Aug. 22, 1950 W. A. BEARD 2,519,733

FLUID INJECTION PUMP

Filed Oct. 22, 1948 3 Sheets-Sheet 1

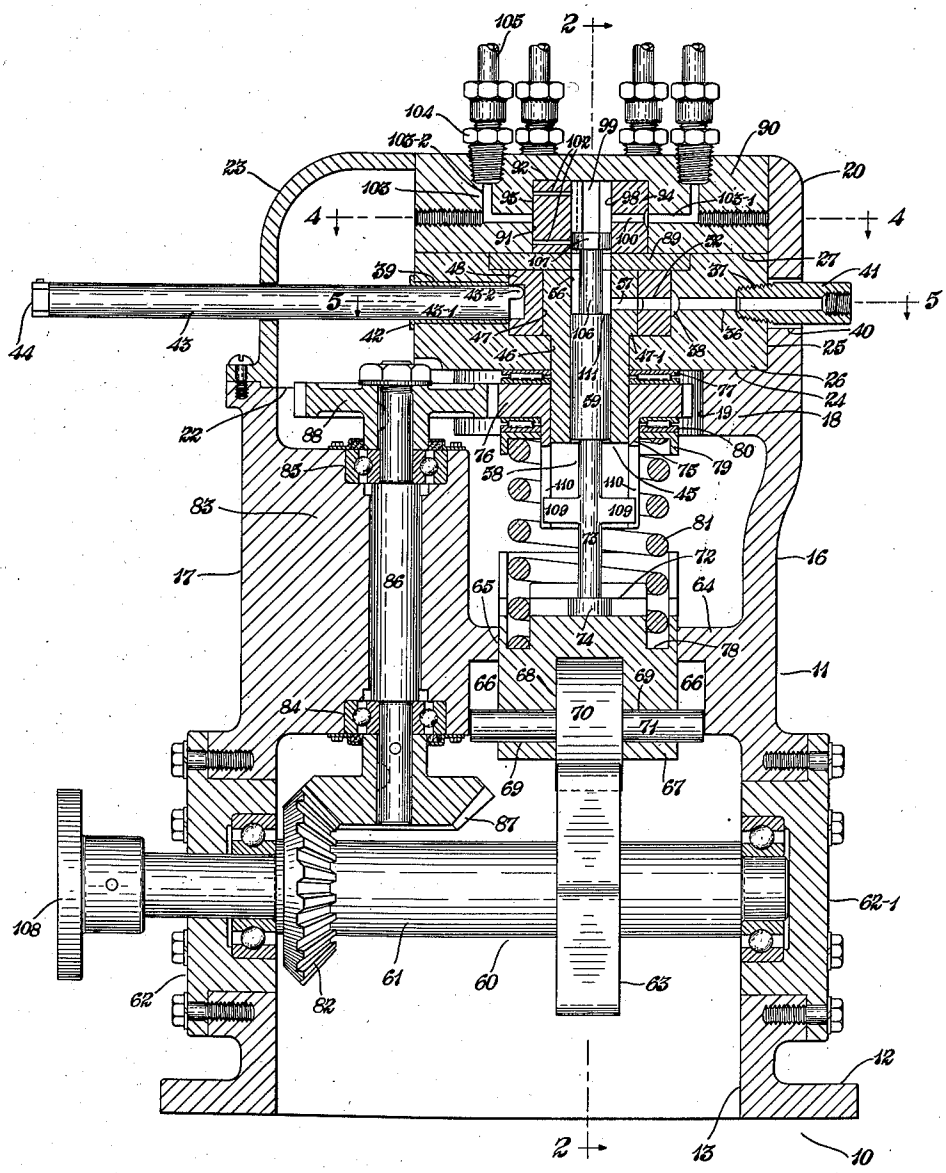

Fig. 1

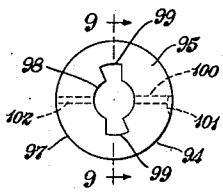

Fig. 8

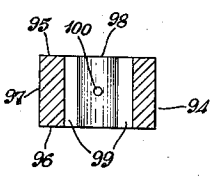

Fig. 9

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FLUID INJECTION PUMP

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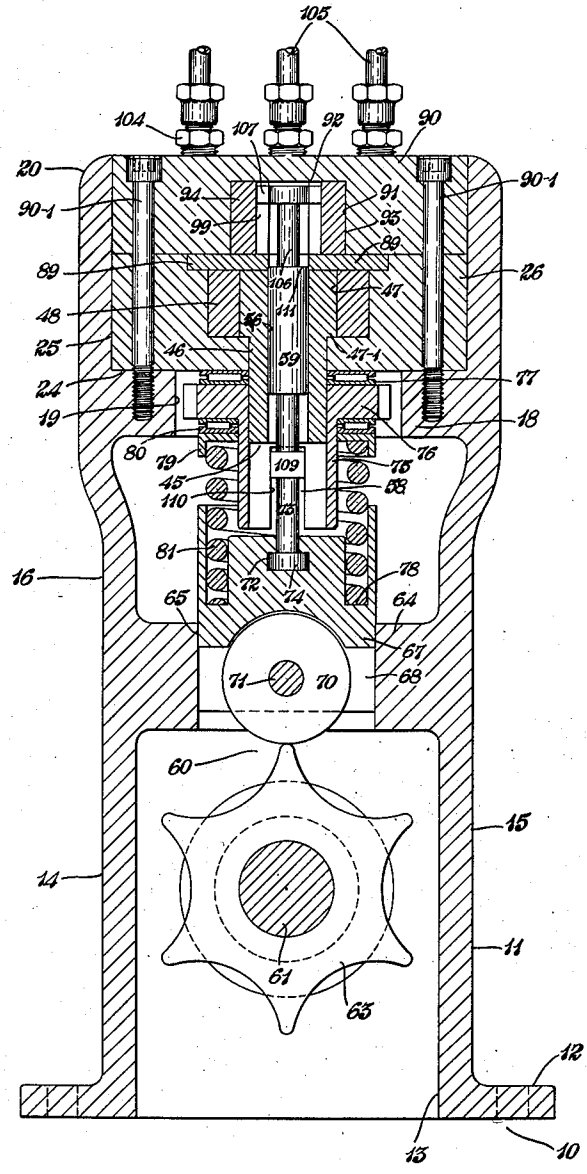

