

May 19, 1942.

P. J. VAN DER WALT

2,283,242

INJECTION FUEL SYSTEM

Filed July 25, 1939

2 Sheets-Sheet 1

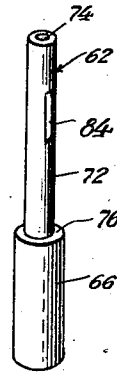
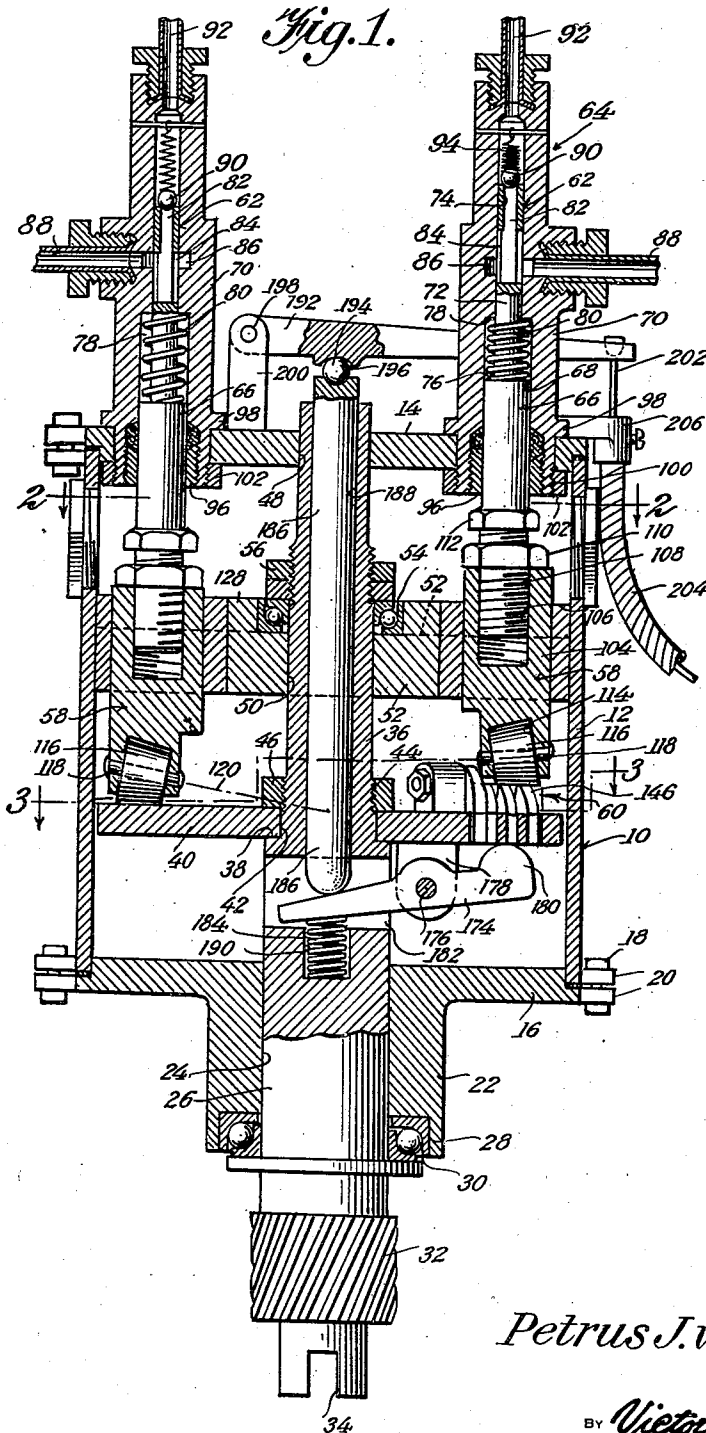


Fig. 6.

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Fig. 2.

