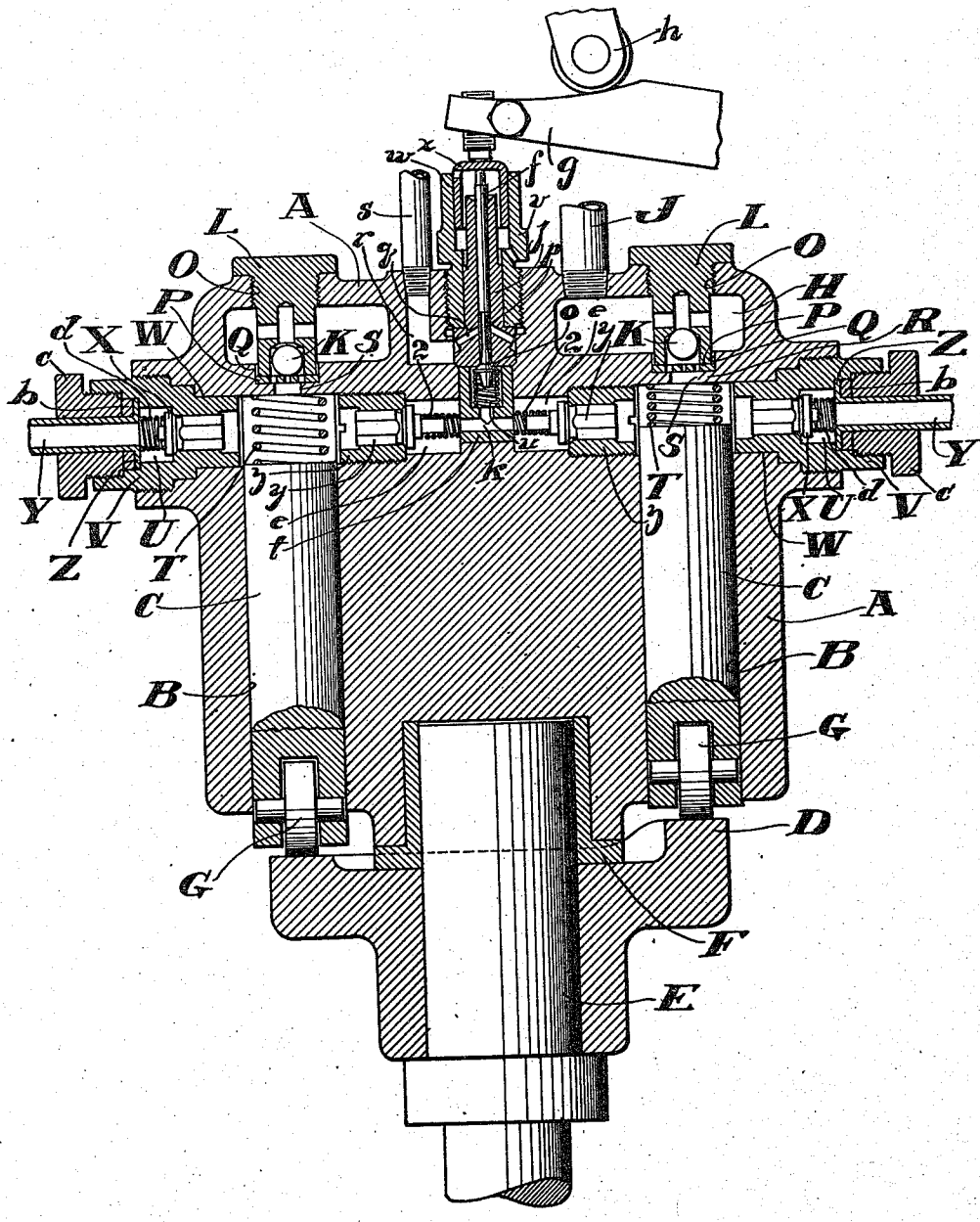
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FUEL OIL PUMP

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FUEL-OIL PUMP.

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This invention relates to fuel oil pumps for internal combustion engines of the solid fuel injection type.