Fig. 2

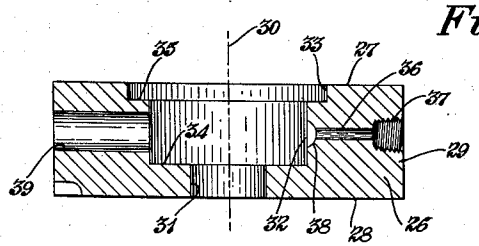

Fig. 10

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FLUID INJECTION PUMP

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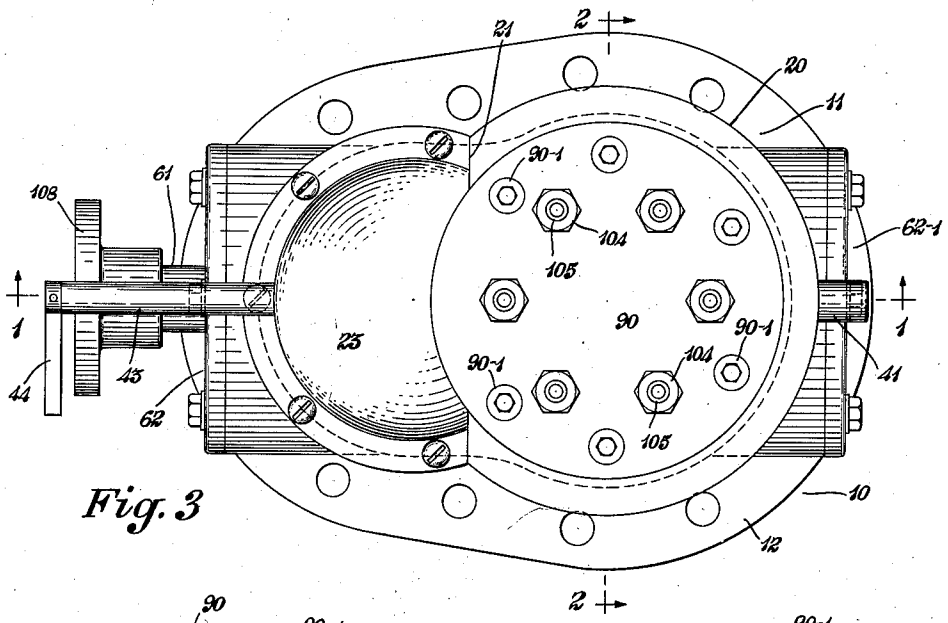

Fig. 3

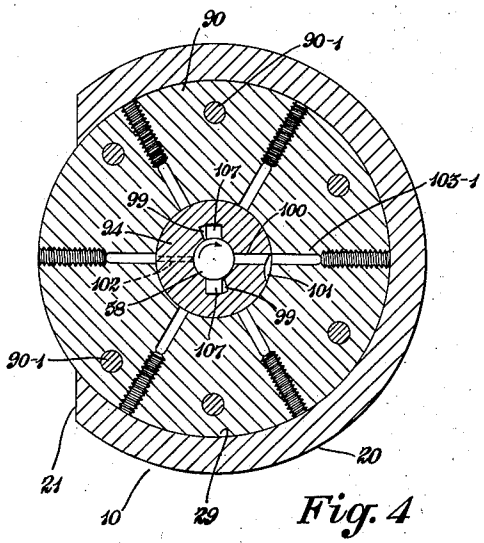

Fig. 4

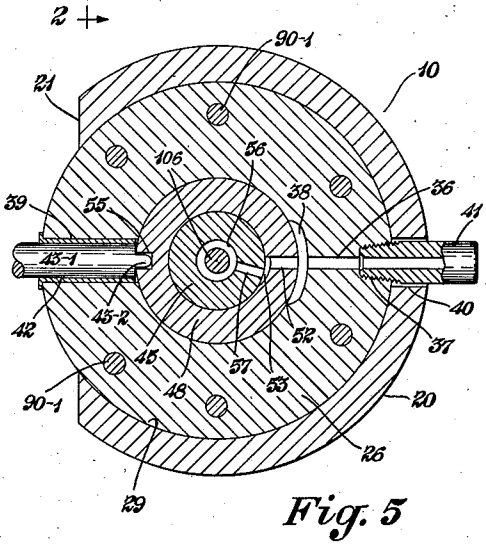

Fig. 5

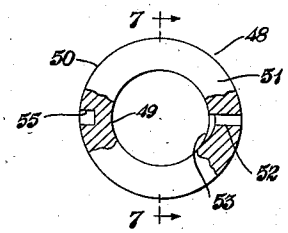

Fig. 6

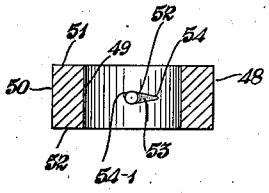

Fig. 7

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FLUID INJECTION PUMP

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Application October 22, 1948, Serial No. 55,980

9 Claims. (Cl. 103—2)

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The invention or discovery relates generally to fluid injection pumps, and particularly to liquid fuel injection pumps for compression ignition internal combustion engines, commonly known as Diesel engines, and more particularly to such pumps for high-speed multicylinder Diesel engines.

