Sept. 1, 1959 F. M. EVANS 2,901,974

LIQUID FUEL INJECTION PUMPS FOR INTERNAL COMBUSTION ENGINES

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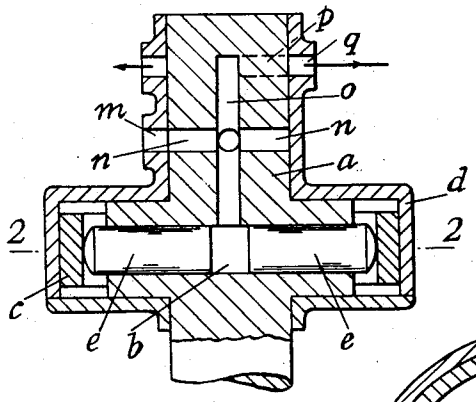

Fig.1

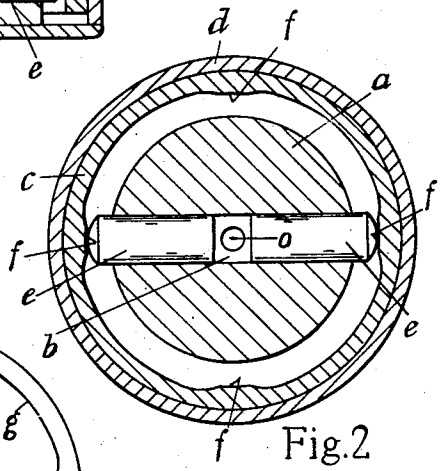

Fig.2

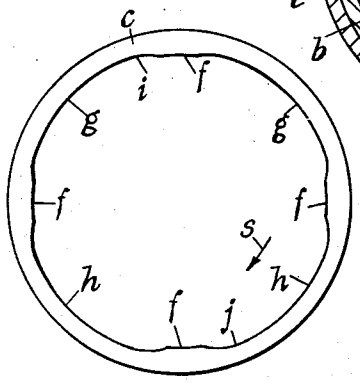

Fig.3

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LIQUID FUEL INJECTION PUMPS FOR INTERNAL COMBUSTION ENGINES

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1 Claim. (Cl. 103—2)

This invention relates to liquid fuel injection pumps for internal combustion engines, of the kind comprising a body having therein at least one diametrical bore, a pair of reciprocatory plungers contained in the ends of the bore and an annular cam acting on the outer ends of the plungers, reciprocation of the plungers being effected by relative rotation of the said body and cam, and the fuel being supplied to and discharged from the central part of the bore between the inner ends of the plungers.

For some purposes (as for example for minimising engine noise) it is desired to effect each injection of fuel to the engine from the pump at different rates, the initial rate being less than that of the latter part of the discharge, and the object of the invention is to enable this requirement to be met in a simple manner.

A pump of the kind aforesaid embodying the invention includes an annular cam the complementary lobes of which are so disposed that one of them comes into operation before the other.

In the accompanying drawings Figure 1 is a sectional side elevation and Figure 2 a sectional plan on the line 2—2 of Figure 1 illustrating a liquid fuel injection pump embodying one form of the invention for a 4-cylinder engine.

Figure 3 is a plan of the cam ring.

Referring to Figures 1 and 2 the body *a* of the injection pump there shown is provided with a single diametrical bore *b*, and is rotatable relatively to a fixed annular cam *c* contained in a housing *d*, the cam being angularly adjustable if desired. The inner periphery of the cam is shaped to impart inward movements to the two plungers *e* in the bore of the pump body, the outward movements of the plungers being effected by pressure of incoming liquid fuel supplied to the injection pump by a feed pump.

Referring to Figure 3, the inner periphery of the cam there shown is provided with lobes in the form of four similar and equi-spaced crests *f*. Between these crests are formed two shallow recesses *g* and two deeper recesses *h*, the recesses being shaped as shown. The crests determine the inward positions of the plungers *e*, and the recesses determine the extent to which the plungers can move outwardly. Assuming that the body part carrying the plungers is rotating in the direction of the arrows the inward movement of the plunger in contact with the surface of one of the shallow recesses commences at the point *i* where this recess commences to merge into the adjacent crest *f*, and the inward movement of the plunger in contact with the corresponding deep recess commences

the point *j* where this recess commences to merge into the adjacent crest. As the latter point is angularly in advance of the other, the plunger which has the longer stroke commences its inward movement earlier than the other. It will, of course, be understood that the two deeper recesses *h* are disposed diametrically opposite to the two shallow recesses *g* respectively.

Apart from the above described differential movements of the plungers, the mode of action of the pump shown in Figure 1 is similar to that of other pumps of the same kind. The fuel is conveyed to the pump from a feed pump through the inlet *m*. The fuel then passes through any of a plurality of radial passages *n* to another passage in the form of a central bore *o* which communicates with the bore containing the plungers. During movement of the plungers *e* over the surfaces *h* and *g* fuel is supplied to the plunger-containing bore *b*. One of the plungers commences its discharge stroke upon reaching the point *j*, and the other plunger commences its discharge stroke upon reaching the point *i*, whereupon the two plungers complete their discharge strokes together. The fuel is discharged along the bore *o* to a single radial discharge passage *p* which during rotation of the pump successively passes each in turn of a plurality of outlets *q* leading to the different engine cylinders.

The invention is not, however, restricted to the example above described as either or both the number of plunger bores in the rotary body, or the number of crests in the cam may be varied according to the number of cylinders in the engine, provided always that the number of cam crests is an even number.

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 housing provided with a fuel inlet and a plurality of fuel outlets, a cylindrical body mounted in the housing and provided with at least one diametrical bore and with passages for connecting the central part of the bore to the fuel inlet and outlets, a pair of reciprocatory plungers mounted in the ends of the bore, and an annular cam secured in the housing and having lobes formed on its inner periphery for co-operating with the outer ends of the plungers to impart inward movements to the latter in response to relative rotation of the body and cam which lobes are formed by an even number of equi-spaced plunger-actuating crests separated from each other by recesses for determining the extent to which the plungers are movable outwardly, and the recesses between at least two of the crests being deeper than and disposed diametrically opposite to the other recesses, and having the points at which they commence to merge into the adjacent crests angularly in advance of the corresponding points of the shallower recesses so that the initial inward movements of the pair of plungers are effected one after the other.

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