Fuel oil pumps of the type using solid airless injection have ordinarily heretofore been provided with separate fuel injection pumps for each engine cylinder. One objection to that arrangement is that each pump has its peculiar characteristics which make it difficult to maintain the fuel charges similar to each other at all loads and speeds. This is partly due to the use of individual by-passing or cut-off valves for each pump.

It is an object of this invention to enable a multi-internal combustion engine to be operated by a plurality of pump plungers, one for each cylinder of the engine and combined in a unitary structure so as to employ a single by-pass valve for governing the injection of fuel into such cylinders.

Other objects and advantages of the structure will be in part obvious and in part pointed out hereinafter.

In the accompanying drawing forming part of the specification and in which similar reference characters refer to similar parts, there is shown in vertical section, a fuel pump constructed in accordance with the practice of the invention.

Referring to the drawing, the pump includes a pump body A in which are disposed a plurality of cylinders B preferably symmetrically arranged with respect to the axis of the pump body and parallel to each other. Within each cylinder B, a pump plunger C is adapted to reciprocate, being actuated by a cam D mounted on a rotatable shaft E preferably journalled in a bushing F axially disposed in one end of the pump body A. The pump plunger C may be provided with cam following rollers G to reduce friction against the cam D. Oil is supplied to the cylinders B from a fuel oil supply chamber H formed in the head of the pump body A and associated with a suitable oil supply pipe J. A suction valve K for each cylinder, in this instance shown as a ball type valve, is mounted in a plug L to control the flow of oil into each cylinder B. The plug L may be screwed into an aperture O coaxial with the cylinder B and is seated against a perforated gasket or washer P in a bore Q in the top wall R of the cylinder B. A smaller bore S forms a passage for the fuel oil into each cylinder B. The suction stroke of the plungers C may be effected by means of coil springs T bearing against the heads of the plungers C.

Each cylinder B is provided with a discharge chamber U formed in a plug V screwed into an aperture W adjacent the head end of the cylinder. Fuel oil is adapted to be discharged into the chamber U passing into said chamber by a check valve X controlling the flow of fuel and preventing the oil from passing back into the cylinder B on the suction stroke of the plunger C. Each discharge chamber U is connected with a particular pipe line Y associated with the spray nozzles of a cylinder of a multi-cylinder internal combustion engine (not shown). Any suitable form of connection may be used, in this instance the pipe Y is flanged as at Z and sealed by means of a gasket *b* held in place by a hollow plug *c* screwed into the plug V. The flanged end Z of the pipe Y provides an abutment for a coil spring *d* resiliently holding the valve X to its seat.

In operating an engine of the solid injection type, regulation of the speed and power is obtained by by-passing the oil from the fuel pump at the proper instant. In accordance with this invention, a single by-pass valve is employed to relieve the pressure in the cylinders B at the instant of fuel cut off. To this end there is provided in the pump body A, a common discharge pressure chamber *e* common to all of the cylinders B. The oil is by-passed from the common pressure chamber *e* by means of a by-pass valve *f* for the chamber *e*. The by-pass valve *f* may be actuated in any suitable manner, as for instance, by means of a lever *g* actuated in any well known manner, the excursions of the lever *g* being regulated by means of a movable fulcrum *h* controlled by a governor (not shown).

In this instance the by-pass valve *f* is mounted in a plug *j* extending into the pres-

sure chamber *e* and having suitable passages *k* for conducting fuel oil from the chamber *e* to the valve *f* at its seat *o*. Preferably, the stem of the valve *f* is tapered as at *p* to permit oil to pass along the valve stem *p* into passages *q* and thence into a conduit *r* connected with a return pipe *s* leading to the fuel tank (not shown). Preferably, the plug *j* is formed in three pieces, the inner end portion *t* having the passages *k* and containing a coil spring *u* for resiliently holding the by-pass valve *f* to its seat. The middle portion *j* having the valve seat *o* is held in place by an outer portion *v* screw threaded into the pump body A and holding the inner portion *j* and the end portion *t* in position. The outer end of the outer portion *v* of the plug is bored as at *w* to guide a cap *x* fitting over the end of the by-pass valve *f* and protecting it from injury, due to constant hammering of the lever *g*.

