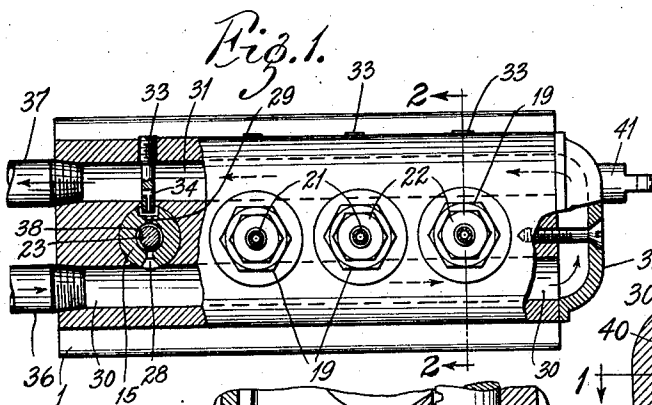
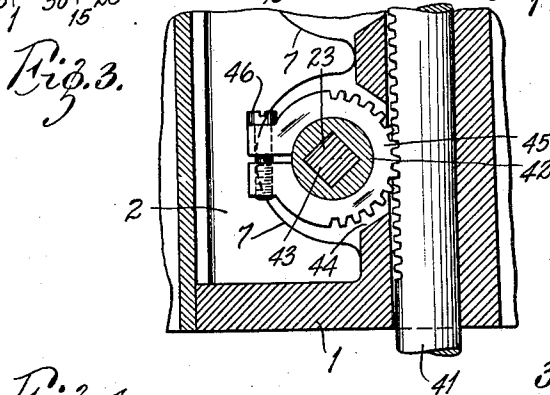
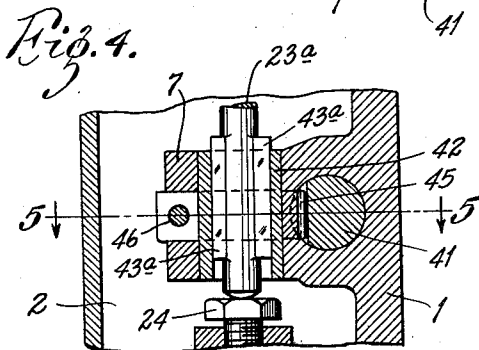
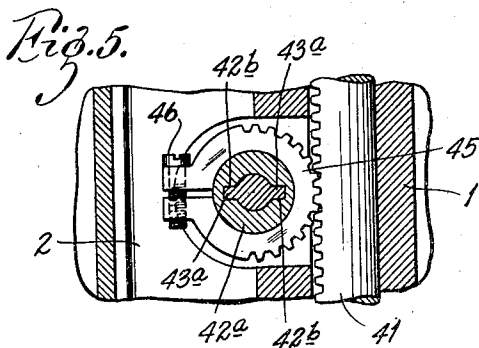
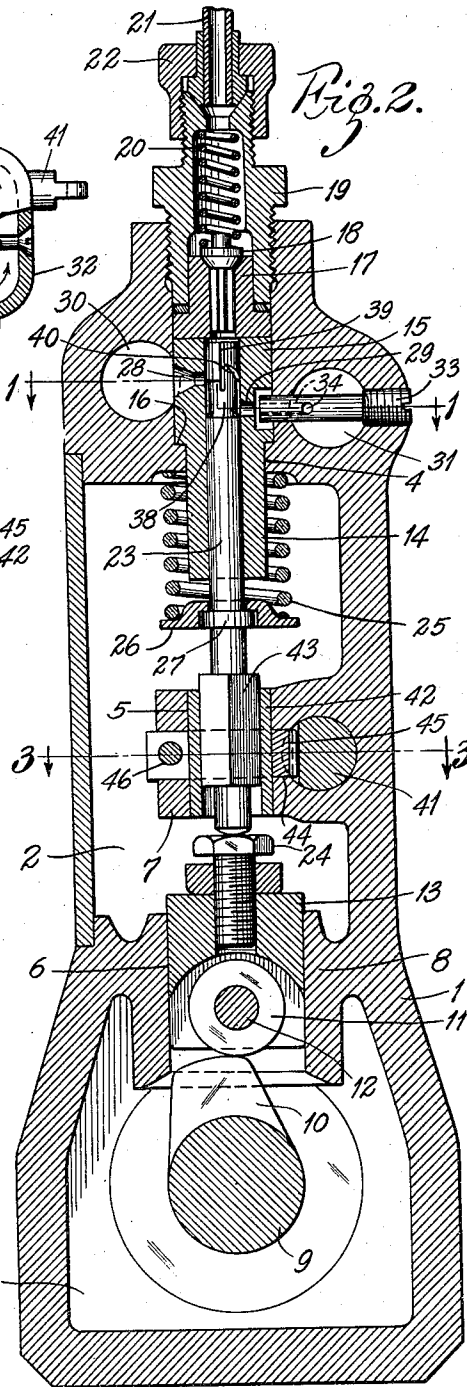


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FUEL INJECTION PUMP
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FUEL INJECTION PUMP

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4 Claims. (Cl. 103—41)

This invention relates to fuel injection pumps of the type wherein the pump plunger at a predetermined point of its pressure stroke by-passes fuel from the pressure space in the pump cylinder to an overflow port therein, thereby relieving the pressure in said space and terminating the fuel delivery.

