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LIQUID FUEL PUMPS FOR INTERNAL COMBUSTION ENGINES

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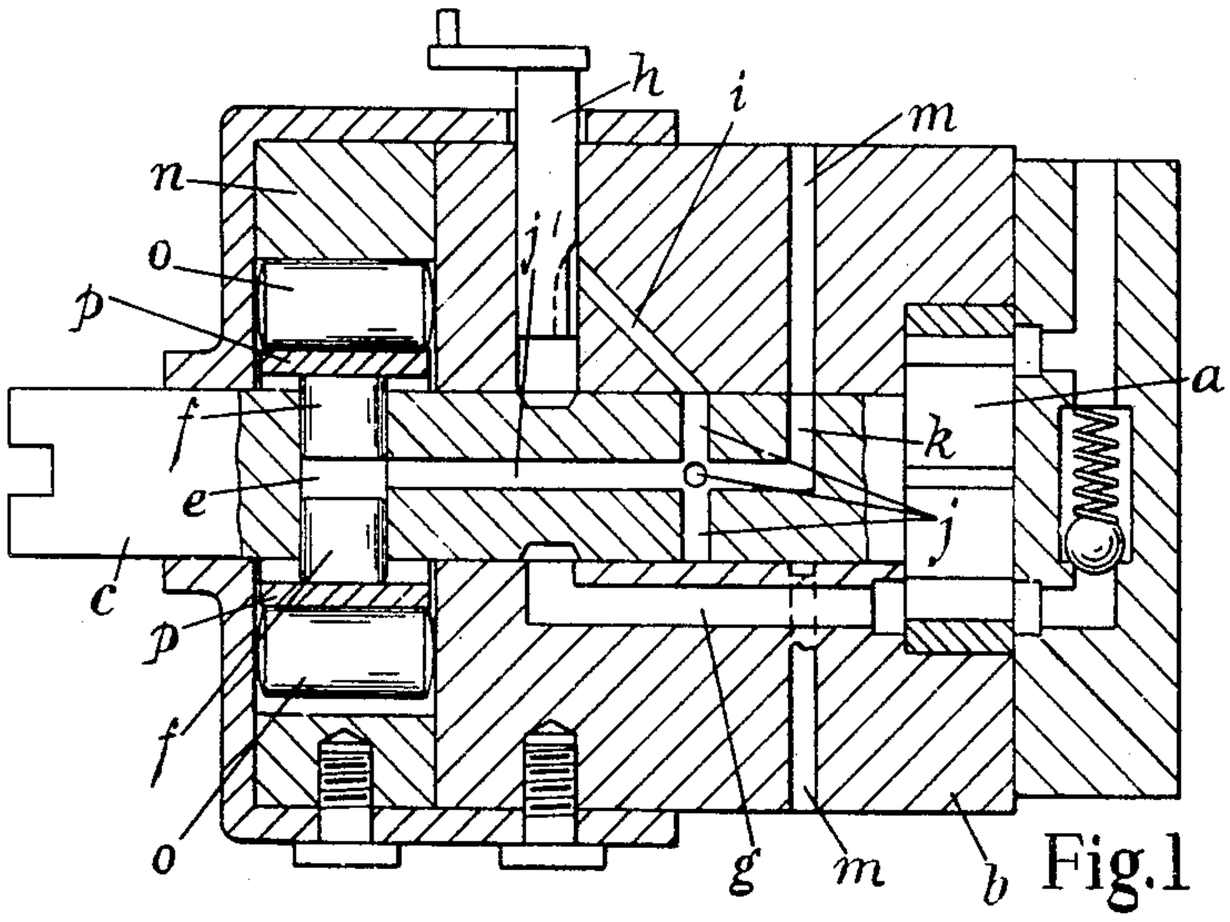


