig. 11 is an elevation of the same;

Fig. 12 is a plan view of the metering cam;

Fig. 13 is an elevation of the same;

Fig. 14 is an elevation of the injection and return cams together; and

Fig. 15 is a view taken on line 15—15 of Fig. 14.

In the present illustration and description, it is taken for granted that the manner of assembly and the connections of the fuel injection device with the other parts of the motor will be readily understood by those who are familiar with the art to which this invention relates, and the disclosure of the injection device itself is therefore sufficient for present purposes.

The present injection device may be recognized as a substantially self-contained unit with suitable means for convenient connection to the other parts of the motor. This device occupies upright position when in assembly and the general axis of the device is vertically disposed, so far as the arrangement and operation of the parts are concerned.

The body of the device, in a general way, comprises the lower casing 1 and the plunger housing 2 between which there is arranged a plunger guide 3, to be more fully described.

The oil pump 4, which is operated by the drive shaft 5, has connection through the tube 6 with the oil reservoir 7 in the upper part of the plunger housing 2, this reservoir being closed by the screw cap 8.

The oil is adapted to be drawn from the reservoir 7 through the restricted passages 9, past the ball check valves 10 and into the chambers of the reciprocatable plungers 11. There will be as many plungers 11 as there are cylinders in the engine, there being illustrated in the present case a six cylinder engine; and each plunger is provided with an individual passage 9 and check valve 10. The check valve 10 in each instance is adapted to be opened by the suction of the plunger 11 and is seated by its coil spring indicated.

Each plunger cylinder is also provided with a restricted discharge passage 12 which is adapted to be closed by the ball check valve 13 which is normally closed by its spring, as indicated in the drawings. The check valve 13 is adapted to be opened by the pressure caused by upward discharging movement of the plunger, and the plunger chamber is then in communication with the tubing 14 which has suitable sealed connection to the plunger housing, as indicated in the drawings, and which leads to a suitable spray nozzle (not shown) and the corresponding cylinder of the engine, as will be understood.

From the above description, it will be seen that downward movement of the plunger 11 will suck the fuel from the reservoir 7 past the check valve 10 and into the plunger chamber whence it will then be forced under pressure by upward discharging movement of the plunger out past the check valve 13 and through the tubing 14 to the spray nozzle and the engine cylinder. All the plungers operate in the same manner and in properly timed sequence, as will be readily understood.

The plungers 11 all have a tight fit in their chambers, with enough freedom for movement in the manner intended, and the fuel is forced by the plungers out through a suitably restricted orifice so as to function in the manner intended.

Each plunger 11 is provided with a sleeve 15 which is engaged at its lower end by a seat formed upon the plunger guide 3. The plunger, in each instance, extends through this seat and has its lower end formed as a clevis within which is received the annular roller 16 on the horizontally disposed pin 17 carried by the clevis end of the plunger. The pin 17, in each instance, has its two ends engaged in opposite vertical slots 3a in the opposite sides of cut-out portions in the plunger guide 3.

The rollers 16 are engaged by the upwardly ex-

tending annular cam portion 18a of the injection cam 18 which is located in the lower casing 1. The cam 18 has a central, upwardly extending neck portion 18b up through which extends the hollowed-out cam shaft 19 which is rotated through the spiral gear 20 affixed to the lower end thereof and the companion spiral gear 21 on the drive shaft 5 which will have suitable operative connection with the mechanism, as will be understood.

The injection cam 18 is located between the lower and upper fixed bearings 22 and 23, respectively, of the cam shaft and is held against any up and down movement. Thus, the injection cam is capable of only rotary movement. This cam is connected to the cam shaft by means of the horizontally disposed pin 24 which extends through the vertical slots 25 in the wall of the hollowed-out cam shaft and the inclined or cam slots 26 in the hollow neck portion 18b of the cam, slots 26 being oppositely inclined, as viewed in the drawings.

Thus, it will be seen that operation of the cam shaft will cause the cam to rotate and to raise the plungers 11 in succession so as to pump fuel from the reservoir to the cylinders of the engine.

The timing of the plunger action can be retarded or advanced by rotatably adjusting the injection cam and this is effected by vertical adjustment of pin 24 in the inclined slots 26 of the injection cam. The pin 24 may be raised or lowered by means of the rod 27 which is capable of such movement within the hollowed-out cam shaft 19. The upper end of the rod 27 has extending therethrough the pin 28 which is permitted to move up or down with the rod 27 by the vertically disposed slots 19a in the opposite sides of the hollowed-out cam shaft 19. Any suitable means may be provided for retaining shaft 19 axially in proper place, as for instance collar means affixed to the shaft and engaged by the inner race of the ball bearing means.