Prior to the present invention or discovery, the most commonly used liquid fuel injection pumps for high-speed multicylinder Diesel engines have each included a separate pumping unit for each engine cylinder served by the pump, all of the pumping units in each pump being operated by a common cam shaft driven by the engine. Such a usual liquid fuel injection pump includes a housing in which the cam shaft is journalled, and which provides a mounting for the individual pumping units. Each individual pumping unit includes among other parts a barrel having a bore and a reciprocating and oscillatable plunger operating in the barrel bore, the top end portion of the barrel bore constituting a pressure chamber having lower fuel inlet and outlet openings traversed by the upper end of the plunger, and an upper check valve controlled fuel discharge opening communicatingly connected by a reservoir tube with the high pressure fuel injection nozzle of one of the engine cylinders. The fuel inlet opening of the barrel is communicatingly connected by a low pressure pump-served fuel supply tube with the fuel tank.

In such a usual liquid fuel injection pump for a high-speed multicylinder Diesel engine, metering of each charge of liquid fuel delivered from the pressure chamber of each individual pumping unit to the engine cylinder served thereby is effected by forming in one side of the plunger adjacent its upper end a recess having a helical face and a vertical groove extending between the upper end of the recess and the upper face of the plunger. During operation of the pump, the recess of each plunger traverses the fuel outlet opening in the barrel, and the engine governor operates the means for oscillating the plunger so as to change the location of the portion of the helical face of the recess in the plunger traversing the fuel outlet opening according to the load requirements of the engine, so as to vary the time at which, on each upstroke of the plunger, communication is effected between the pressure chamber and the fuel outlet opening through the groove and recess, thereby reducing the pressure in the pressure chamber below the pressure required to open the discharge check valve from the pressure chamber and closing the discharge check valve, thereby varying the quantity of fuel injected from the reservoir tube through the injection nozzle into the combustion chamber of the engine cylinder.

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Such a usual liquid fuel injection pump for a high-speed multicylinder Diesel engine has many disadvantages from one or more of the different standpoints of design, manufacture, use including initial adjusting and timing, and maintenance including servicing and parts replacement. All these disadvantages are ultimately reflected in high initial costs and maintenance costs.

As an example of one of these disadvantages, any particular model of high-speed multicylinder Diesel engine requires a particular metering of the fuel charges injected into the combustion chamber of each cylinder through its injection nozzle by the liquid fuel injection pump for the engine. In a usual liquid fuel injection pump as described above, since the metering is effected by the shape of the helical face of the recess in the plunger, it has been necessary to provide a different plunger with a recess having a particular helical face for each different model of engine. This has required the design, manufacture as original equipment and for replacement, and inventorying for replacement, of hundreds of different plungers for the hundreds of different models of high-speed multicylinder Diesel engines being used commercially prior to the present improvements.

As an example of another of the disadvantages of the usual liquid fuel injection pump for a high-speed multicylinder Diesel engine, the necessity of providing an individual pumping unit for each cylinder requires great multiplicity of parts for each pump. This is undesirable from each and all of the different standpoint of manufacture, use and maintenance.

As an example of another of the disadvantages of the usual liquid fuel injection pump for a high-speed multicylinder Diesel engine, the necessity for the use of a check valve including means for minimizing secondary injection in the fuel discharge opening of the pressure chamber of each pumping unit, has been an unavoidable necessity complicating and adding to the cost of the manufacture, use and maintenance.

The objects of the present invention and discovery include the provision of an improved fluid injection pump which generally has a simplified construction and arrangement, and more particularly which has a construction and arrangement in which only a single plunger operating in a single barrel is required for serving a multicyl-

inder Diesel engine or the like, and in which the total number of parts is greatly reduced as compared with the usual liquid fuel injection pump for a high-speed multicylinder Diesel engine, and in which the number of mechanical parts requiring machining, grinding, and lap finishing operations and intricate assembly is greatly reduced as compared with the usual liquid fuel injection pump.

Further objects of the present invention and discovery include the provision of an improved fluid injection pump which is adapted for a standardization of parts including the plunger for use in connection with any of a large number of different models of Diesel engines.

Further objects of the present invention and discovery include the provision of a fluid injection pump including improved and simplified metering means, and improved and simplified fuel distributing means.

The foregoing and other objects are attained by the fluid injection pumps, parts, combinations, and subcombinations which comprise the present invention and discovery, and the nature of which is set forth in the following general statement, and preferred embodiments of which are set forth in the following description, and which are particularly and distinctly pointed out and set forth in the appended claims forming part hereof.

The nature of the improved fluid injection pump of the present invention and discovery may be stated in general terms as including a housing, a barrel supported in the housing, the barrel having a bore, and a plunger reciprocating and continuously rotating in the bore of the barrel.

A metering bushing is mounted for oscillation about the upper end of the barrel in the housing, and the metering bushing has a tear-drop shaped recess in its inner face making a variably sized communicating connection with a single inlet port in the barrel, and the tear-drop shaped recess in the metering bushing communicatingly connecting through a duct with a fuel sump in one of the walls of the housing. The plunger has an upper end which picks up charges of liquid fuel from the barrel fuel inlet port on the upstroke of the plunger.

