

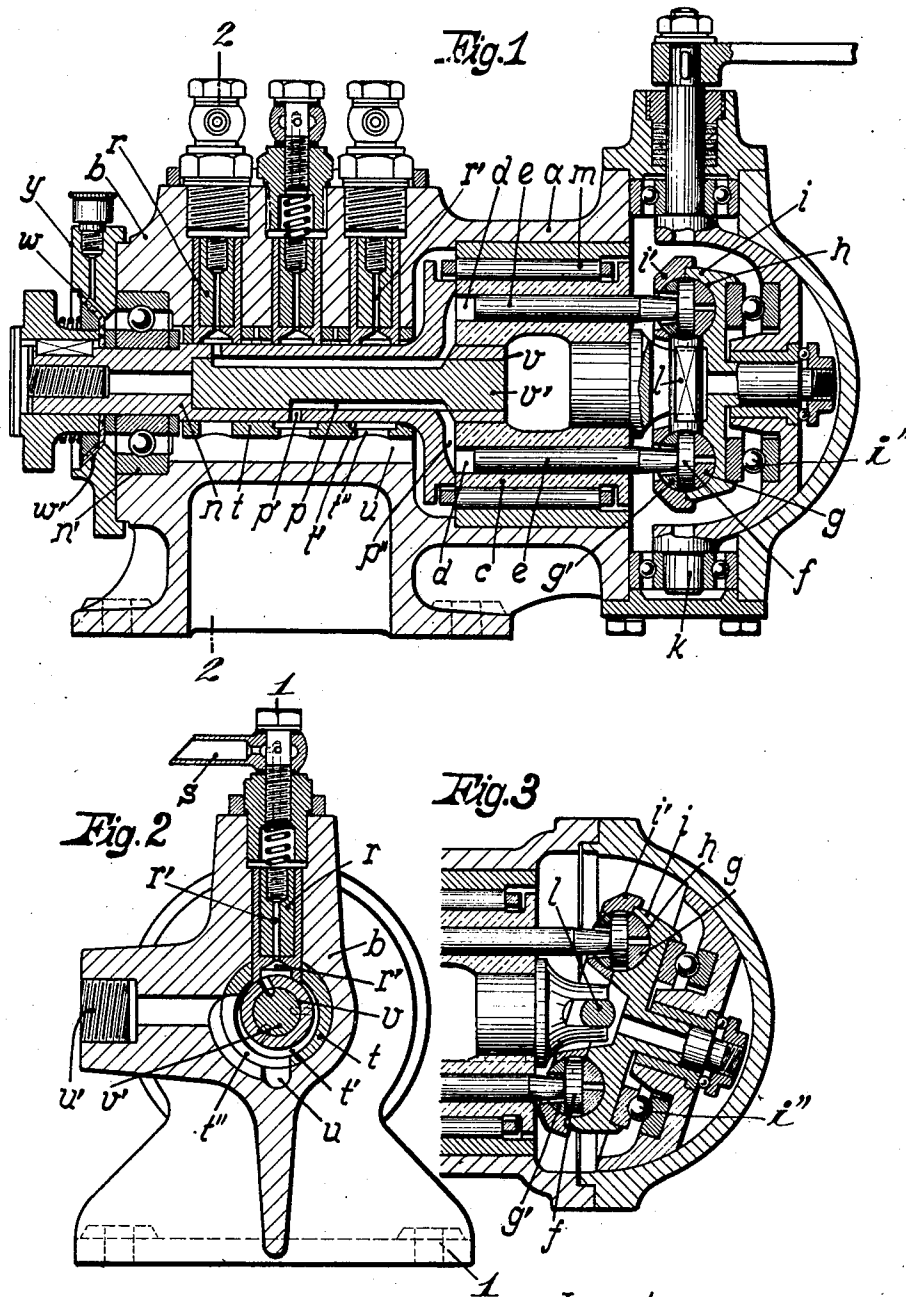
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PUMP

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The invention relates to pumps, particularly fuel pumps for internal combustion engines, and is concerned with pumps in which an axially movable plunger or plungers is or are actuated by a cam or swash plate.

It is usual in connection with pumps of this kind to provide the rotor with suction and delivery passages, and the suction passage at the circumference of the rotor must in that case be made tight, during the pressure stroke, by means of a special guide member. As the rotor has a comparatively high circumferential velocity the packing is difficult, and considerable heating is caused by friction. This is very harmful, for instance, when pumping petrol or gasoline, as it causes vapour to be generated.

According to my invention this defect is removed by placing the suction and delivery channels for the liquid in the shaft driving the rotor. The shaft then functions as a rotary valve of low circumferential velocity, and the difficulties with regard to packing and friction are reduced to a minimum.

The invention can be applied to pumps for any purpose. It is of particular value for the fuel pumps of internal combustion engines. The shaft may have a plurality of fuel channels and ports serving a series of fuel nozzles in succession.

In the preferred form the shaft has a channel for each piston or plunger, one end of the channel being in permanent communication with the chamber in which the plunger works, and the other end being by rotation of the shaft placed in communication with a suction channel and a delivery channel alternately. The delivery channels, each leading to a consumer or group of consumers, may be side by side, each consumer or group being served by one plunger, for which the shaft has a channel of appropriate length. Alternatively a single plunger may serve several channels, the delivery stroke, occurring during rotation through 180°, being sub-divided so that for example two channels are served, each during rotation through 90°.

