March 17, 1942. R. H. SHEPPARD 2,276,630

FUEL INJECTION PUMP

Filed Oct. 6, 1938

FIG. 1.

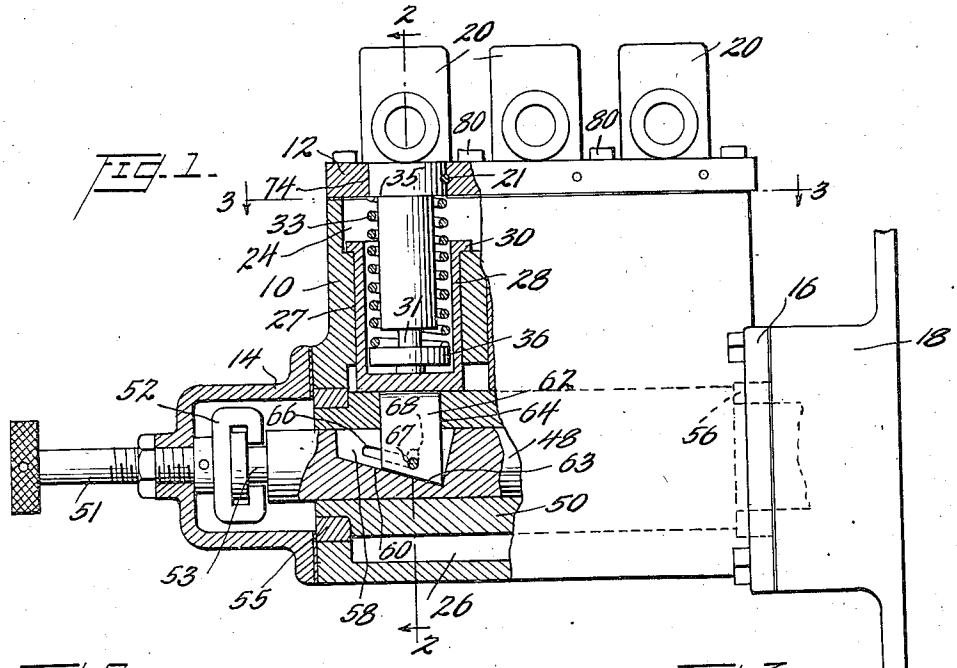


FIG. 2.

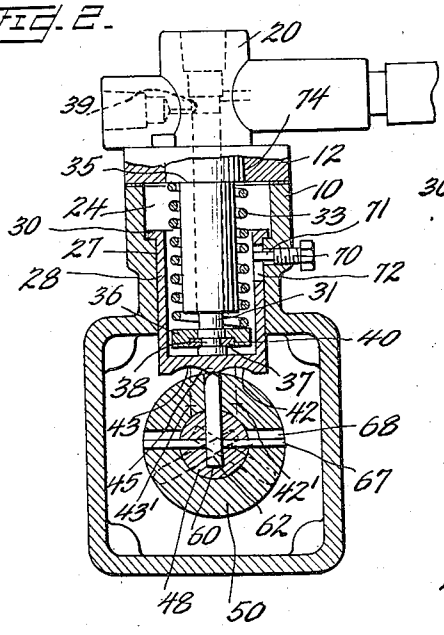


FIG. 3.

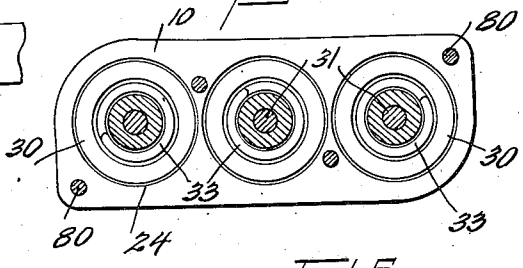


FIG. 4.

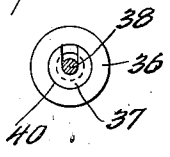
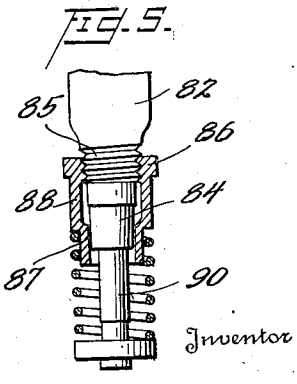


FIG. 5.