A fuel distributor head is mounted on the housing, and a rotating distributing bushing is journalled in the distributor head and has a bore constituting a continuation of the bore of the barrel and forms therewith a pressure chamber. The rotating distributor bushing is driven by a slide and relieved wing connection with the upper end of the plunger.

The rotating distributing bushing has a single discharge duct enlarged at its outer end and communicating at its inner end with the pressure chamber. The outer end of the discharge duct makes successive connections with each of a plurality of ducts in the distributor head each connecting to one of the engine cylinders served by the pump. Compensating ducts in the distributing bushing communicate at their inner ends with the pressure chamber and have outer ends opening against the bearing surface for the distributing bushing in the distributor head.

The relieved wing connection of the distributing bushing with the upper end of the plunger permits the distributing bushing to rotatably float ahead of the plunger rotation, when the pressure chamber has a charge of fuel therein under pressure, causing the distributing bushing instantaneously to align its discharge duct successively with the distributor head ducts.

By way of example, preferred embodiments of the improved fluid injection pumps of the present invention and discovery, and parts thereof, are illustrated in the accompanying drawing forming part hereof, in which—

Figure 1 is a vertical sectional view as on line 1—1, Figs. 2 and 3, of one embodiment of the improved fluid injection pump hereof;

Fig. 2 is another vertical sectional view thereof as on line 2—2, Figs. 1 and 3;

Fig. 3 is a top plan view thereof;

Fig. 4 is a transverse sectional view thereof as on line 4—4, Fig. 1;

Fig. 5 is another transverse sectional view thereof as on line 5—5, Fig. 1;

Fig. 6 is a detached fragmentary plan view of the improved metering bushing of the improved pump;

Fig. 7 is a vertical sectional view thereof as on line 7—7, Fig. 6;

Fig. 8 is a detached plan view of the improved distributing bushing of the improved pump;

Fig. 9 is a vertical sectional view thereof as on line 9—9, Fig. 8; and

Fig. 10 is a detached vertical sectional view of one of the removable mounting and bearing members or heads of the improved pump.

Similar numerals refer to similar parts throughout the drawings.

The illustrated embodiment of the improved fluid injection pump is indicated generally by 10, and constitutes a liquid fuel injection pump for a high-speed compression ignition internal combustion engine, commonly called a Diesel engine.

The improved liquid fuel injection pump 10 includes walls forming a one-piece housing indicated generally by 11 and which may be made of cast aluminum alloy. The walls of the housing 11 include a horizontal base flange 12 engirdling a lower opening 13, and side walls 14, 15, 16, and 17 extend upwardly from the base flange 12, the side walls being corner-connected with each other. The walls of the housing furthermore include an inwardly extending flange 18 at the upper ends of the side walls, the flange 18 engirdling an opening 19, and a cylindrical segment wall 20 extending upwardly above the flange 18.

The cylindrical segment wall 20 has vertical end faces 21 at each side of a side opening and at the inside of a top opening 22 in the housing 11, and as shown, there is provided a detachable cover 23 for the housing top opening 22 and the side opening of the housing cylindrical segment wall 20.

The housing flange 18 has a top face 24 and the housing cylindrical segment wall 20 has an inner cylindrical face 25, and a first removable mounting and bearing member or head 26 is centered by the cylindrical inner face 25 and seated on the top face 24. As shown in detail in Fig. 10 the first removable mounting and bearing member or head 26 is in the form of a thick disc having a circular flat top face 27, a circular flat bottom face 28, and a cylindrical side face 29. The circular flat bottom face 28 of the first disc 26 seats on the top face 24 of the housing flange 18 and the circular side face 29 of the first disc 26 fits, abuts, and is centered by the cylindrical inner face 25 of the housing cylindrical segment wall 20.

The cylindrical side face 29 of the first disc 26 has an axis indicated by the dot-dash line 30 in Fig. 10 which passes through the centers of the

circular top and bottom faces 27 and 28. The first disc 26 has a double counterbored central opening formed therein which is coaxial with the axis 30 and which includes a lower smaller counterbore section 31, an intermediate counterbore section 32, and an upper larger counterbore section 33, there being an inwardly extending annular flat-faced shoulder 34 between the upper end of the lower smaller counterbore section 31 and the lower end of the intermediate counterbore section 32, and an annular flat-faced shoulder 35 between the upper end of the intermediate counterbore section 32 and the lower end of the upper counterbore section 33. The first disc 26 also has formed therein a radially extending fuel inlet duct 36 extending between the cylindrical side face 29 and the inner cylindrical surface of the intermediate counterbore section 32, the outer end of the duct 36 terminating in an internally pipe-threaded tapered socket 37, and the inner end of the duct 36 terminating in a segmental sump recess 38 formed in the cylindrical inner face of the counterbore intermediate section 32.

The radially extending duct 36 is on one side of the axis 30, as shown in Fig. 10, and on the other side of the axis 30 the first disc 26 has formed therein a radial bushing bore 39 for a purpose hereinafter described. The housing cylindrical segment wall 20 has a side opening 40 formed therein through which extends a fuel inlet nipple 41 having a pipe-threaded tapered inner end screwed into the internally threaded tapered socket 37 at the outer end of the fuel inlet duct 36 of the first disc 26.