The ends of pin 28 seat in the race provided between the metering cam 29 and its companion ring member 30 which is secured therewithin by means of counter-sunk screws, this metering cam mechanism surrounding the upper end of the cam shaft 19. The metering cam 29 is provided with three equi-spaced inclined cam slots in the outer face thereof for co-operation with the correspondingly spaced stationary pins 31 projecting in through the wall of the plunger housing. The purpose of this mechanism is to convert a turning adjustment of the metering cam combination into the vertical movement of the rod 27, as above referred to, for effecting rotary adjustment of the plunger cam, as above explained.

The turning adjustment of the metering cam, above referred to, is effected by manipulation of the crank 32 which has an operating extension to the panel board where it is easily accessible by the operator and which turns the shaft 33 upon which is fixed the depending pin 34. This pin has engagement within a recess cut out in the top of the member 30, the effect being to cause turning of the metering cam one direction or the other about its vertical axis as a result of the turning of the crank shaft 33 in one direction or the other.

Thus, it will be seen that by manipulating crank 32, the metering cam will be turned and, by virtue of the pins 31, will be given a vertical adjustment with the rod 27. Such movement of rod 27 will cause the pin 24 to have vertical active engagement with the cam slots 26 of the injection cam which thereby is given rotatable adjustment. The effect of such adjustment of the cam 18 is to vary the timing of the operation of the plungers by the cam.

The manipulation of the crank 32, as above described, is effective also in producing an adjustment of the length of stroke of the plungers, this adjustment being effected simultaneously with the adjustment of the timing above referred to.

The ends of pin 24 are mounted in the lateral slots 24a in the return cam 35 in the outer side of which there is formed a cam slot 35a, the inner ends of plunger pins 17 engaging in this cam slot 35a.

The cam 35 surrounds and has spline engagement with the neck of the injection cam 18 so as to be rotatably adjustable therewith as a unit and to be adjustable vertically independently thereof, the injection cam being capable of only rotatable adjustment.

The purpose of the vertical adjustment of the cam 35 is to vary the vertical position of the plunger pins 17 and hence the plungers themselves with respect to the injection cam 18 and thereby vary the length of stroke of the plungers. This adjustment is in co-ordination with the variation in the timing of the plunger operation above referred to. That is, as the length of stroke is increased and the quantity of fuel injection correspondingly increased, the timing will be advanced, and vice versa.

As will be readily understood, the length of stroke of the plungers will be increased by lowering the cam 35 and the plungers so as to thereby increase the effect of the cam 18 upon the plungers.

The cam portion 18a of the injection cam extends approximately 110° about the cam while the remaining portion of the cam is flat. Likewise, the upper corresponding portion of cam groove 35a of the return cam extends approximately 110° thereabout while the remaining portion thereof is flat. The bottom part of cam groove 35a is flat throughout its entire extent. That portion of cam groove 35a which corresponds to cam portion 18a is of greater height than cam portion 18a, so as to permit vertical adjustment of the plungers and thereby vary the length of stroke thereof. Thus, the plungers can be lowered so as to lower their pins 17 more or less with respect to cam portion 18a and the increased height of the cam groove 35a will permit the full upward movement of the pins 17 for the length of stroke for which the cam 35 has been set. When the cam 35 has been set for the greatest possible length of stroke of the plungers, the pins 17 at their peak of upward movement will be at approximately the top or peak of the heightened portion of cam groove 35a.

It is to be understood that the design of the cam members 18 and 35 and their grooves may be varied from the particular form herein disclosed.

In the present structure as herein disclosed, the rise and fall of the cam portion 18a are of the same degree; or in other words, the angle of this cam portion on opposite sides of the peak thereof is the same. As a result, this cam is reversible in its operation and the same thing is true of the upper part of cam groove 35a of the return cam. Thus, the structure herein disclosed can be operated in either direction.

As will be seen from the above description, cam 18 is a single, unitary cam for actuating all of

the plungers and this cam is also adjustable rotatably for varying the timing.

Cam 35 is also a single, unitary cam which serves to ensure return of the plungers to lower position by engagement of the inclined surface of the cam groove 35a with the plunger pins, and which also is adjustable vertically for varying the length of stroke of the plungers.

As above explained, the cams 18 and 35 are fixed against relative rotatable movement and thus the cam portions 18a and 35a are always maintained in proper correspondence with each other regardless of the variations in the timing and the length of stroke.