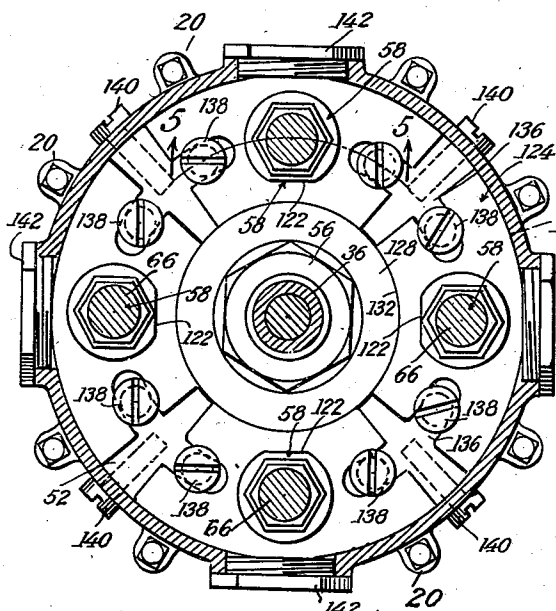


Fig. 5.

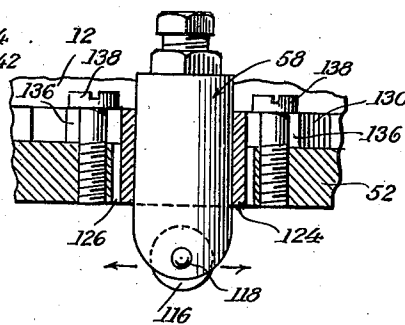


Fig. 3.

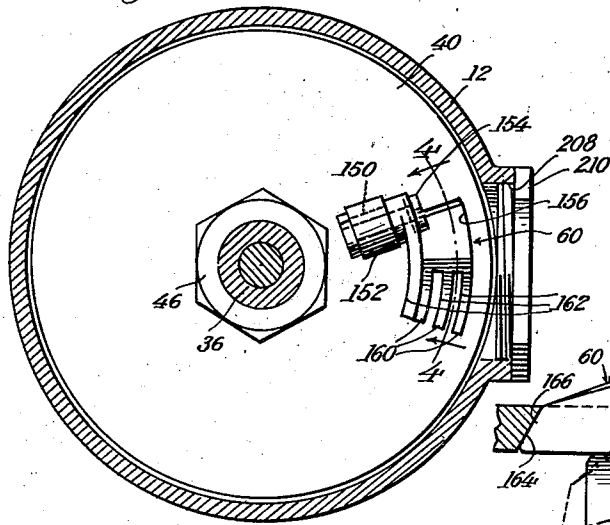
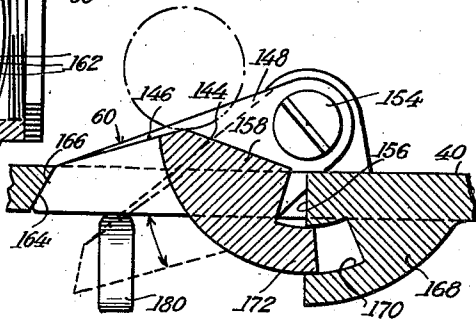


Fig. 4.



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UNITED STATES PATENT OFFICE

2,283,242

INJECTION FUEL SYSTEM

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Application July 25, 1939, Serial No. 286,481

5 Claims. (Cl. 123—139)

My invention relates to internal combustion engines, and has among its objects and advantages the provision of an improved fuel supplying system for supplying fuel to the cylinders of an engine.

The invention embodies an engine driven shaft provided with a race provided with an adjustable cam. Tappets are arranged to ride on the race and are successively brought into engagement with the cam to be actuated thereby for operating plungers for forcing fuel oil to the cylinders. Thus I provide a fuel pump particularly adapted to engines of the Diesel type wherein a single cam is arranged to successively actuate a plurality of tappets which are connected with fuel delivering plungers. The cam is adjustable to lengthen and shorten the stroke of the plungers for varying the amount of fuel delivered to the cylinders, the plungers have a non-varying injection period with respect to a given degree of crankshaft rotation in all positions of the cam.

In the accompanying drawings:

Figure 1 is a vertical sectional view of a fuel supplying system in accordance with my invention;

Figure 2 is a sectional view along the line 2—2 of Figure 1;

Figure 3 is a sectional view substantially along the line 3—3 of Figure 1;

Figure 4 is a sectional view taken along the line 4—4 of Figure 3;

Figure 5 is a sectional view along the line 5—5 of Figure 2; and

Figure 6 is a perspective view of one of the plungers.