The bushing bore 39 of the first disc 26 has fitted therein a bearing bushing 42, and a metering shaft 43 has an inner end portion 43—1 journalled in the bore of the bushing 42, and on the outer end of the metering shaft 43 there is secured a crank arm 44 adapted for connection with a usual Diesel engine governor, not shown.

A barrel indicated generally by 45 includes a reduced lower shank 46 and an enlarged upper head 47, the shank 46 of the barrel 45 fitting in the lower smaller counterbore section 31 of the disc 26 and the lower annular face 47—1 of the barrel head 47 seating on the flat-faced lower shoulder 34 of the first disc 26. The barrel head 47 has a cylindrical outer side face which is spaced a substantial distance inwardly from the cylindrical face of the intermediate counterbore section 32 of the first disc 26.

In the annular space between the barrel head 47 and the inner face of the intermediate counterbore section 32, there is oscillatably fitted a metering bushing or ring 48 having an inner cylindrical side face 49, an outer cylindrical side face 50, a flat annular top face 51, and a flat annular bottom face 52 as best shown in Figs. 6 and 7. The metering ring 48 has formed therein a single radial fuel inlet duct 52 which extends between its outer cylindrical face 50 and its inner cylindrical face 49, in which there is formed a tapered recess 53 having a small point end 54 offset from the inner end of the fuel inlet duct 52, and the tapered recess 53 having a larger end 54—1 into which the inner end of the duct 52 opens. Diametrically opposite the duct 52, a vertical slot 55 is formed in the outer cylindrical side face 50 of the metering ring 48, and on the inner extremity of the metering shaft 43 there is formed an inwardly extending crank head 43—2 which extends into the slot 55 of the metering ring 48, the crank head 43—2 being radially offset from the axis of the metering shaft 43, whereby oscillation of the metering shaft 43 serves to oscillate the metering bushing 48. The outer end of the duct 52 of the metering ring 48 is in registration with the segmental sump recess 38 of the first disc 26.

The barrel 45 is secured stationary in the first disc 26 and has a cylindrical bore 56 whose longitudinal axis coincides with the axis 30 of the first head or disc 26, and the head 47 of the barrel 45 has formed therein a radial fuel inlet port 57 whose outer end is in communication with a variable portion of the tapered recess 53 of the metering ring 48, when the pump 10 is operating. A plunger indicated generally by 58 includes a central cylindrical portion 59 which fits and is reciprocatable and rotatable in the bore 56 of the barrel 45. The reciprocation of the plunger 58 is effected by cam and tappet means indicated generally by 60 and which include as shown a cam shaft 61 journalled in the lower portion of the housing 11 by usual ball bearing means indicated generally by 62 and 62—1, and the cam shaft 61 mounts a six-lobed cam 63 which may be formed integrally thereon intermediate its ends.

The housing 11 furthermore includes a transverse bearing wall 64 located intermediate the top and bottom of the housing 11, and the bearing wall 64 has formed therein a vertical bore 65 above the cam 63, and the lower end of the vertical bore 65 has formed therein diametrically opposite vertical slots 66. An externally cylindric tappet 67 fits and is slidable in the bore 65 of the transverse bearing wall 64. The lower end of the tappet 67 has formed therein a transverse slot 68 and aligned tappet roller shaft bearing bores 69 extending at right angles to the slot 68. A tappet roller 70 is located in the tappet slot 68 and has a bore aligned with the bearing bores 69 of the tappet 67, and a tappet roller shaft 71 extends through the aligned bearing bore 69 and the bore of the roller 70 and the outer ends of the shaft 71 extend into, and are guided by, the slots 66 in the housing wall 64. The upper end of the tappet 67 has a transversely extending inverted T-slot 72 formed therein, and the plunger 58 includes a reduced lower end shank 73 having an enlarged head 74 fitting in the T-head portion of the T-slot 72.

Means are provided for rotating the plunger 58, which, as shown, include a sleeve 75 having a central bore journalled on the lower end of the barrel 45 and having an enlarged upper pinion head 76 which has an upper face spaced below the lower face of the first disc 26 and a needle thrust bearing 77 is interposed therebetween. The tappet 67 has an upper annular spring seat 78 formed therein, and on the sleeve 75 and spaced below the pinion head 76 there is slidable an annular spring seat member 79, and a lower needle thrust bearing 80 is interposed between the lower face of the pinion head 76 and the upper face of the spring seat member 79. A helical compression spring 81 has its coils extending around the sleeve 75, and the lower end of the plunger 58, and has its ends seated in the tappet spring seat 78 and in the spring seat member 79.

The cam shaft 61 has a miter gear 82 formed thereon at one side of the cam 63. Above the miter gear 82 the transverse wall 64 of the housing 11 is provided with an enlarged boss 83 in which a vertical intermediate shaft 86 is journalled as by usual upper and lower ball bearing

means 84 and 85. On a lower end of the shaft 86 is secured a miter gear 87 meshed with the cam shaft miter gear 82. On the upper end of the shaft 86 is secured a pinion 88 meshed with the pinion head 76 of the sleeve 75.

The top face 51 of the meter ring 48 is aligned with the flat face of the shoulder 35 of the first head or disc 26, and in the upper counterbore section 33 of the first disc 26 there is seated an annular cover disc 89 having a central bore aligned and registering with the bore 56 of the barrel 45, and the top face of the annular cover disc 89 is aligned with the top face 27 of the first disc 26.

