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DIESEL FUEL INJECTOR PUMP

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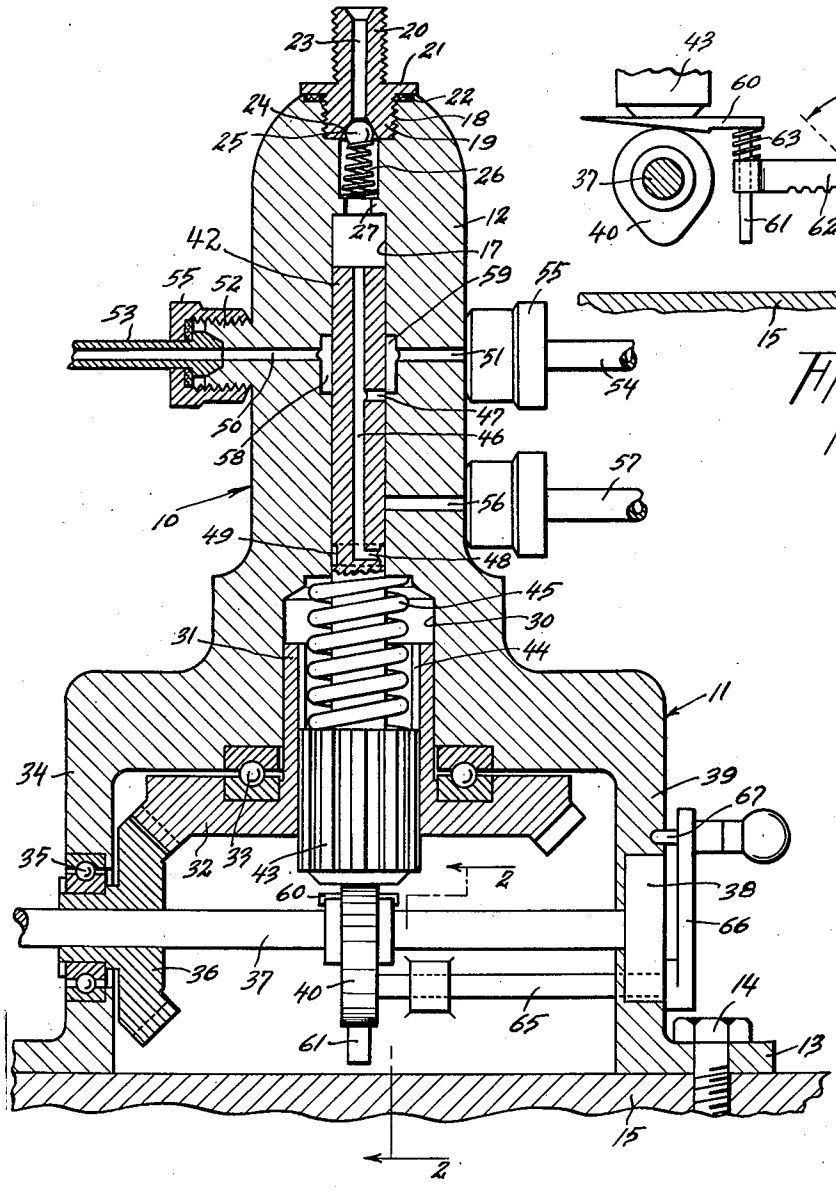


Fig. 1

Fig. 2

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DIESEL FUEL INJECTOR PUMP

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4 Claims. (Cl. 103—2)

This invention relates to Diesel engines and particularly to the pumping and distributing of the fuel under pressure to the individual cylinders.

The principal object of this invention is to provide a pumping and distributing unit having a reciprocating and rotatable plunger that is adjustable as to its stroke so as to regulate the quantity of fuel delivered.

Other objects of this invention relate to the provision of a simple, economical, efficient and compact arrangement for rotating and reciprocating the plunger, to facilitate assembly of the parts and to obtain other advantages hereinafter appearing.

With the foregoing in view the invention resides in the novel arrangement and combination of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention herein disclosed may be made within the scope of what is claimed without departing from the spirit of the invention.

A practical embodiment of the invention is illustrated in the accompanying drawing, wherein:

Figure 1 is a vertical sectional view of the fuel injector pump.

Figure 2 is a detail view taken on line 2—2, Figure 1, showing control mechanism for varying supply of fuel pumped.

Referring to the drawing, the fuel injection pump comprises a housing 10 having an enlarged bottom chamber 11; the upper part of housing 10 being of substantially cylindrical form as at 12 to form a pump chamber and the chamber 11 being formed along its lower edge with a flange 13 carrying the bolts 14 for attaching the housing 10 to a suitable support 15 on the Diesel engine (not shown). The cylindrical portion 12 of the housing 10, constitutes the pump chamber and is provided with an axial bore 17 terminating at its upper end in an enlarged diameter threaded opening 18. Positioned within said opening 18 is the threaded end 19 of a flanged nipple 20, there being provided between the flange 21 of the nipple 20 and upper end of the pump chamber 12, a packing 22 so as to provide a liquid tight connection.