In the embodiment selected to illustrate my invention, I make use of a housing 10 which comprises a tubular wall 12, a top plate 14 and a bottom plate 16. These parts are connected into a unitary structure through the medium of bolts 18 which pass through aligned openings in lugs 20 formed on the side wall and cover plates. Plate 16 includes a boss 22 bored at 24 for the reception of a drive shaft 26 and counterbored at 28 for accommodating a roller bearing assembly 30. To the shaft 26 I fixedly connect a worm gear 32 to be driven by a worm connected with a cam shaft of the engine (not shown). Shaft 26 is also slotted at 34 for connection with an oil pump which forms no part of the present invention.

Shaft 26 extends into the housing 10 and is provided with a reduced diameter reach 36 to provide a ledge 38 upon which I mount a plate

40 which is keyed to the shaft for rotation therewith. Plate 40 is bored at 42 for receiving the reach 36, which reach is threaded at 44 for the reception of a nut 46 which clamps the plate 40 firmly against the ledge 38. Reach 36 extends through an opening 48 in the top plate 14 as well as through an opening 50 in a bed plate 52. The portion of the reach 36 extending through the plate 14 is reduced slightly in diameter as illustrated in Figure 1. Both runs of the reach 36 extend loosely through the openings 48 and 50, while the bed plate 52 is counterbored for the reception of a roller bearing assembly 54 held in place by lock nuts 56 having threaded relation with the reach 36.

Bed plate 52 guides four tappets 58, which tappets are arranged to be reciprocated at right angles to the bed plate through the medium of a cam 60. According to Figure 2, four tappets 58 are incorporated in the present unit, which tappets are spaced ninety degrees apart and concentrically about the axis of the shaft 26. Thus rotation of the cam plate 40 through the medium of the shaft 26 will bring the cam 60 successively into engagement with the tappets for actuating the plungers 62 for delivering fuel oil to the cylinders of the engine.

All the plungers 62 as well as the tappets 58 are identical in construction and operation so that the description of one will apply to all. Figure 1 illustrates the plunger 62 in the 64 position as being elevated while the other plunger in this view is in its lower position. Referring to the plunger 62 in the 64 position as a matter of convenience, the plunger includes a shaft 66 slidably disposed in the bore 68 in the injector housing 70. Shaft 66 carries a smaller diameter reach 72 which is slidably disposed in the smaller diameter bore 74 in the injector housing. Between the ledge 76 constituting one end of the shaft 66 and the bottom 78 of the bore 68 I mount a compression spring 80. Reach 72 is provided with a longitudinal bore 82 and a transverse slot 84 which has communication with a reservoir 86 in all positions of the plunger. Reservoir 86 has communication with a fuel feed tube 88 connected with a source of supply (not shown). Upon the upper end of the plunger 62 I mount a ball valve 90 which closes the opening 82 when the plunger is thrust upwardly for delivering fuel to the engine through the medium of the delivery pipe 92. However, ball 90 unseats as the plunger 62 moves downwardly so as to permit fuel oil to flow into the chamber 94 for delivery to the engine cylinder.

Shaft 66 extends through a packing gland 96 in the injector housing 70, the latter being flanged at 98 to have abutting relation with the outer face of the cover plate 14, and threaded at 100 for the reception of a nut 102 located on the opposite side of the plate 14 for fixedly relating the injector housing to the cover plate. Tappet 58 includes an enlarged shaft 104 having a threaded opening 106 for the reception of a threaded shaft 108 arranged in axial alignment with and contacting the plunger 62. I provide a lock nut 110 upon the shaft 108 for engagement with the upper end of the shaft 104, and the shaft is provided with a bolt head 112 for the reception of a wrench which may be applied thereto for supporting the shaft against rotation as the lock nut 110 is tightened down.

The lower end of the shaft 104 is slotted at 114 for accommodating a roller 116 which normally runs on the upper face of the cam plate 40. Roller 116 is mounted on a shaft 118, which shaft has its axis angularly related to the upper face of the cam plate 40, as indicated by the line 120. The roller is tapered so as to roll in a circular path about the axis of the shaft 26. Means is provided to restrain the shaft 104 from relative rotary movement. Referring to Figure 2, each shaft 104 has a flattened face 122 and each shaft extends through a body 124 mounted on the bed plate 52. I provide the bed plate with transverse bores 126 for housing the bodies 124, the latter having outside diameters considerably smaller than the diameters of the bores 126 so as to permit shifting of the bodies inside their respective bores.