In such a pump construction, fuel is drawn into the pressure space, during the suction stroke of the plunger, through the overflow port and, quite commonly, through an additional inlet port also, and the surplus fuel in said space is discharged through the overflow port during the pressure stroke of said plunger after injection, with the result that the fuel adjacent to said overflow port is in a state of commotion or turbulence, thereby preventing the proper quantity of fuel from being drawn into the pressure space on the following suction stroke of the plunger. The principal object of the present invention is to provide improved means for preventing such interference with the filling of the pressure space on the suction stroke of the plunger, to provide an improved arrangement for rotating the reciprocating pump plunger to vary the quantity of delivered fuel, and to provide for simplicity and cheapness of construction and compactness of design. The invention consists in the fuel injection pump and in the parts and combinations and arrangements of parts hereinafter described and claimed.

In the accompanying drawing, which forms part of this specification and wherein like symbols refer to like parts wherever they occur.

Fig. 1 is a view partly in plan and partly in horizontal section on the line 1—1 in Fig. 2 of a multi-cylinder fuel injection pump embodying my invention.

Fig. 2 is a vertical transverse section through said pump at one of the cylinders on the line 2—2 in Fig. 1.

Fig. 3 is a fragmentary horizontal section on the line 3—3 in Fig. 2; and

Figs. 4 and 5 are fragmentary sections similar to Figs. 2 and 3, respectively, illustrating a modified form of non-rotary axial sliding connection between the plunger and the turning sleeve therefor.

Referring to the accompanying drawing, my invention is illustrated in connection with a multi-cylinder fuel injection pump for multi-cylinder internal combustion engines of the compression ignition type. Said pump comprises a suitable housing 1 having upper and lower longitudinal chambers 2 and 3, respectively, a plu-

rality of vertical bores 4 that are spaced apart lengthwise of said housing and lead downwardly into said upper chamber, and bores 5 and 6 disposed in axial alignment with the bores 4 and extending respectively through horizontal lugs 7 on one side wall of said housing and the partition wall 8 between the two longitudinal chambers. Located in the lower chamber 3 of the pump housing is a cam shaft 9 provided with cams or tappets 10 adapted to engage rollers 11 journaled on pins 12 mounted in blocks 13 that are mounted for axial sliding movement in the vertical bores 6 in the partition wall 8 of said housing.

Mounted in each of the vertical bores 4 in the top of the pump housing 1 is a cylinder 14 having an enlarged upper end portion 15 that rests on an annular seat 16 in said bore. Mounted in said bore is a tubular member 17 which seats on the upper end of the cylinder 14 and is provided at its upper end with a seat for a fuel discharge valve 18. The cylinder 14 is held down on its seat 16 and the valve seat member is held down on said cylinder by a cylindrical shell 19 that is threaded into the upper end of said bore and encloses a spring 20 for holding the valve 18 down on its seat. A fuel delivery pipe or line 21 is secured to the upper end of the shell 19 by means of a cap nut 22 threaded thereon. Working in the cylinder 14 is a plunger or piston 23 whose lower end seats on the head of a cap screw 24 that is threaded in the upper end of the roller supporting block 13 and located therebelow. Located in the upper chamber 2 around the portion of the pump cylinder therein is a piston retracting spring 25, the upper end of which seats in a circular recess provided therefor in the top of said chamber and the lower end of which bears against a washer 26 that is sleeved on said plungers and seats on a collar 27 formed integral therewith.

The head of each cylinder 14 is provided on one side with an inlet port 28 and on the opposite side with an overflow by-pass or metering port 29 that is preferably located at a lower level than said inlet port. The pump housing is provided above the upper chamber 2 with two longitudinal bores 30 and 31 that extend from end to end of said housing on opposite sides of the cylinder and are cross-connected at one end of said housing preferably by a removable fitting or cap 32. The bore 30 extends alongside and at the level of the inlet ports 28 and is in direct communication therewith. The other bore 31 extends alongside and at the level of the

overflow ports 29 and communicates therewith through threaded pins or screws 33, which prevent the cylinders from rotating in the pump housing. Each of these screws is threaded horizontally through the outer wall of the housing 1 and extends through the bore 31 transversely thereof and through an opening between said bore and the adjacent overflow port 29 into the outer end of the latter. As shown in the drawing, the inner end of the screw 33 is provided with a passageway 34 that establishes communication between the overflow port 29 and the bore 31. An inlet or supply pipe or conduit 36 leads from a suitable supply pump (not shown) to the end of the bore 28 remote from the cap 32; and a suitable return pipe or conduit 37 leads from the corresponding end of the other bore 31 back to said supply pump or to the source of fuel supply.