The nipple 20 is adapted to have connected thereto a conduit (not shown) for connecting the pump chamber 12 to a source of fuel supply (not shown), and is formed with an axial passage 23 terminating at its lower end in a valve seat 24 for a ball valve 25. A coil spring 26 acts to retain the ball valve 25 seated, said spring at its lower end being positioned on an annular shoulder 27 formed in the bore 17.

At the lower end of the pump chamber 12 there is provided a cylindrical opening 30 co-axial with the bore 17 and in open communication with the bottom chamber 11. Suitably supported within the opening 30 for rotational movement therein is the hub 31 of a bevel gear 32, there being provided between the gear 32 and base of the pump chamber an anti-friction bearing 33. Mounted in one wall 34 of the bottom chamber 11 through the medium of the anti-friction bearing 35 is a bevel gear 36 adapted to mesh with the bevel gear 32. Rotation of said gears is effected by a shaft 37 extending axially through the gear 36 and transversely across the bottom chamber 11, the end of the shaft 37 being mounted in the anti-friction bearing 38 supported in the wall 39 opposite the wall 34, the gear 36 being secured to the shaft 37 for rotation therewith, in any desired manner. The shaft 37 is disposed as to extend diametrically beneath the opening 30 and has fixedly mounted thereon a cam 40 so positioned as to lie in a plane co-incident with the axis of the opening 30.

Mounted for reciprocating movement within the bore 17 is a plunger 42 provided at its lower end with a splined head 43 arranged for reciprocatory and guiding movement in the splined bore 44 of the gear boss 31. Surrounding the plunger 42 within the opening 30 is a coil spring 45 engaging at its ends the inner face of the splined head 43 and the base of the opening 30, said spring acting to urge the plunger 42 in a downwardly direction and to maintain the splined head 43 in engagement with the cam 40.

The plunger 42 is provided with an axial passage 46 communicating with upper and lower transverse ports 47 and 48, the lower port opening into an annular groove 49 formed in the plunger 42, for a purpose to be hereinafter described.

Suitably positioned in the wall of the pump chamber 12 are opposed passages 50 and 51. Each passage terminates within a threaded boss 52 to which is detachably secured, respectively, the feed pipes 53 and 54, by means of threaded caps 55 in the manner well known. In a like manner there is provided below the opposed passages a passage 56 in communication with a return pipe 57 similarly connected to the pump chamber 12 as the feed pipes 53—54. Provided in the wall of the bore 17 are opposed grooves 58 and 59 of a predetermined length and width such that in the lowermost position of the plunger 42,

the port 47 will barely be in communication with one or the other of said grooves which communication will be complete for the entire length of the stroke of the plunger and for a predetermined part of a revolution thereof as will be hereinafter described. In the form of pump shown the feed pipes 53 and 54 are each connected to a cylinder of a two cylinder Diesel engine (not shown) and the return pipe 57 is connected to the fuel supply tank (not shown).

The cycle of operation of the pump is as follows:

The shaft 37 is connected to the engine so as to operate the gears 36 and 32, the ratio of which depends on the number of cylinders of the engine. Thus for a two cylinder engine the ratio is "2 to 1," for a four cylinder engine it is "4 to 1," and so on, so that in the two cylinder engines the plunger 42 will have two strokes through the action of the cam 40 for each revolution thereof. In a like manner for a four cylinder engine the plunger 42 will have four strokes for each revolution thereof.

Thus the oil is taken in through nipple 20 under pressure from the supply pump (not shown) and drawn into the pump bore 17 on the downstroke of the plunger 42. On the upstroke the valve 25 is closed and the oil is then under pressure being forced into axial passage 46 and out through port 47 into one or the other of grooves 58 or 59, depending upon the rotary position of the plunger for transmission through the corresponding passage 50 or 51 and feed pipe 53 or 54 so as to thereby deliver oil to the respective cylinder of the engine.

When the plunger 42 reaches a predetermined position substantially at the end of its upward stroke the port 48 and groove 49 will register with the passage 56 whereupon the delivery of oil through one or the other feed pipes is discontinued allowing the oil to return to the supply tank through return pipe 57 and at the same time cutting off the pressure to the engine cylinder. By virtue of the annular groove 49 there is a return of oil through port 48 into passage 56 upon the termination of each upward stroke of the plunger 42.

In order to control the speed of the engine there is provided a stroke adjusting mechanism, a preferred form see Fig. 2 of which consists of a finely tapered wedge 60 fixed at its base to a rod 61, said wedge being adapted to be inserted between the cam 40 and splined plunger head 43. The rod 61 is supported for vertical movement on the end of a rack 62, there being provided a coil spring 63 between the base of the wedge and the rack for resiliently supporting the wedge. Movement of the rack 62 is achieved by a pinion 64 carried on the end of a shaft 65 under the control of a lever 66 which is provided with a conventional form of spring catch 67, the pinion 64 meshing with the rack. The spring catch 67 acts to hold the lever in adjusted position to thereby retain the wedge 60 in its selected adjusted position. Movement of the wedge 60 inwardly between the cam 40 and splined plunger head 43 acts to raise the stroke of the plunger 42 so that the port 48 lines up with the passage 56 earlier in the stroke thus delivering less oil to the cylinders to thereby provide a reduction in the speed of the engine.