Check valves *y* mounted in valve seat plugs *z* are interposed between the cylinders B and the pressure chamber *e* to prevent direct communication between the cylinders. Check valves *y* may be of any suitable form and are held to their seats by means of coil springs 2.

In operation, the shaft E is rotated preferably by connections to the engine crank shaft (not shown) and at suitable speed depending upon the type of cycle of the engine. If the engine is of a two stroke cycle type, the shaft E should rotate at the crank shaft speed; likewise, if the engine is of the four stroke cycle type the shaft E should be rotated at one half the crank shaft speed. The cam D engaging the plungers C therefore causes a reciprocation of the plungers successively as the shaft rotates. On the suction stroke of the plungers C oil is introduced into the cylinders B from the fluid supply chamber H past the suction valves K. At the pump stroke of the plungers C fuel oil is injected partly into the common pressure chamber *e* past the check valves *y* but first into the discharge chamber U past the check valves X and thence through the pipe lines Y to the injection nozzles (not shown). At the instant of cut off, the lever *g* is adapted to depress the by-pass valve *f* permitting from that instant the fuel oil displaced in the cylinders B to flow past the check valve *y* into the common pressure chamber *e* and the passages *k* of the plug *j* and thence returning through the conduit *r* to the return pipe *s*. Upon release of the lever *g* the spring *u* recedes the by-pass valve *f* permitting the plungers C to again inject fuel oil through the pipes Y to the injection nozzles.

The number of cylinders B and pump plungers C correspond to the number of cylinders of the engine (not shown). In this instance, only two cylinders B are illustrated being understood that as many as desired may be provided depending upon the number of engine cylinders.

Thus by the above construction are accomplished among others, the objects hereinbefore referred to.

I claim:

1. A fuel pump for a multi-cylinder solid injection internal combustion engine comprising a plurality of pump plungers, a discharge pressure chamber associated with all of said pump plungers, and a by-pass valve adapted to relieve the pressure in said chamber at each stroke of each plunger.

2. A fuel pump for a multi-cylinder solid injection internal combustion engine comprising a plurality of pump plungers, a discharge pressure chamber associated with all of said pump plungers, a by-pass valve adapted to relieve the pressure in said chamber at each stroke of each plunger, and means for causing successive reciprocation of said plungers.

3. A fuel pump for a multi-cylinder solid injection internal combustion engine comprising a plurality of cylinders, plungers adapted to reciprocate in said cylinders, discharge passages for said cylinders, a common discharge pressure chamber in communication with all of said cylinders, and a by-pass valve in said pressure chamber to relieve the pressure in said cylinders at each stroke of each plunger.

4. A fuel pump for a multi-cylinder solid injection internal combustion engine comprising a plurality of cylinders, plungers adapted to reciprocate in said cylinders, discharge passages for said cylinders, a common discharge pressure chamber in communication with all of said cylinders, a by-pass valve in said pressure chamber to relieve the pressure in said cylinders at each stroke of each plunger, and a cam for successively actuating said plungers.

5. A fuel pump for a multi-cylinder solid injection internal combustion engine comprising a pump body having symmetrically disposed pump cylinders therein, plungers adapted to reciprocate in said cylinders, a cam adapted to actuate said plungers successively, separate discharge chambers for each cylinder, a check valve in each of said discharge chambers, said pump body being provided with a discharge pressure chamber common to said cylinders, and a by-pass valve to relieve the pressure in said pressure chamber at each stroke of each plunger.

6. A fuel chamber for a multi-cylinder solid injection internal combustion engine comprising a pump body having a plurality of symmetrically disposed pump cylinders, plungers adapted to reciprocate in said cylinders, a cam adapted to actuae said plungers successively, separae discharge chambers for

each cylinder, a check valve in each of said discharge chambers, a suction valve for each cylinder, said pump body being provided with a discharge pressure chamber common to all of the cylinders, check valves controlling the flow of fuel oil from said cylinders to said pressure chamber, and a by-pass valve in said discharge pressure chamber adapted to relieve the pressure in said pressure chamber at each stroke of each plunger.

In testimony whereof I have signed this specification.

ARTHUR G. LUNDSTROM.