Fig.1

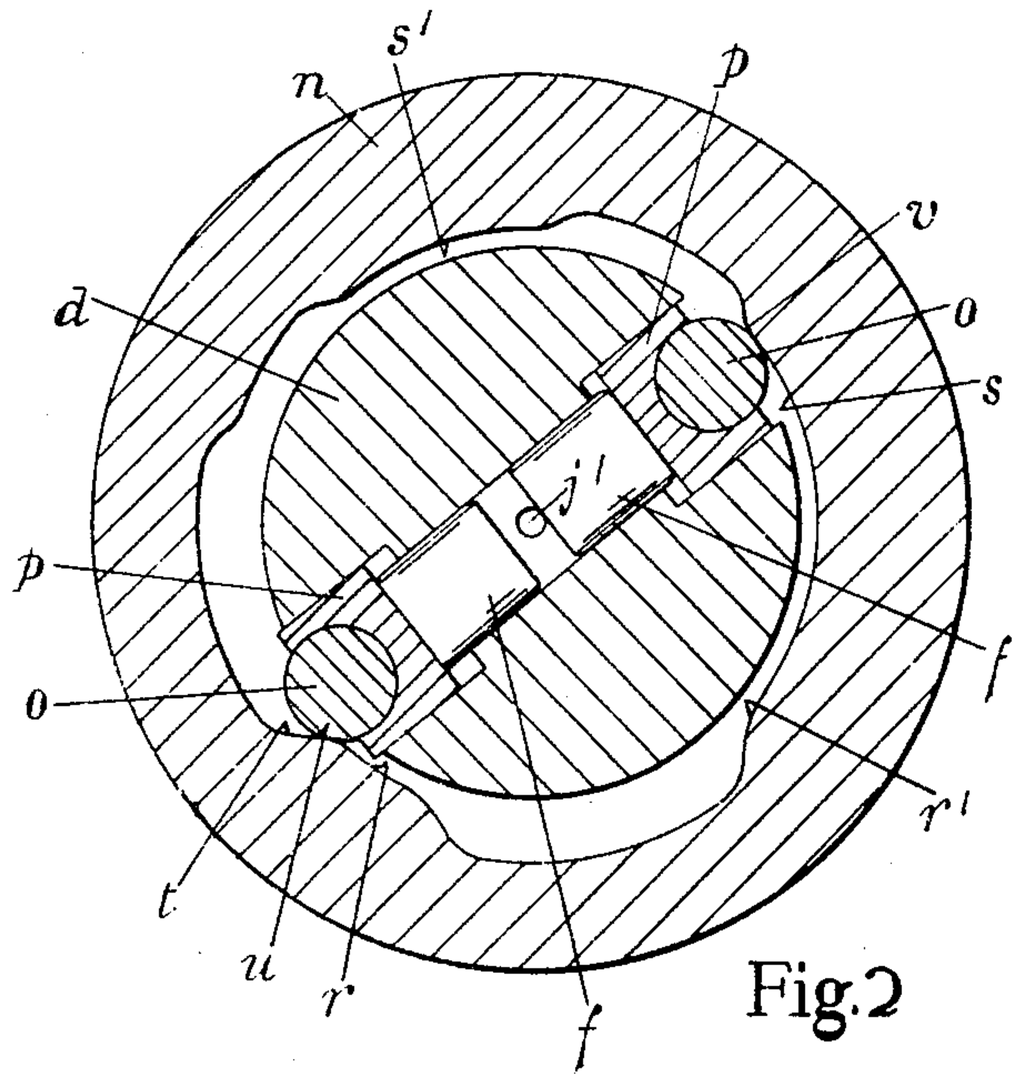


Fig.2

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LIQUID FUEL PUMPS FOR INTERNAL COMBUSTION ENGINES

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1 Claim. (Cl. 103—160)

This invention relates to liquid fuel pumps for internal combustion engines, of the kind comprising a rotary head, a pair of plungers slidable in a diametrical bore in the head, and an annular cam for actuating the plungers.

In the accompanying drawings Figure 1 is a sectional view illustrating diagrammatically an example of a pump of the kind for which the invention is required and Figure 2 is an end view which illustrates the invention to be hereinafter described.

In the pump shown in Figure 1 the fuel is supplied to the injection pump by a feed pump *a* of the rotary vane or gear type, embodied in the same housing *b* as the injection pump, the two pumps being interconnected by a common driving and distributor spindle *c*. The injection pump consists of a rotary body *d* having therein a diametrical bore *e* in the ends of which are contained a pair of reciprocatory plungers *f*. The fuel is supplied from the feed pump through a passage *g* in the housing, and thence through an adjustable throttle *h* and a passage *i* to one of a plurality of radial inlet ports *j* leading to an axial bore j^1 in the said spindle, and is admitted to the space between the adjacent ends of the plungers. Discharge of the fuel to the engine from this space is effected through the same bore and a radial port *k* to a passage or passages *m* leading to the engine cylinder, or each of its cylinders in turn, by inward movements of the plungers under the action of a stationary annular cam *n* having at least one pair of lobes which act on the outer ends of the plungers, which cam may also be angularly adjustable. In the example illustrated the actuation of the plungers is effected by the cam through the medium of rollers *o* carried by slippers *p* which are carried by the rotary body *d* as shown in Figure 2.