The improved liquid fuel injection pump 10 furthermore includes a second removable mounting and bearing member or head 90 which, as shown, is in the form of a thick disc having flat circular top and bottom faces and a cylindric side face whose radii are equal to the radii of the similar faces of the first disc 26, and the bottom face of the second or upper disc 90 seats on the top face of the first or lower disc 26 and the cylindrical side face of the second disc 90 fits and is centered by the cylindrical inner face 25 of the housing cylindrical segment wall 20. The upper and lower discs 90 and 26 have a plurality of sets of registering vertical bores formed therein through each set of which extends the shank of a countersunk cap screw 90—1 whose externally threaded lower end is screwed into an internally threaded socket formed in the housing flange 18.

The upper disc 90 has a downwardly opening cylindrical pocket 91 formed therein which has a flat circular top face 92 and a cylindrical side face 93, and the pocket forms with the top face of the annular cover disc 89 a bearing compartment, and a distributing bushing or ring 94 is rotatably fitted in the bearing compartment of the second disc 91. As best shown in Figs. 8 and 9, the distributing ring 94 has a flat top face 95, a flat bottom face 96, and a cylindrical side face 97. The distributing ring 94 also has formed therein a central bore 98 which is coaxial and registers with the registering bores of the barrel 45 and the cover disc 89, and diametrically opposite vertical and radial slots 99 are also formed as extensions of the inner cylindrical surface of the bore 98.

The distributing ring 94 furthermore has formed therein a single fuel discharge duct 100 extending radially between the inner cylindrical surface of the bore 98 and the cylindrical side face 97, preferably as shown midway between and parallel with the ring top and bottom faces 95 and 96, and at 90° to the vertical diametrical bisecting plane of the slots 99. The discharge duct 100 is provided with an enlarged outer end 101 formed by a recess in the outer cylindrical face 97 of the distributing ring 94. Above and below the radial axis of the duct 100 the distributing ring 94 has formed therein a radial compensating duct 102 the inner end of each of which opens into the bore 98 of the distributing ring 94 and the outer ends of which open against the cylindric inner face 93 of the pocket of the upper disc 90.

The upper disc 90 furthermore has formed therein a plurality of fuel receiving ducts each indicated generally by 103. The illustrated liquid fuel injection pump 10 is designed for serving a six-cylinder Diesel engine, and there are six fuel receiving ducts 103 in the upper disc 90, and each fuel delivery duct 103 includes a radial

section 103—1 whose longitudinal axis is in the same plane parallel with the top and bottom faces of the distributing ring 94 as is the fuel discharge duct 100, and the inner end of each of each radial section 103—1 of each fuel receiving duct 103 opens through the inner cylindrical side face 93 of the pocket 91 in the upper disc 90 for registering with the enlarged outer end 101 of the fuel discharge duct 100 of the fuel distributing ring 94 as the ring 94 rotates. The inner ends of the ducts 103 are equally spaced from each other circumferentially.

Each fuel receiving duct 103, as shown, also includes a vertical section 103—2 whose lower end communicatingly connects with the outer end of the radial section 103—1, and the upper end of each vertical section 103—2 of each fuel receiving duct 103 opens into an internally threaded tapered socket in which is screwed an externally threaded fitting 104 by which a tube 105 is communicatingly connected between the outer end of each duct 103 with the fuel injection nozzle, not shown, of one of the cylinders of the compression ignition internal combustion engine, not shown, served by the pump 10.

The plunger 58 includes a reduced upper shank 106 having at its upper end a pair of diametrically opposite wings 107, each of which loosely fits in one of the slots 99 of the distributing ring 94, and the wings 107 and slots 99 provide a loose or floating rotary drive connection between the plunger 58 and the distributing ring 94.

The several parts of the improved fluid injection pump 10 are made of selected metals including hardened steel wherever desirable and the parts having surfaces bearing against each other have these bearing surfaces provided with ground and lapped finishes when desirable.

As shown, the outer end of the cam shaft 61 has secured thereon a coupling fitting 108 for connection with another shaft driven by the shaft of the engine served by the pump 10 at one-half engine speed, the improved pump 10 being adapted to serve a six-cylinder four-stroke cycle engine. The ratio of the miter gears 82 and 87 is 1:1, and the ratio of the pinion 88 and the pinion head 76 is 1:1, and consequently the sleeve 75 is driven at one-half engine speed. For the purposes of rotating the plunger 58, its lower end shank 73 has formed thereon diametrically oppositely extending wings 109, and the lower end of the sleeve 75 has formed therein diametrically opposite slots 110 in each of which one of the wings 109 slidably fits.

The plunger 58 in the pump 10 is thus rotated at one-half engine speed, and the six-lobed cam 62 reciprocates the plunger 58 up and down once for each of the six engine cylinders served by the pump 10 for every two revolutions of the engine crank shaft.

In the operation of the improved liquid fuel injection pump 10, the outer end of the fuel inlet nipple 41 is communicatingly connected by a low pressure pump served tube with the interior of a tank containing a supply of liquid fuel, such as Diesel oil. The fuel inlet duct 36 and the segmental sump recess 38 of the lower head or disc 26 are always maintained filled with liquid fuel at low pressure. The outer end of the fuel inlet duct 52 of the metering ring 48 is always in communication with the sump recess 38 of the lower disc 26, and when the engine served by the pump 10 is running, the inner tapered recess 53 at the inner end of the duct 52 is turned by operation of the metering shaft 43 to effect communication

between a portion of the tapered recess 53 and the outer end of the fuel inlet port 57 of the barrel 45, as shown in Fig. 5.