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FUEL INJECTION PUMP

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Application October 6, 1938, Serial No. 233,640

12 Claims. (Cl. 103—38)

This invention relates to fuel injection pumps for Diesel type engines and has for its general object the simplification of the design of such pumps.

A particular object of the invention is to provide a pump which may be assembled and disassembled quickly and easily and in which the parts may be interchanged easily with a minimum expenditure of time; incidentally it is an object of my invention to provide a variable bore cylinder whereby the plungers and cylinders may be more completely interchangeable and whereby more tolerance than usual is permissible in the parts.

Another object is to provide a variable throw cam mechanism for driving the plungers of such pumps. Still another object is to provide an improved cam rider in novel combination with a variable throw cam. A still further object is to provide a variable throw cam mechanism in which the throw may be positively and micrometrically varied. Another object is to provide a variable throw cam mechanism for fuel pumps in which the throw varying mechanism as well as all the other parts are sealed from dirt, dust, and liquid or other foreign matter.

An important object is to provide an extremely accurate device for precisely varying the effective stroke of reciprocating pumps and in a manner to increase slightly the acceleration of the plunger as the effective stroke is increased.

A further important object is to provide pump plunger actuating mechanism which operates the plunger in a manner to avoid dribbling at the end of each fuel delivery stroke whether at idling speed or at full load.

Another object is to provide a pump in which the more vital parts such as the plunger, cylinder, cam and cam rider may be made of metal best suited to their individual functions and with respect to efficiency, long life and similar factors while the more bulky parts such as the cam shaft, casing, etc. may be made of less expensive and more easily worked materials.

In the drawing:

Figure 1 is a bottom plan view, partly in section, of the pump as mounted on an engine.

Figure 2 is a transverse sectional elevation taken on line 2—2 of Figure 1.

Figure 3 is a view looking into the top of the pump casing.

Figure 4 is a detailed view showing the plunger and spring seat connection.

Figure 5 is a fragmentary sectional view showing a modified form of cylinder.

Referring to Figure 1 the pump casing 10 is provided with a main cover or head 12, a control supporting cover 14 at one end and a connecting flange 16 at the other end for mounting the pump on a supporting boss 18 of an engine not shown. The cover 12 carries a number of pump cylinders 20 which are held in place as by tapered pins 21 extending transversely through the cover to thus make up a compact cylinder block assembly.

The casing 10 is divided into a cylinder chamber 24 and a cam chamber 26 which are connected by a number of bores 27 in each of which reciprocates a cam rider 28, these riders being cup-shaped and each having a rim 30 resting on the margin of its bore 27 when the pump plunger 31 is held in no load position by the helical spring 33, surrounding the plunger and lower part of the cylinder. Each spring 33 engages the annular shoulder 35 of the cylinder body 20 and at the other end engages the spring seat 36 which is held on the plunger 31 by means of an open washer 37 which washer engages the reduced portion or groove 38 of the plunger and seats in an annular recess 40 in the underside of the spring seat 36. The plunger acts as a slide valve for the intake port 39.

As best shown in Figure 2 the cam rider 28 is provided with two cam engaging faces 42 and 43 which faces are of the same cylindrical shape and preferably do not intersect but rather are separated from each other by a narrow strip forming a ridge or nose 45. The axes 42' and 43' of the cylindrical faces 42 and 43 are on opposite sides of the center line of the cam rider and the curves have a radius preferably of somewhat less length than the minimum radial length of the cam. In its lowest position the cam rider nose 45 is just out of contact with the tip of the cam when the cam is in no load position so that strictly speaking the cam rider is really a cam wiper. The construction of cam and rider as shown permits the plunger to drop away with maximum acceleration as the cam leaves the nose 45 and thus eliminates dribbling at the end of the delivery stroke.

The variable throw cam mechanism includes a shaft 48 mounted in the sleeve 50 to rotate therewith but being axially shiftable in the sleeve when actuated by means of a knurled-headed control screw 51 projecting through the cover 14 and rigidly connected to a yoke 52 rotatably coupled with the shaft 48 by having its ends engaging in the annular reduced portion 53 of the shaft. The sleeve 50 is journalled in the

bronze bushings 55 and 56, which are removably held in place in each end of the casing respectively by the cover 14 and the boss 16. The shaft 48 is provided with a number of radial longitudinal slots 58 corresponding with the number of pump plungers, in the present case three, each slot 58 having a sloping bottom 60 on which slides a cam 62 having a correspondingly sloped base 63. As relative axial motion is produced between the sleeve and shaft by turning the control screw 51 the effective radial length or throw of each cam is varied; that is the cams project more or less from the sleeve 50 through the short

bled the cylinder block is positioned on the casing in a manner to bring the sets of plungers, springs and cylinders into their respective cam rider cups 28 and then the block is secured to the casing by means of screws 80. The pump is now ready to be attached to the engine.

