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FUEL INJECTION PUMPS HAVING DISTRIBUTING PISTONS

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Fig. 1.

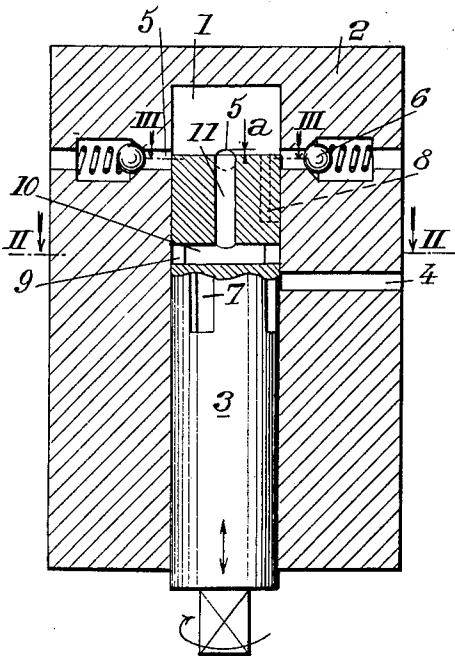


Fig. 2.

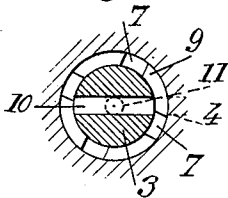
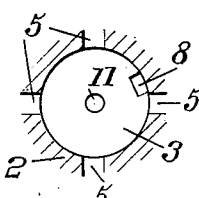


Fig. 3.



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FUEL INJECTION PUMPS HAVING DISTRIBUTING PISTONS

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2 Claims. (Cl. 103—2)

The present invention relates to fuel injection pumps the piston of which acts as a distributor to send the fuel delivered by the pump successively to a plurality of delivery conduits leading to injectors serving for instance to supply with fuel the respective cylinders of an internal combustion engine.

To obtain a satisfactory operation of such a pump, the residual pressures existing in the respective delivery conduits at the beginning of every delivery stroke of the piston must be made all equal to one another.

The object of the present invention is to provide a pump of simple construction capable of complying with this condition.

The pump with which my invention is concerned comprises a piston, which is given, in addition to its reciprocating pumping movement, a movement of rotation about its axis to distribute fuel successively to a plurality of delivery conduits starting from the cylindrical wall of the pump cylinder, this piston being provided, to ensure communication between the pump working chamber and the delivery conduits successively, with a longitudinal groove formed in the side wall of said piston and extending from the end face thereof to a distance such that the delivery conduit located opposite said groove remains in communication with the pump working chamber during the whole of a delivery stroke of the piston.

My invention is characterized in that the outer (lower) dead center position of the piston is so located that the end face of the piston, in this position, axially clears the openings of all the delivery conduits, thus placing them in communication with one another through the pump working chamber, the axial distance over which these openings are thus cleared being sufficiently small to prevent any fuel injection through the injectors provided at the ends of said delivery conduits during the initial portion of the delivery stroke of the piston for which said piston is travelling to close said openings, with the exception of that in communication with said longitudinal groove.

A preferred embodiment of the present invention will be hereinafter described with reference to the accompanying drawings, given merely by way of example and in which:

FIG. 1 is an axial section of a pump according to my invention.

FIG. 2 is a cross-section on the line II—II of FIG. 1.

FIG. 3 is a cross-section on the line III—III of FIG. 1.

The pump shown by the drawings comprises a cylinder having a cylindrical bore 1 formed in a block 2. In this cylinder is slidably mounted a piston 3 driven through any suitable means (not shown), such as a cam, to have both a reciprocating movement between an outer (lower) dead center position (where it is shown by the drawings) and an inner (upper) dead center position, and a movement of rotation about its axis.

A fuel inlet conduit 4 opens into the cylindrical wall of bore 1 and four delivery conduits 5, each provided with a check valve 6, start from this wall. The number of delivery conduits determines the speed of rotation of piston 3, acting as a distributor.