Bed plate 52 includes a collar 128 extending above the upper face of the plate 52, and the bodies 124 have wings 130 which lie on the upper face of the bed plate 52, with the upper faces of the wings 130 terminating flush with the upper face of the collar 128 through which the bore 50 extends. Each body 124 is provided with a curved face 132 which fits snugly against the vertical wall of the collar 128, and each body includes a curved face 134 which fits snugly against the inner face of the tubular wall 12. Figure 2 illustrates each body 124 as being provided with two slots 136 for accommodating screws 138 threaded into the bed plate 52. It will thus be seen that the shafts 104 of the tappets 58 are mounted for reciprocation in the bodies 124 and that the latter are adjustable in two directions concentrically about the axis of the shaft 26. Thus the tappets may be adjusted for accuracy. Bed plate 52 is fixedly related to the tubular wall 12 through the medium of screws 140 which extend through openings in the wall and are threaded into the bed plate. I provide the tubular wall 12 with a plurality of removable plugs 142 which may be removed to facilitate access to the tappets for maintenance purposes.

Figure 1, 3 and 4 illustrate the specific construction of the cam 60. The cam includes an inclined face 144 and a declined face 146. One end of the cam terminates in an arm 148 terminating in a shaft 150 rotatably journaled in a post 152 projecting upwardly from the cam plate 40. Shaft 150 is provided with a threaded opening for the reception of a screw 154 through the medium of which the arm may be fixedly related to the post 152. I provide the plate 40 with an opening 156 for accommodating the body part 158 of the cam, which cam is provided with a plurality of fingers 160 operating in slots 162 in

the plate 40. Arm 148 comprises an integral part of one of the fingers 160. Figure 4 illustrates the slots 162 as including angular ends 164 arranged to have abutting relation with the angular ends 166 of the fingers 160 when the cam 60 is elevated its maximum height, as illustrated in full lines in Figure 4. The lower face of the bed plate 40 carries a body 168 having a curved slot 170 for slidably receiving the curved flange 172 projecting from the body 158 of the cam 60. Slot 170 and the flange 172 are concentrically related with respect to the axis of the shaft 150 about which the cam may be rotated for adjustment. The flange 172 fits snugly inside the slot 170 so that the walls of the latter afford stabilizing protection for the cam.

The axis of the shaft 150 is arranged radially with respect to the axis of the shaft 26. At the same time, the face 144 is so arranged that when the cam 60 is lowered to its maximum position the face will lie flush with the upper face of the cam plate 40. At no time does the face 144 lie beneath the upper or race face of the plate 40. In fact, the inclined face 144 retains its original length regardless of the position of the cam 60 so that the plungers 62 will have a non-varying injection period with respect to a given degree of crankshaft rotation, but the stroke of the plungers will be varied in accordance with the position of the cam so as to determine the amount of fuel oil delivered to the cylinders of the engine. Lowering of the cam 60 will shorten the decline 146 but the variable decline is no objection whatsoever so far as efficient operation of the engine is concerned. Fingers 160 more freely in the slots 162 and the material of the plate 40 between the fingers 160 constitutes a floor for the rollers 116 as they pass off the decline 146. Thus the slotted area of the cam plate 40 provides a race surface for the rollers 116 in all positions of the cam 60 except when it is elevated to the maximum position of Figure 4. Cam 60 may be adjusted about the axis of the shaft 150 through the medium of a lever 174 pivoted at 176 to lugs 178 depending from the cam plate 40. One end of the lever includes a rounded elevation 180 which contacts the cam 60 in the manner illustrated in Figures 1 and 4. The opposite end of the lever extends into a slot 182 in the shaft 26 and is positioned between a compression spring 184 and the lower end of a shaft 186 slidable in a bore 188 in the shaft 26. Spring 184 is housed inside a bore 190.