The type of gears may be varied or the type of governor (not shown) may be varied without changing the basic idea which is presented herewith. The principal feature of this invention is a rotating plunger that acts as a distributor as well as a high pressure pump.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. In a fuel pump for engines comprising a reciprocatory and rotatable plunger, cam and gear means simultaneously operative to respectively reciprocate and rotate said plunger, said cam being arranged beneath said plunger and in engagement with the adjacent end thereof, and stroke adjusting means for regulating the amount of fuel pumped comprising a wedge adapted to be moved between said cam and plunger end for raising the stroke of said plunger, a rod fixed to the base of said wedge, a movable support, said rod being mounted on one end of said support for vertical movement relative thereto, a coil spring surrounding said rod seated between said support and the base of said wedge, manually operated means connected with said support for moving the same including means for locking said support in adjusted position whereby to hold said wedge in proper position for a selected engine speed.

2. A fuel pump for a Diesel engine comprising a pump casing, a plunger reciprocal therein, means for reciprocating and rotating said plunger, an axial bore in said plunger, valve means for admitting fuel into the pump chamber on the intake stroke of said plunger, upper and lower transverse ports connecting said bore with the exterior of said plunger, a plurality of delivery passages in said pump casing arranged in radial relation to the axis of said plunger, each of said delivery passages being provided with an individual conduit formed in said pump casing wall arranged to communicate said upper transverse port with an associated delivery passage for substantially the full length of the pumping stroke of said plunger at predetermined intervals of rotation of said plunger, a return passage in said pump casing, an annular groove formed in said plunger in the plane of said lower port and providing communication between said lower port and said return passage at a predetermined point near the end of the pump stroke whereby to relieve the pressure in said pump casing and to interrupt the discharge of fuel therefrom and including a stroke adjusting mechanism operative to raise the pumping stroke of the plunger whereby said annular groove will register with the return passage earlier in the pump stroke.

3. A fuel pump for a Diesel engine comprising a pump casing, a plunger reciprocal therein, means for reciprocating and rotating said plunger, an axial bore in said plunger, valve means for admitting fuel into the pump chamber on the intake stroke of said plunger, upper and lower transverse ports connecting said bore with the exterior of said plunger, a plurality of delivery passages in said pump casing arranged in radial relation to the axis of said plunger, each of said delivery passages being provided with an individual conduit formed in said pump casing wall arranged to communicate said upper transverse port with an associated delivery passage for substantially the full length of the pumping stroke of said plunger at predetermined intervals of rotation of said plunger, a return passage in said pump casing, an annular groove formed in said plunger in the plane of said lower port and providing communication between said lower port and said return passage at a predetermined point near the end of the pump stroke whereby

to relieve the pressure in said pump casing and to interrupt the discharge of fuel therefrom, wherein said means for reciprocating and rotating said plunger comprises a driven gear rotatably mounted in said pump casing co-axially with said plunger, a splined sleeve in said gear, a splined head on said plunger axially movable on said sleeve, a shaft, a drive gear on said shaft meshing with said driven gear whereby to rotate said plunger, and a cam on said shaft adapted to engage the end of said splined head whereby to reciprocate said plunger, the gear ratio being such that for each revolution of the plunger the cam will impart a number of pumping strokes to the plunger equal to the number of said delivery passages.

4. A fuel pump for a Diesel engine comprising a pump casing, a plunger reciprocal therein, means for reciprocating and rotating said plunger, an axial bore in said plunger, valve means for admitting fuel into the pump chamber on the intake stroke of said plunger, upper and lower transverse ports connecting said bore with the exterior of said plunger, a plurality of delivery passages in said pump casing arranged in radial relation to the axis of said plunger, each of said delivery passages being provided with an individual conduit formed in said pump casing wall arranged to communicate said upper transverse port with an associated delivery passage for substantially the full length of the pumping stroke of said plunger at predetermined intervals of rotation of said plunger, a return passage in said pump casing, an annular groove formed in said plunger in the plane of said lower port and providing communication between said lower port and said return passage at a predetermined point near the end of the pump stroke whereby to relieve the pressure in said pump casing and to interrupt the discharge of fuel therefrom, wherein said means for reciprocating and rotating said plunger comprises a driven gear rotatably mounted in said pump casing coaxial with said plunger, a splined sleeve in said gear, a splined head on said plunger axially movable on said sleeve, a shaft, a drive gear on said shaft meshing with said driven gear whereby to rotate said plunger, a cam on said shaft adapted to engage the end of said splined head whereby to reciprocate said plunger, a coil spring surrounding said plunger and acting on said splined head to move said plunger outwardly of said pump casing as well as to maintain the engagement of said splined head and cam at all times, the gear ratio being such that for each revolution of the plunger the cam will impart a number of pumping strokes corresponding to the number of said delivery passages.

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