In Fig. 1, the parts of the pump 10 are shown with the plunger 58 in its down position, and the central cylindrical portion 59 of the plunger 58 has an upper annular end shoulder 111 which in the down position of the plunger 58 is below the lower edge of the inner end of the barrel inlet port 57. The plunger shoulder 111, the registering bores of the barrel 45 and the cover disc 89 and the distributing ring 94, and the central portion of the flat circular top face 92 of the pocket 91 of the upper disc 90 form the pressure chamber of the pump 10. On each upstroke of the plunger 58, the shoulder 111 picks up the charge of liquid fuel which has been delivered into the pressure chamber through the barrel port 57, and the fuel charge is placed under high pressure when the plunger shoulder 111 passes the inner end of the port 57 on the upstroke.

The plunger 58 is being continuously rotated during its up and down strokes and continuously rotates the distributing ring 94 through the loose or floating connection between the upper end of the plunger and the distributing ring. In the pump 10 when looking at the top of the plunger as shown in Fig. 4, the direction of rotation of the plunger is clockwise, and the forward or leading end of the distributing ring recess 101 is in advance of the fuel discharge duct 100.

Accordingly, when the leading end of the distributing recess 101 makes communication with the inner end of one of the radial sections 103—1 of one of the fuel delivery ducts 103, the recess 101 and duct 100 being filled with high pressure liquid fuel, the distributing ring 94 jumps ahead of the rotating wings 107 of the plunger making instantaneous communicating connection of the fuel discharge duct 100 with the inner end of the fuel receiving duct 103. The compensating ducts 102 in the distributing ring 94 relieve back pressure from the distributing ring 94 upon discharge of the fuel from the discharge duct 100 into any fuel receiving duct 103.

When the metering shaft 43 is oscillated in the usual manner by operation of the governor of the engine served by the pump 10, the oscillation of the shaft 43 about its horizontal axis, through the crank head and slot connection of the shaft 43 with the metering ring 48, oscillates the metering ring 48 about its vertical axis and positions a portion of the tapered recess 53 in communication with the outer end of the barrel port 57. The effective fuel inlet port area depends on the particular portion of the tapered recess 53 which is communicatingly connected with the outer end of the barrel port 57, the minimum fuel inlet port area being produced just after pointed end 54 of the tapered recess 53 effects communicating connection with the outer end of the barrel port 57, and the effective fuel inlet port area being at a maximum when the larger end 55 of the tapered recess 53 is in communicating connection with the outer end of the barrel port 57.

In the operation of the improved liquid fuel injection pump 10, secondary injection is eliminated by reason of the fact that when the rotating distributing ring 94 closes any particular fuel receiving duct 103, the plunger 58 simultaneously starts on its downstroke, reducing the pressure in the fuel receiving duct 103 just closed below the pressure which would cause secondary injection.

The embodiments of the improved fluid injection pump and parts described herein are by way of example, and the scope of the present invention or discovery is not limited to the same or to the particular details thereof, but is commensurate with any and all novel subject matter contained herein which may at any time properly under the patent laws be set forth in the claims hereof or originating herein, and the elements of any such claims are intended to include their reasonable equivalents.

I claim:

1. In a fluid injection pump, walls forming a housing, a barrel supported by the housing, the barrel having a bore, a plunger reciprocatable and rotatable in the barrel bore, some of the housing walls and the upper end of the barrel forming an annular compartment around the upper end of the barrel, a metering ring fitting and oscillatable in the annular compartment, some of the housing walls forming a cylindrical bearing compartment above the upper end of the barrel, the barrel bore having a longitudinal axis, and the cylindrical compartment having a cylindrical axis which is an extension of the barrel bore axis, a distributing ring fitting and rotatable in the cylindrical compartment, the distributing ring having a bore coaxial with its cylindrical axis and registering with the upper end of the barrel bore, the upper end of the barrel having an outer cylindrical face and a fuel inlet port formed therein and opening into the barrel bore and through the barrel outer cylindrical face, the metering ring having inner and outer cylindrical faces and a circumferentially tapered recess formed in the inner cylindrical face and a fuel inlet duct extending between an opening into the cylindrical outer face and the tapered recess, the tapered recess being registrable with the fuel inlet port of the barrel, means for oscillating the metering ring, one of the housing walls forming the annular compartment having an inner cylindrical face abutting the outer cylindrical face of the metering ring and a fuel sump in the annular compartment inner cylindrical face registering with the outer end of the metering ring fuel inlet duct and a fuel supply duct communicating with the sump, the upper end of the plunger having a reduced shank extending into the bore of the distributing ring, the bore of the distributing ring having opposite radial slots formed therewith and the upper reduced shank of the plunger having opposite radial wings loosely fitting in the distributing ring slots, the distributing ring having an outer cylindrical face with a recess formed therein and fuel discharge duct extending between the distributing ring bore and the distributing ring recess and a compensating duct offset from the discharge duct and extending between the distributing ring bore and the distributing ring outer cylindrical face opposite the fuel discharge duct, and one of the housing walls forming the cylindrical compartment having a cylindrical inner face and a fuel receiving duct with an inner end opening through the cylindrical compartment inner cylindrical face, the inner end of the fuel receiving duct being located for being traversed by the outer recess of the outer end of the fuel discharge duct of the distributing ring, means for reciprocating the plunger and means for simultaneously rotating the plunger.

2. In a fluid injection pump as set forth in claim 1 and in which the means for oscillating the metering ring includes a metering shaft and a crank pin and slot connection between the metering shaft and the metering ring.