Between the upper end of the shaft 186 and a lever 192 I position a ball bearing 194. The shaft and the lever 192 are recessed at 196 for holding the ball 194 in position. One end of the lever 192 is pivotally connected at 198 with a post 200 on the closure plate 14. The opposite end of the lever is connected with an adjusting wire 202 slidably enclosed in a flexible conduit 204. The upper end of the conduit is fixedly anchored in a bracket 206 secured to the cover plate 14, while the opposite end of the conduit may extend to any desirable position with respect to the engine or the operator's position. Thus the wire 202 may be actuated from a remote position. Spring 184 exerts pressure on the lever 174, and the lower end of the shaft 186 rests on the lever so that the spring 184 moves the associated end of the lever 174 and the shaft 186 upwardly as a unit when slack is imparted to the wire 202 to permit the associated end of the lever 192 to pivot upwardly. Such movement of the cam operating mechanism permits the cam to pivot downwardly

about the axis of the shaft 150. Similarly, a pull on the wire 202 will cause the rounded end 180 on the lever 174 to exert pressure on the bottom face of the cam for pivoting the same upwardly.

Tubular wall 12 is provided with a large threaded bore 208 for the reception of a threaded closure plug 210 which may be removed to lend access to the cam 60 for servicing purposes.

In operation, the amount of fuel delivered to the cylinders of the engine is determined by the length of the strokes of the plungers 62, but variation in the length of the strokes does not alter the duration of the plunger strokes for a given degree of rotation of the crankshaft. In other words, the duration of the plunger strokes remains the same regardless of the adjusted position of the cam 60 for varying the length of the strokes. In my invention, the cam 60 is so designed as to inject fuel into the cylinders of the engine for the most desirable period of time such as, for example, 34 degrees rotation of the crankshaft. Each plunger will deliver fuel to its respective cylinder for such a given period of time, which period of time remains constant regardless of the amount of fuel being delivered to the engine. This feature results in a smooth running engine under all loads and operating conditions.

Each plunger is actuated in the same degree because of the provision of a single cam for successively operating all the plungers. Figure 2 illustrates the provision of four tappets 58. Thus in a four-cylinder, four-cycle engine of the type disclosed the shaft 26 rotates at one-half the speed of the crankshaft of the engine.

The correct time of the starting point of injection, the correct time of contact between the tappets and their respective plungers are easily determined and maintained because of the adjustable nature of the tappets. Bodies 124 may be adjusted circumferentially of the shaft 26 and effectively secured in accurate positions through mere tightening of the bolts 138.

I claim:

1. An injection fuel pump for internal combustion engines, comprising a support, a drive shaft mounted in the support, a race fixed to said shaft, downwardly spring pressed plungers for injecting fuel into a cylinder of the engine, a cam carried by the race and having an angular plunger engaging face, means for adjusting said cams so that the entire angular face at all

times remains above the race, and a second angular face carried by the cam to allow the plungers to return to the race.

2. An injection fuel pump for internal combustion engines, comprising a support, a drive shaft mounted in the support, a race fixed to said shaft, downwardly spring pressed plungers for injecting fuel into a cylinder of the engine, a cam pivotally carried by the race in such a position that the angular plunger engaging face thereof at all times remains entirely above the race, and a second angular face on the cam to allow the plungers to return to the race.

3. An injection fuel pump for internal combustion engines, comprising a support, a drive shaft mounted in the support, a race fixed to said shaft, downwardly spring pressed plungers engaging the race when injecting fuel into the cylinder of the engine, a cam pivotally mounted on the race and having camming faces passing through slots in the race, and means below the race for engaging the cam for raising and lowering the same.

4. An injection fuel pump for internal combustion engines, comprising a support, a drive shaft mounted in the support, a race fixed to said shaft, downwardly spring pressed plungers engaging the race for injecting fuel into a cylinder of the engine, a cam pivoted to the upper face of the race and having a series of camming faces passing through slots in the race, and an intermediately pivoted lever carried by the lower face of the race and engaging the camming faces below the faces for raising and lowering the same, whereby the throw of the plungers is varied.

5. An injection fuel pump for internal combustion engines, comprising a support, a drive shaft mounted in the support, a race fixed to said shaft, downwardly spring pressed plungers engaging the race for injecting fuel into a cylinder of the engine, a cam pivotally carried by the upper face of the race and extending through slots in the race, an intermediately pivoted lever carried by the lower face of the race for engaging the cam, a vertically movable rod passing through the shaft and engaging the opposite end of the intermediately pivoted lever, and means having a pivotal connection with the upper end of the rod for moving the same vertically through the shaft to operate the intermediately pivoted lever for raising and lowering the cams.

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