The fuel feed through conduit 4 is controlled, not only by the axial movement of piston 3 but also by its rotation, in such manner that communication between said

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conduit 4 and the pump working chamber (portion of bore 1 above the top end face of piston 3) is stopped just before the beginning of every delivery (upward) stroke of said piston. For this purpose, the cylindrical wall of piston 3 is provided with four longitudinal grooves 7 in communication with the pump working chamber through an annular groove 9 formed in piston 3 and a transverse conduit 10 and an axial conduit 11 also provided in said piston. Each of the grooves 7 has a length and a width such that it begins to connect inlet conduit 4 with the working chamber from the beginning of every downward (suction) stroke of piston 3 and maintains the communication until a time immediately preceding the beginning of the next upward (delivery) stroke of this piston, this communication being then cut off by the rotation of the piston.

I thus obtain a filling of the working chamber during the maximum time.

Distribution of the fuel successively to the four delivery conduits 5 is controlled by piston 3 which, during each of its upward (delivery) strokes, must close three of said conduits 5 and place the fourth one in communication with the pump working chamber. For this purpose the openings of conduits 5 in bore 1 are located at a height such that when piston 3 starts moving upwardly it closes (at least approximately) three of these openings while placing the fourth one in communication with the pump working chamber through a longitudinal groove 8 then located opposite said fourth opening, the length of said groove 8 from the top end face of piston 3 and its width being such that this communication is maintained for the whole of the piston upward stroke.

For a good operation of the pump, it is necessary to equalize, on every pump cycle, the residual pressures existing in the portions of the respective delivery conduits extending between their openings in bore 1 and the check valves 6 provided therein.

For this purpose, according to my invention, the said openings are located at a level such that when piston 3 is in its lower dead center position its end face has just come a little below the top of each of these openings, thus slightly clearing them. Thus at this time the four delivery conduits 5 communicate together through the pump working chamber and, advantageously, also communicate with intake conduit 4 through conduits 11 and 10, groove 9 and one of the grooves 7.

The distance a at which the top face of piston 3 is located below the top of each of the openings of conduits 5 when said piston is in its lower dead center position must be sufficiently small to prevent, during the initial upward travel of piston 3 through this distance a , any injection of fuel through the injectors located at the ends of the three delivery conduits 5 the openings of which are not located opposite groove 8.

Owing to the equalizing of the residual pressures in conduits 5, I obtain exactly equal amounts of fuel injected successively through the four delivery conduits.

In a general manner, while I have, in the above description, disclosed what I deem to be a practical and efficient embodiment of my invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of invention as comprehended within the scope of the accompanying claims.

What I claim is:

1. A fuel injection pump which comprises, in combination, a cylinder, a cylindrical piston slidably movable in said cylinder and having therein both a reciprocating movement in the direction of its axis and a movement of rotation about said axis, the end face of said piston limit-

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ing, together with said cylinder, a working chamber of variable volume the displacements of said piston in said cylinder that reduce the volume of said working chamber being called delivery strokes, and the displacements of said piston that increase said volume being called outward strokes, said cylinder being provided with an inlet conduit, said piston being provided with passages adapted to cooperate with said inlet conduit to place it in communication with said working chamber during the outward strokes of said piston and to cut off said communication, at least mostly, by the effect of the rotation of said piston, before the beginning of every delivery stroke of said piston and during the time when said piston is in its outer dead center position for which the volume of said working chamber is maximum, said cylinder being provided with a plurality of delivery conduits opening into the cylindrical wall of said cylinder at points distributed at regular intervals along its periphery, said piston being provided in its cylindrical wall with a longitudinal groove extending from said piston end face to a distance therefrom so that the delivery conduit located opposite said groove remains in communication with said working chamber during the whole of a delivery stroke of said piston, the outer dead center position of said piston, being positioned so that, when said piston is in this position, the openings of all of said delivery conduits each have a portion thereof in communication with said working chamber, the height, measured in the axial direction, over

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which said openings then communicate with said working chamber being sufficiently small to prevent any fuel delivery from taking place during the initial portion of the delivery stroke of said piston for which said piston is travelling to close said openings after the closing of said inlet conduit with the exception of that in communication with said groove and spring loaded check valves mounted in said delivery conduits, respectively.

2. A pump according to claim 1 including a fuel inlet conduit in said cylinder and means carried by said piston for placing said inlet conduit in communication with said working chamber during the return strokes of said piston, this communication still existing when said delivery conduits are all placed in communication with said working chamber.

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