April 3, 1934. E. O. P. THEGE ET AL 1,953,449

FUEL PUMP

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Fig. 1.

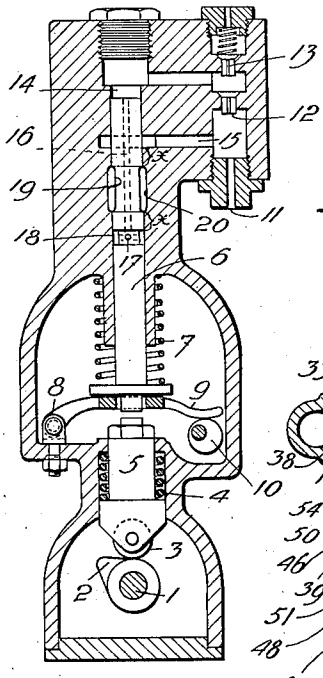


Fig. 3.

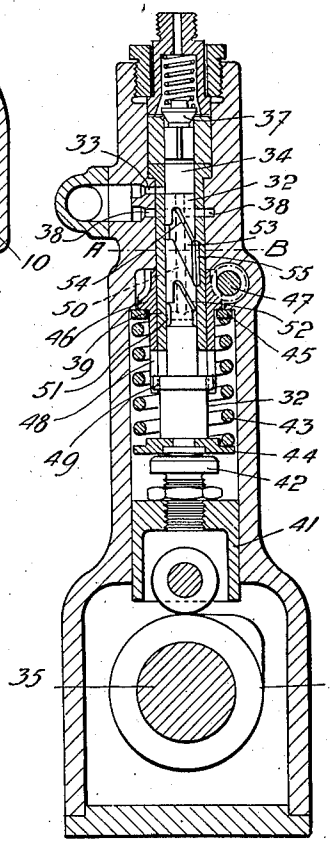


Fig. 2.

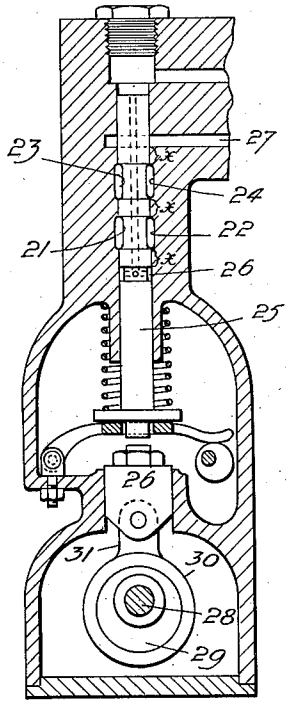
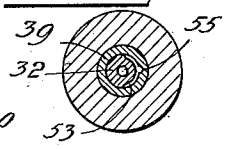


Fig. 4.



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Fig. 5.

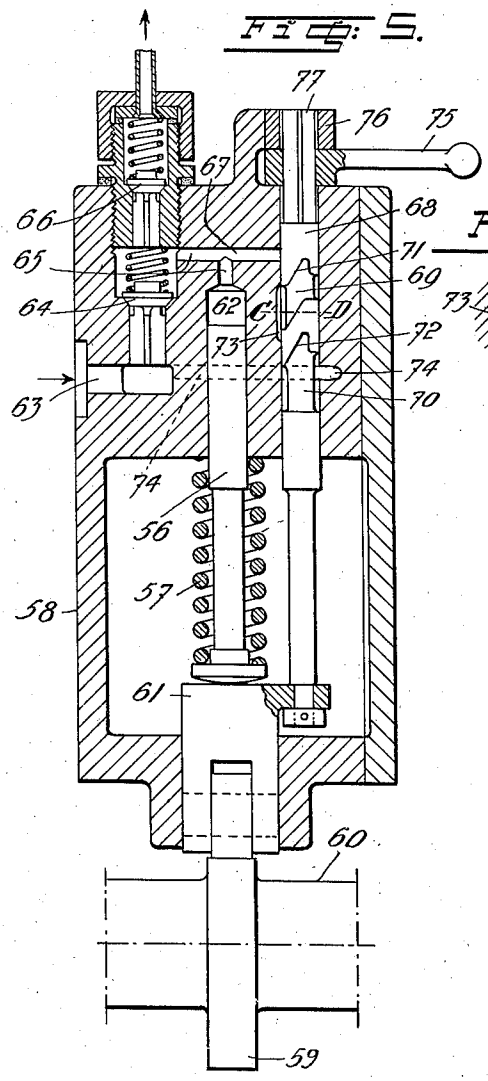
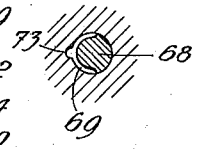


Fig. 6.