Should it be necessary to change any one of the pump cylinders or plungers it is only necessary to drive out a tapered pin 21, remove the cylinder body 20 and secure in place the substituted body. The bores in the cover 12 receiving the pump bodies are preferably of greater diam-

2. The device of claim 1 with means for changing the radial length of the cam at will during the operation of the pump.

3. In a fuel injection pump having a cylinder with intake and outlet ports, a spring retracted plunger reciprocable in the cylinder and acting as a slide valve for the intake port, a variable throw crest nosed cam for actuating the plunger, a cam rider between the cam and plunger, said rider having an incurved substantially cylindrical surface for cooperating with the cam nose to produce constant acceleration of the plunger at a given cam throw, the axis of the cylindrical surface lying in a plane parallel to the axis of rotation of the cam at such distance therefrom that the entire cylindrical surface lies in a single half of the working face of the rider whereby the acceleration increases slightly with an increase of the cam throw, and means for varying the cam throw from zero stroke to full stroke.

4. The pump of claim 3 in which a second surface is recessed in the cam rider adjacent the first surface to form therewith a diametrical ridge or nose, said surfaces each covering about half the bottom surface of the cam rider.

5. A cam rider for a pump comprising a cylindrical cup having an annular flange to serve as a stop to limit axial movement, the bottom wall of the cup having therein two parallel concave cylindrical recesses forming between them a diametrical rib.

6. The cam rider of claim 5 in which the radius of the two cylindrical recesses is the same and the axes are parallel and located on opposite sides of the rider axis.

7. A cam follower adapted to be moved in one direction by a rotating cam and moved in the opposite direction by a resilient means such as a spring, said cam follower having a cam engaging face having therein a concave cylindrical recess positioned to one side of the center of the follower with its axis parallel to the axis of rotation of the cam, whereby the follower may end its stroke abruptly.

8. A cam follower comprising a member having a circular cam engaging face, said face having a diametrical cam engaging ridge and having on one side of said ridge a cylindrical depression, the axis of which is parallel with said ridge.

9. In a fuel injection pump, variable throw cam mechanism for actuating a plunger comprising a shaft having a longitudinal slot therein of which the central plane is radial to the shaft, the bottom of the slot being sloped with respect to the shaft axis, a sleeve telescoped over the shaft and having a short slot therein, a cam seated on said sloping bottom and fitting in the short slot whereby relative axial movement of the shaft and sleeve causes the cam to move radially with respect to the shaft, said shaft having a pair of slots therein normal to and adjacent the longitudinal slot and sloped similarly to the sloping bottom, and a pin projecting through the cam into said pair of slots whereby the cam is held on its seat when the shaft is shifted axially with respect to the sleeve and means for producing said relative motion thereby to change the throw of the cam.

10. In a fuel injection pump, a casing having a cam chamber, a compound cam shaft rotatably mounted in the ends of said chamber and comprising a sleeve having a number of cam openings therein, cams slidably fitting in said openings and having radial movement with respect to the sleeve, a shaft slidably fitting in the sleeve and having longitudinal slots for receiving the cams, said slots having sloping bottoms engaging correspondingly shaped seats on the cams, and means to keep the cams on their sloping bottoms during retracting movement of the cams, said means comprising studs projecting from the sides of the cams into stud slots in the shaft normal to the cam slots and sloped in the same direction as the bottoms of the cam slots.

11. The device of claim 10 in which the sleeve is also provided with stud receiving slots normal to the longitudinal cam slots and elongated in the direction of cam travel and communicating with the sloped slots in the shaft whereby permitting the cam studs to be removed from or inserted in the cams.

12. A cam blade for pumps comprising a body having a rounded nose at the top edge and a sloping bottom at the opposite edge whereby the front and back faces are similar while one side face is longer than the other, and guiding studs extending from the flat front and back faces, said studs and said bottom being adapted to cooperate with slots for altering the throw of the cam.

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