Thus, my present pump is simple and compact in its structure and arrangement of parts; it is dependable and highly efficient in its operation; and it can be installed as a unit with comparative ease and in the least possible and most readily available space by virtue of the general extension of this device in an upright manner. This device can be manufactured at a reduced cost as compared with other such devices and its generally practical nature is calculated to promote the more general use of Diesel motors in the airplane as well as automobile industry. When adapted in an airplane engine, the operating shaft 5 will extend co-axially with respect to the cam shaft 19 instead of the arrangement herein illustrated.

Other advantages resulting from this invention will readily suggest themselves to those who are familiar with the art to which it relates.

What I claim is:

1. A fuel injection pump for a Diesel motor, comprising an oil reservoir, a plurality of reciprocatable plungers for drawing the oil therefrom and for injecting the same into the engine, a single rotatably adjustable cam for actuating the injection plungers in proper sequence and for effecting variation in the timing of the plunger movement, a single vertically adjustable closed cam for ensuring return movement of said plungers and for varying the length of stroke of the plungers, and an operative connection for said cams.

2. A fuel injection pump for a Diesel motor, comprising an oil reservoir, a plurality of concentrically arranged and vertically disposed reciprocatable plungers for drawing the oil therefrom and injecting the same into the engine, a single rotatably adjustable cam concentrically arranged with respect to the plungers for actuating the same in proper sequence and for effecting variation in the timing of the plunger movement, another single vertically adjustable cam concentrically arranged with respect to the plungers for ensuring return movement of said plungers and for varying the length of stroke of the plungers, an operative connection for said cams, and a single means for effecting adjustment of said cams.

3. A fuel injection pump for a Diesel motor, comprising an oil reservoir, a plurality of concentrically arranged and vertically disposed reciprocatable plungers for drawing the oil therefrom and injecting the same into the engine, rotatably adjustable means for actuating the injection plungers in proper sequence and for varying the timing thereof, vertically adjustable means for varying the length of stroke of the plungers, and a single manipulating means for effecting adjustment of said adjustable means.

4. A fuel injection pump for a Diesel motor, comprising an oil reservoir, a plurality of concentrically arranged and vertically disposed reciprocatable plungers for drawing the oil therefrom and injecting the same into the engine, concentrically disposed cams arranged about the vertical axis of the device and having spline connection preventing relative rotative movement and causing their rotatable adjustment as a unit, one of said cams being operatively associated with said plungers for operation of the same and being rotatably adjustable so as to vary the timing, the other of said cams being also operatively associated with said plungers and being vertically adjustable for varying the length of stroke of said plungers so as to vary the quantity of the oil injection and being adapted also to ensure return of the plungers, an operating connection for said cams, and means for simultaneously effecting said adjustments of the cams.

5. A fuel injection pump for a Diesel motor, comprising an oil reservoir, a plurality of concentrically arranged and vertically disposed reciprocatable plungers for drawing the oil therefrom and injecting the same into the engine, concentrically disposed cams arranged about the vertical axis of the device, one of said cams being operatively associated with said plungers for operation of the same and being adjustable for varying the timing of the plunger movement, the other of said cams being operatively associated with said plungers and being adjustable for varying the length of stroke of the plungers so as to vary the quantity of oil injection, and a single means for simultaneously effecting adjustment of said cams so as to vary the length of stroke of the plungers and their timing, said adjusting means including a metering cam arranged concentrically with respect to the plungers, and a vertically disposed and concentrically arranged rod operatively connected to said first-named cams, and means for manipulating said adjusting means, and a concentrically arranged operating connection for said cams.

6. A fuel injection pump for a Diesel motor, comprising an oil reservoir, a plurality of concentrically arranged and vertically disposed reciprocatable plungers for drawing the oil therefrom and injecting the same into the engine, concentrically disposed cams arranged about the vertical axis of the device, one of said cams being operatively associated with said plungers for operation of the same and being rotatably adjustable for varying the timing of the plunger movement, the other of said cams being operatively associated with said plungers and being longitudinally adjustable for varying the length of stroke of the plungers so as to vary the quantity of oil injection, a concentrically arranged hollow operating shaft for said cams, and a single means for simultaneously effecting adjustment of said cams so as to vary the length of stroke of the plungers and their timing, said adjusting means including a rod concentrically disposed within said operating shaft, a metering cam slot and pin mechanism at the upper end of said rod for manipulating the same, and cam slot and pin mechanism at the lower end of said rod for transmitting such adjustment to said first named cams, and an operating connection for said cams.

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