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FUEL PUMP

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2 Claims. (Cl. 103—41)

In slide valves, especially of fuel pumps for internal combustion engines, in which the fuel is subjected to a very great pressure during the injection, it is necessary that the tightness of the slide valve is effective, so that no fuel necessary for the working stroke of the engine piston gets lost. This invention relates to a simple arrangement, through which the surface closure between the slide valve and its casing is doubled, trebled and so on, which results in the escaping of the fuel between the slide valve and its casing being rendered highly difficult or entirely impossible. The invention may be applied also to plungers or pistons of for instance fuel pumps operating simultaneously as slide valves.

Some forms of execution of the invention are shown as examples in the accompanying drawings. Figs. 1 and 2 are vertical sections of fuel pumps in which the pump plunger operates also as a slide valve. Fig. 3 shows in a vertical section a pump for internal combustion engines and provided with a turnable working plunger which operates also as a slide valve controlling the supply of fuel. Fig. 4 is a section on the line A—B in Fig. 3. Fig. 5 shows in a vertical section a fuel pump provided with a controlling slide valve arranged in accordance with the invention. Fig. 6 is a section on the line C—D of Fig. 5. 1, Fig. 1, is the driving shaft of the pump. The said shaft is provided with a cam disc 2, which during the rotary motion of the shaft acts upon a roller 3, provided in a plunger 5, which by a spring 4 is forced towards the cam disc. The plunger 6 of the fuel pump is forced downwards during the suction stroke by a spring 7 and its motion is stopped by an arm 9, which is swingable on a pin 8 and may be brought into different positions vertically by an eccentric 10, adjusted manually or by a governor, not shown. 11 is the fuel supplying conduit, 12 the suction valve and 13 the delivery valve leading to the combustion chamber of the engine cylinder.

During its downward stroke the plunger 6 sucks fuel into the pump chamber 14 in a quantity determined by the stop arm 9. As the plunger 5 is then forced upwards by the cam disc 2 and enters into contact with the plunger 6, the latter forces the fuel through the valve 13 and further to the combustion chamber of the engine. The fuel superfluous for the working stroke of the engine piston is discharged through a channel 15 leading to the fuel supplying conduit 11.

For this purpose a channel 16 is provided in the plunger 6 and communicates through side openings 17 with a groove or recess 18 made in the plunger 6 and preferably extending round the same. For improving the tightness between the plunger and the pump casing, a second groove 19, according to this invention, is provided in the outer side of the plunger, with which co-operates a groove 20 in the pump casing. The said groove 20 has such a position, that, as the plunger 6 is in its lowermost position shown in Fig. 1, which is assumed to be the normal position at the end of the suction stroke of the plunger, the groove 19 is located opposite to the groove 20 and the distance x between the top edge of the groove 18 and the lower edge of the groove 20 is equal to the distance x between the top edge of the groove 19 and the channel 15.

As the plunger 6 is moved upwards through the distance x, fuel is forced into the combustion chamber. As the plunger 6 is moved further upwards, the groove 18 enters into communication with the chamber constituted by the grooves 19 and 20, which in its turn enters into communication with the channel 15 through the groove 19, so that fuel flows through channel 16, groove 18, grooves 19 and 20 and finally into the channel 15. Through the provision of the grooves 19 and 20 a double surface closure between the plunger 6 and the pump casing is gained, the escaping of fuel being thereby rendered difficult or impossible.

The said surface closure may, evidently, be still more increased through the provision of one or more additional grooves in the plunger and the pump casing. Thus in Fig. 2 two pairs of co-operating grooves 21, 22 and 23, 24 are shown, which are so located, that at the normal lower position of the plunger 25 the distances x are equal. Consequently, in the pump now in question there are three closing places between the groove 26 of the plunger and the discharge channel 27 for the superfluous fuel. Plunger 25 of the pump is moved upwards and downwards by an eccentric 29, strap 30 and rod 31.

In Figs. 3 and 4 the invention is shown applied to a plunger 32 acting also as a controlling slide valve, and so arranged, that the plunger, turned into different positions controls the quantity of returning fuel superfluous for the working stroke of the engine piston. 33 is the fuel inlet of the pump chamber 34. The said inlet has no valve, so that fuel rushes into the chamber, as the inlet is uncovered by the plunger 32 during its suction stroke. 37 is a spring actuated delivery valve leading to the combustion chamber of the engine. Fuel superfluous for the working stroke of the

engine piston returns to the supply of fuel through a channel 38. Plunger 32, sliding in the lining 39 of the pump, is moved upwards by a cam disc 40 provided on the driving shaft 35 of the pump. The said cam disc acts upon a plunger 41, provided with a head 42, against which the lower end of the plunger 32 is forced by a spring 43, bearing against a ring 44 on the plunger and at its top end against a ring 45. A worm wheel 46 is journaled on the pump lining 39, between the ring 45 and an offset in the pump frame, and meshes with a screw spindle 47 journaled in the said frame. The said screw spindle may be rotated manually, for instance by means of a crank (not shown) or by a governor driven by the engine. The said governor may be of the centrifugal type and the means transmitting the motion from the governor to the screw spindle may be of any suitable or conventional construction. Two arms 48 extend downward from the worm wheel 46 and engage lateral projections 49 provided on the plunger 32, so that the latter is rotated together with the worm wheel 46 and thus may be turned into different positions.