Each plunger 23 is preferably provided near its upper end with an annular groove 38 which is in constant communication through a longitudinal groove 39 in said plunger with the pressure space thereabove. During the pressure stroke of the plunger, the annular groove 38 thereof is adapted to be placed in communication with the overflow port 29 in the cylinder thereof and thus cause the fuel in said pressure space to be by-passed through said overflow port and the passageway 34 in the screw 33 into the longitudinal bore 29. The annular groove 38 in the plunger is preferably provided with an inclined or helical edge 40, whereby the effective delivery stroke of the plunger may be regulated by turning the plunger in its cylinder to vary the point in the delivery stroke of the plunger at which the overflow port 29 is placed in communication with space above said plunger through the grooves 38 and 39. With this arrangement, delivery of the fuel begins as soon as the plunger on its way covers the inlet and overflow ports and ends as soon as the inclined edge 40 of the annular groove 38 opens the overflow port and relieves the pressure in the space above said plunger.

The mechanism for simultaneously rotating the reciprocating plungers 23 to vary the point at which the annular groove 38 therein open into the overflow ports 29 comprises a rack rod 41 that extends longitudinally of the pump housing from end to end thereof and is mounted for axial sliding movement in a longitudinal bore therein. The connection between the rack rod 41 and each of the pump plungers 23 comprises a sleeve 42 having a flatsided opening extending therethrough adapted to receive a similar flatsided portion 43 of said plunger, thereby permitting relative axial sliding movement of said sleeve and plunger but preventing relative rotary movement thereof. The sleeve 42 is journaled in the vertical bore 5 in the lateral lug 7 in the upper chamber 2. The lug 7 is provided between its upper and lower ends with a horizontal opening or recess 44 adapted to receive and support a pinion 45, which meshes with and is driven by the rack rod 41. As shown in the drawing, this pinion 45 is split and is provided with a suitable clamping screw 46, whereby it may be rigidly clamped to the sleeve 42. This clamp connection between the pinion 45 and the sleeve 42 also permits relative angular adjustment thereof in order to obtain the desired initial setting of the inclined upper edge 40 of the an-

nular groove 38 in the plunger with respect to the overflow port 29.

In the modified construction shown in Figs. 4 and 5, the non-rotary but axial sliding connection between the pinion receiving sleeve 42a and the plunger 23a comprises longitudinally extending ribs 43a on opposite sides of the plunger that fit within diametrically opposite longitudinal grooves 42b provided therefor in the plunger receiving bore of said sleeve.

By the arrangement described, the longitudinal bores 30 and 31 in the pump housing and the cap 32 cooperate to form a single fuel passageway that provides a continuous flow of fuel along both the inlet and overflow sides of the cylinders, and returns the surplus fuel to the supply pump or source of fuel supply. With this arrangement of fuel feed, any turbulence or disturbance created in the fuel stream adjacent to the inlet and overflow ports by the return flow of the fuel therethrough is carried along and absorbed by said stream, thereby eliminating or greatly minimizing the effect of such disturbance on the fuel drawn into the inlet and overflow ports during the next suction stroke of the plunger. This continuous flow of fuel past the ports in the cylinder also serves to carry away any bubbles created by the return flow of the fuel and thus further increases the efficiency of the pump.

What I claim is:

1. A fuel injection pump comprising a cylinder having inlet and overflow ports in opposite sides thereof, and a plunger reciprocating in said cylinder, said pump having a single fuel passageway that extends across and communicates with the inlet port on one side of said cylinder, thence across said pump to the opposite side thereof, and thence across and in communication with the overflow port on that side of said cylinder, the inlet and outlet ends of said passageway being located in the same face of said pump.

2. A fuel injection pump comprising a plurality of cylinders having inlet and overflow ports facing the opposite sides of said pump, plungers reciprocating in the respective cylinders, said pump being provided on opposite sides of said cylinders with longitudinal bores that extend through said pump from end to end thereof and communicate respectively with the inlet and overflow ports of said cylinders, and a member removably secured to one end of said pump and forming a connecting passageway between the two bores at that end of said pump, the opposite ends of said bores being adapted to receive fuel supply and fuel return conduits.

3. A fuel injection pump comprising a plurality of cylinders having inlet and overflow ports facing opposite sides of said pump and plungers reciprocating in the respective cylinders, said pump having a fuel passageway with an inlet portion extending across and in communication with the inlet ports on one side of said cylinders, and having an inlet connection adjacent to one end of said pump, an overflow portion extending across and in communication with the overflow ports on the opposite sides of said cylinders and having an outlet connection adjacent to said end of said pump and a portion other than said ports and cylinders located exteriorly of said pump adjacent to the other end thereof for establishing continuous communication between said inlet and overflow portions.

4. A fuel injection pump comprising a plurality

of cylinders having inlet and overflow ports facing opposite sides of said pump and plungers reciprocating in the respective cylinders, said pump having a combined fuel inlet and overflow passageway with portions spaced apart on opposite sides of said cylinders and communicating respectively directly with said inlet and overflow

ports and a portion other than said ports and cylinders for establishing continuous communication between said spaced apart portions between an endmost cylinder and the corresponding end of said pump.

OSWALD SCHLAUPITZ.