When the fuel is fed to the injection pump at a low rate such as is required for example when the engine is idling or running under a light load, the outward movement imparted to the plungers by the fuel from the feed pump is small, and the point at which each plunger (or roller *o*) encounters the adjacent cam lobe is near the rounded crest of the lobe. The effect of this is that the fuel will be discharged by the action of the cam lobes on the plungers at a rate which is insufficient to produce rapid disintegration or nebulisation of the jet delivered to the engine cylinder and satisfactory mixing of the jet with the air in the cylinder. On the other hand, when the fuel is fed to the injection pump at a high rate to meet a full load condition, the plungers are moved outwardly by the fuel to a correspondingly greater extent, with the result that they encounter the sloping flanks of the cam lobes at positions nearer to their roots. The resulting inward movements of the plungers are then effected abruptly, and the fuel is discharge into the engine cylinder at high speed so causing the fuel to break up and mix with the air in the engine cylinder more satisfactorily.

What is required is that the fuel shall be delivered to the engine in each discharge of the injection pump at rates which are independent of the amount of fuel in each

discharge, and so ensure the production of satisfactory fuel-air mixtures under all load conditions. The object of the present invention is to enable this requirement to be met in a simple and convenient manner.

According to the invention the cam lobes which act on the plungers in each discharge action of the injection pump are so shaped that the discharge is obtained wholly or mainly by the action of one of the lobes on one of the plungers, the other and opposite lobe serving wholly or mainly to hold the other plunger against movement during the initial part of the discharge action, and further the second lobe being so shaped and positioned that it releases the plunger suported by it before the other plunger passes the crest of the active lobe.

In carrying the invention into effect as illustrated by Figure 2, the annular cam *n* may be provided with a single pair of co-operating lobes or two or more of such pairs. For a 4-cylinder engine, two pairs are provided. One pair comprises an active lobe *r* and a control lobe *s*. The other pair comprise corresponding lobes r^1 and s^1. For the purpose of explaining the invention it will suffice to consider one pair only. The active lobe *r* is made of any appropriate shape which includes an abruptly sloping flank *t* and a rounded crest *u*. The control lobe *s* is so shaped that it can hold its interacting plunger against axial movement during the discharge movement of the other plunger, and moreover is so positioned that it can release the associated plunger suddenly at *v* before the other plunger has passed the crest of the active lobe *r*.

The arrangement is such that when the fuel is supplied by the feed pump to the space between the ends of the plungers of the injection pump, the first effect is to push both plungers outwardly, the extent of this movement being dependent on the amount of fuel received between the plungers. Under all conditions one of the plungers (or rollers) will encounter the active lobe *r* at a position somewhere on the sloping flank *t* of this lobe. At a high rate of feed this position will be near the root of the flank, and at a low rate it will be nearer the crest. When the active lobe becomes operative, the other plunger will be held by the control lobe. By the action of the active lobe the associated plunger will then move inwardly at a rapid rate depending on the slope of the lobe flank *t* and the discharge will continue until the other plunger is suddenly released by the control lobe at *v*. The discharge is thereupon arrested, as continued inward movement of the first plunger while it moves over the remaining part of the active lobe is accompanied by a corresponding outward movement of the second plunger.

After the plunger (or roller) which was previously in contact with the control lobe *s* has passed the point *v* it it will pass into contact with the control lobe s^1 and thereby will be moved inwardly to its initial position with the bore. Also the other plunger (or roller) will move into coincidence with the second active lobe r^1. The above mentioned sequence of events will then recur.

From the foregoing it will be understood that the rate of discharge of the fuel from the injection pump to the engine is substantially constant under all load conditions and is determined by the slope of the flank of the active lobe.

The invention is not however, restricted to the particular embodiment of the invention above described. In an alternative arrangement the feed pump may be separate from the injection pump and may be of any convenient form other than a rotary pump.

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

A liquid fuel injection pump comprising in combination a rotary body provided with a diametrical bore, and with a fuel inlet and outlet opening communicating with said

bore at a position intermediate the ends thereof, a pair of reciprocatory plungers slidably mounted in opposite ends of said bore, and an annular cam surrounding said body, and provided at its inner periphery with at least one pair of lobes for co-operating with the outer ends of said plungers, one of said lobes having an abruptly sloping flank and rounded crest whereby inward movements are imparted to said plungers during rotation of said body, and the other of said lobes having a dwell diametrically opposite to said first mentioned crest, an abruptly sloping flank, and a rounded crest of substantially the same radius as said first mentioned crest disposed between said dwell and said last mentioned crest whereby during the initial

part of the inward movement of either plunger over said first mentioned abruptly sloping flank and rounded crest, sliding movement of the other plunger is prevented by the opposite crest, and thereafter said other plunger is released before the inwardly moving plunger passes said first mentioned crest.

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