A channel 50 in the plunger 32 communicates through radial openings with a groove or recess 51 provided in the outer side of the plunger at the lower end of the same. The said recess 51 has a special shape and extends upwards like a wedge along the plunger, so that a slanting bounding wall 52 is effected, constituting an overflow edge for superfluous fuel. Nearer to the top end of the plunger a groove or recess 53 is provided in the plunger surface, which has substantially the same shape and the same position relatively to the plunger as the recess 51 and constitutes an overflow edge 54. The said recess 53 co-operates with a groove 55 in the lining 39. As the plunger 32 is turned into different positions either parts of the overflow edges 52 and 54 respectively located at a higher level arrive first to the recess 55 and the outlet channel 38 respectively during the upward stroke of the plunger, so that the escaping of superfluous fuel starts at an earlier moment, the quantity of discharged fuel being thereby increased, or lower parts of the overflow edges 52 and 54 enter first into action, which results in the quantity of the discharged fuel being reduced.

Consequently also in the pump illustrated in Figs. 3 and 4 the surface closure on the distance between the groove 51 and the channel 38 for the superfluous fuel is doubled. Through the provision of a still greater number of recesses the surface closure is accordingly multiplied.

The invention may, evidently, be applied also to members acting only as a controlling slide valve. Fig. 5 shows a fuel pump provided with a controlling slide valve arranged in accordance with this invention.

The plunger 56 of the pump is forced by a spring 57 against a plunger 61, which is slidably mounted in the pump frame 58 and acted upon by an eccentric 59 on the driving shaft 60 of the pump (in accordance with Fig. 2). Plunger 56 sucks fuel into the pump chamber 62 from the fuel supplying conduit 63 and through a valve 64 and channel 65 and forces during its working stroke the fuel through the delivery valve 66 to the combustion chamber of the engine. 67 is a return conduit for fuel superfluous for the working stroke of the engine piston. The amount of the returning superfluous fuel is controlled by a slide valve 68, which is arranged substantially in the same manner as the slide valve 32, Fig. 3, operating also as a plunger Thus two wedge shaped grooves or recesses 69 and 70 are provided in the side of the slide valve, which extend upwards and constitute slanting overflow edges 71 and 72 respectively. A groove or recess 73 is provided in the pump casing at the groove 69, and the groove 70 communicates uninterruptedly with a channel 74 leading to the fuel supplying conduit 63. The slide valve 68 is connected to the plunger 61 in a turnable manner and is moved upwards and downwards by the same. The slide valve 68 may be turned into different positions by means of a hand lever 75, which bears against the pump frame and an arm 76 and engages a part 77 of the slide valve 68, for instance square in cross section.

By turning the slide valve 68 into different positions, a part of the overflow edge 71 located at a higher or lower level will arrive to the channel 67 at an earlier or later moment, while a corresponding part of the overflow edge 72 arrives simultaneously to the lower edge of the recess 73. In this manner a return passage for the superfluous fuel is effected viz. channel 67, chamber 69, 73, groove 70 and channel 74, which passage is opened at an earlier or later moment in accordance with the position of the slide valve 68 peripherally.

The channels and openings of the slide valve or the plunger or piston of the fuel pump operating as a slide valve and the casing of the same may evidently be arranged in other manners than shown in the drawings and described above without exceeding the limits of the invention.

We claim:

1. In a fuel pump for internal combustion engines arranged for discharging fuel superfluous for the working stroke of the engine piston, a casing having a pump chamber, a discharge passage for the superfluous fuel, a member reciprocally mounted in said casing, said member having a plurality of recesses forming axially spaced slide valve surfaces thereon, said casing having recesses corresponding to the recesses of said member, the axial extent of said recesses being greater than the stroke of said reciprocable member and the axial extent of the said slide vlave surfaces, and a passageway between the pump chamber and the discharge passage constituted in part by all of said recesses and controlled by said slide valve surfaces.

2. A fuel pump as claimed in claim 1, characterized in that a bounding wall of one of the recesses is oblique with respect to the axis of movement of said member whereby the latter may be turned to vary the quantity of fuel discharged.

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