The invention enables a high speed rotary pump to be used for fuel injection, as it combines reliable and accurate working with avoidance of liability to overheating.

A pump constructed in accordance with the invention is shown by way of example in the annexed drawing, in which

Fig. 1 is a vertical section thereof on the line 1—1 of Fig. 2,

Fig. 2 a section on the line 2—2 of Fig. 1, and

Fig. 3 a sectional view of part of the mechanism.

In the drawing *a* designates the pump chamber and *b* the distributing chamber. As shown in the drawing these are made in one casing, but they may be made as separate parts, joined by appropriate means. In the chamber *a* there is a rotor *c* having therein plungers *e* working in longitudinal bores *d*. Outside the bores *d* the plungers have heads *f* engaged with hemispherical shoes *g, g'*. These shoes are seated in pockets *h* in a swash plate *i*, and are retained in the pockets by a ring *j'*. The shoes are capable of universal rotational movement in the pockets, without radial play. The swash plate *i* is rotatably mounted on a pivoted carrier *k*, and is engaged with a carrier or universal joint *l* fixed to the rotor, so that it rotates with the rotor. The rotor has roller or ball bearings *m* at its circumference, and the plate *i* is seated on a ball bearing *j''*.

Integral with the rotor, or bolted thereto, is a driving shaft *n* extending through the distributing chamber *b*, with a ball bearing *n'* taking axial thrust, so that endwise movement of the rotor, resulting in irregular delivery, is prevented.

The shaft *n* is hollow, and into its bore *v* is fitted a rod *v'*, which has longitudinal channels *p* communicating at one end with the bores *d*, by means of ducts *p''*. At the other end the channels *p* terminate at ports *p'* formed in the hollow shaft. The hollow construction of the shaft, with a rod fitted into it, facilitates the provision of the channels. In the course of the rotation of the shaft the ports *p'* are in succession placed opposite bores *r'* in plugs *r*, which are held against the shaft by spring pressure. Each of the bores *r'* communicates with a pipe *s* (Fig. 2) leading to a fuel nozzle served by the pump. There are three plungers *e*, Figs. 1 and 2 showing only two of them, one for each bore *r'*.

The shaft *n* rotates in a fixed bushing *t* having for each plug *r* an annular slot *t'*, which may be eccentric. Each of these slots opens into a port *t''* communicating with a feed chamber *u*, to which the fuel to be pumped is supplied through a pipe *u'* (Fig. 2).

It may be convenient to construct the shaft and the rotor as separate parts, and connect them by means of bolts.

Over-heating of the pump is not liable to occur, as all the rubbing surfaces are amply flushed by the liquid pumped.

At the driving end of the shaft there is a gasket *w* thrust by spring pressure against the face

w' of a head y fixed to the chamber b . A grease box feeds grease to the face w' . The gasket is joined directly to the shaft.

- The suction stroke of each plunger e causes
 5 liquid to be sucked through a port p' , channel p and duct p'' into one of the bores d . This operation may, for example, occur during half a revolution of the rotor. During the following half revolution the liquid is forced back into
 10 the suction channel till the respective port p faces one of the bores r' , whereupon delivery takes place. When the port has cleared the mouth of the bore such liquid as may continue to issue from it enters the feed channel u .
 15 The rate of delivery is controlled by adjusting the angle of the swash plate, or in any other convenient manner.

- It will be understood that the plungers may be actuated by a cam or swash plate of any other
 20 construction, and that springs or the like may be interposed between them and the actuating gear.

I claim:

1. A distributor pump for liquid fuel comprising a stationary casing, a rotor in said casing
 25 having a plurality of axial bores constituting pump cylinders, a plunger in each cylinder, means for axially reciprocating the plungers, a drive shaft of smaller diameter than the rotor extending therefrom, said shaft having a plurality
 30 of axial channels of different lengths each communicating at one end with one of the pump cylinders and having at the other end a port in the surface of the shaft, said ports being located in different planes axially of said drive
 35 shaft, means for admitting fuel into said ports during part of each revolution of the shaft, a plurality of plugs arranged radially to the shaft in holes in the casing said plugs having bores communicating with said ports during the other

part of each revolution of the shaft, and means for maintaining sealing contact between said plugs and the shaft.

2. A distributor pump for liquid fuel comprising a stationary casing, a rotor in said casing
 5 having a plurality of axial bores constituting pump cylinders, a plunger in each cylinder, means for axially reciprocating the plungers, a drive shaft of smaller diameter than the rotor extending therefrom said shaft having a plurality
 10 of axial channels of different lengths each communicating at one end with one of the pump cylinders and having at the other end a port in the surface of the shaft, said ports being located in different planes axially of said drive
 15 shaft, means for admitting fuel into said ports during part of each revolution of the shaft, a plurality of plugs arranged radially to the shaft in holes in the casing said plugs having bores
 20 communicating with said axial channels during the other part of each revolution of the shaft and being exposed at both their ends to the pressure of the pumped liquid, and springs for maintaining sealing contact between said plugs
 25 and the shaft.

3. A device according to claim 1, in which the means for axially reciprocating the plungers includes a swash plate, a ring for connecting the
 30 plungers to said plate, and a carrier movably supporting said plate in the casing.

4. A device according to claim 1, in which the admission means includes a feed chamber and a fixed bushing around the drive shaft, said
 35 bushing having for each cylinder a port leading from said chamber into an annular slot extending partly around the shaft in the plane of the corresponding port in said shaft.

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