3. In a fluid injection pump as set forth in claim 1, and in which the means for reciprocating the plunger and the means for rotating the plunger have a common drive shaft.

4. In a fluid injection pump, walls forming a housing, a lower head supported by the housing, a barrel supported by the lower head, the barrel having an upper enlarged head and a lower reduced shank and a bore extending longitudinally therethrough, a plunger reciprocatable and rotatable in the barrel bore, the lower head having a double counterbored central opening formed therein and including a lower smaller bore section and an intermediate counterbore section and an upper larger counterbore section and there being a first annular shoulder between the upper end of the lower smaller bore section and the lower end of the intermediate counterbore section and there being a second annular shoulder between the upper end of the intermediate counterbore section and the lower end of the upper counterbore section, the lower shank of the barrel fitting and extending through the lower smaller bore section of the central opening of the lower head and the head of the barrel having a lower annular face seating on the first annular shoulder of the lower head, the intermediate counterbore section of the lower head having a cylindrical inner face and the barrel head having a cylindrical outer face concentric with the barrel bore and the cylindrical outer face of the lower head, an annular cover disc seated on the second annular shoulder of the lower head, the cover disc having a lower face, and the inner cylindrical face of the intermediate counterbore section of the lower head and the outer cylindrical face of the barrel and opposite annular portions of the first annular shoulder of the lower head and lower face of the cover disc forming an annular compartment, a metering ring fitting and oscillatable in the annular compartment, the metering ring having an inner cylindrical face abutting the outer cylindrical face of the barrel head and the metering ring having an outer cylindrical face abutting the inner cylindrical face of the intermediate counterbore section of the lower head, the barrel head having a fuel inlet port formed therein and opening into the barrel bore and through the outer cylindrical face of the barrel head, the metering ring having a circumferentially tapered recess formed in its inner cylindrical face and a fuel inlet duct with an inner end opening into the tapered recess and an outer end opening through the outer cylindrical face of the metering ring, the tapered recess being located for traversing the outer end of the fuel inlet port of the barrel, and the lower head having a fuel sump recess formed in the inner cylindrical face of the intermediate counterbore section and a fuel supply duct communicating with the fuel sump recess, the outer end of the metering ring fuel duct registering with the fuel sump recess of the lower head, means for oscillating the metering ring, an upper head supported on the lower head, the upper head having formed therein a downwardly opening cylindrical pocket forming a cylindrical compartment with the central portion of the upper face of the cover disc, a distributing ring fitting and rotatable in the cylindrical compartment, the cylindrical pocket including an inner cylindrical side face and the distributing ring including an outer cylindrical side face abutting the inner cylindrical side face of the upper head, the distributing ring having a central bore formed therein and the cover disc having a central bore formed therein, the distributing ring bore and the cover disc bore registering with each other and with the upper end of the barrel bore, the distributing ring having opposite radial slots opening into its bore and the plunger having an upper reduced shank extending through the cover disc bore and into the distributing ring bore and opposite radial wings on the reduced shank loosely fitting in the distributing ring slots, the distributing ring having a recess formed in its outer cylindrical side face and a fuel discharge duct extending between the distributing ring bore and the recess and a compensating duct offset from the discharge duct and extending between the distributing ring bore and the distributing ring outer cylindrical side face opposite the fuel discharge duct, and the upper head having a fuel receiving duct with an inner end opening through the inner cylindrical side face of the pocket, the inner end of the fuel receiving duct being located for being traversed by the outer recess of the outer end of the fuel discharge duct of the distributing ring, means for reciprocating the plunger and means for simultaneously rotating the plunger.

5. In a fluid injection pump as set forth in claim 4, and in which the means for oscillating the metering ring include a metering shaft, means journalling the metering shaft in the lower head, and crank pin and slot connecting means between the metering shaft and the metering ring.

6. In a fluid injection pump as set forth in claim 4, and in which the means for reciprocating the plunger and the means for rotating the plunger have a common drive shaft.

7. In fluid distributing apparatus, walls forming a housing, some of the housing walls forming a cylindrical compartment having a cylindrical axis and an axial fluid inlet opening in one of the compartment forming walls, a distributing ring fitting and rotatable in the cylindrical compartment, the distributing ring having a bore coaxial with its cylindrical axis and aligned with the compartment fluid inlet opening, a rotary drive shaft member having a shank extending into the bore of the distributing ring, the bore of the distributing ring having opposite radial slots formed therewith and opening therein and the shank of the rotary drive shaft member having opposite radial wings loosely fitting in the distributing ring slots, the distributing ring having an outer cylindrical face with a recess formed therein and a fuel discharge duct extending between the distributing ring bore and the distributing ring recess and a compensating duct extending between the distributing ring bore and the distributing ring outer cylindrical face opposite the fuel discharge duct and offset therefrom, and one of the housing walls forming the cylindrical compartment having a cylindrical inner face and a fuel receiving duct with an inner end opening through the cylindrical compartment inner cylindrical face, the inner end of the fuel receiving duct being located for being traversed by the outer recess of the outer end of the fuel discharge duct of the distributing ring, and means for rotating the drive shaft member.

8. In fluid distributing apparatus as set forth in claim 7, and in which means are provided for introducing fluid into the bore of the distributing ring through the axial fluid inlet opening in one of the compartment forming walls.

9. In fluid distributing apparatus as set forth in claim 7, and in which means are provided for introducing metered charges of liquid fluid into

the bore of the distributing ring through the axial fluid inlet opening in one of the compartment forming walls.

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