Nov. 3, 1936. F. B. STEARNS 2,059,758

FUEL PUMP FOR INTERNAL COMBUSTION ENGINES

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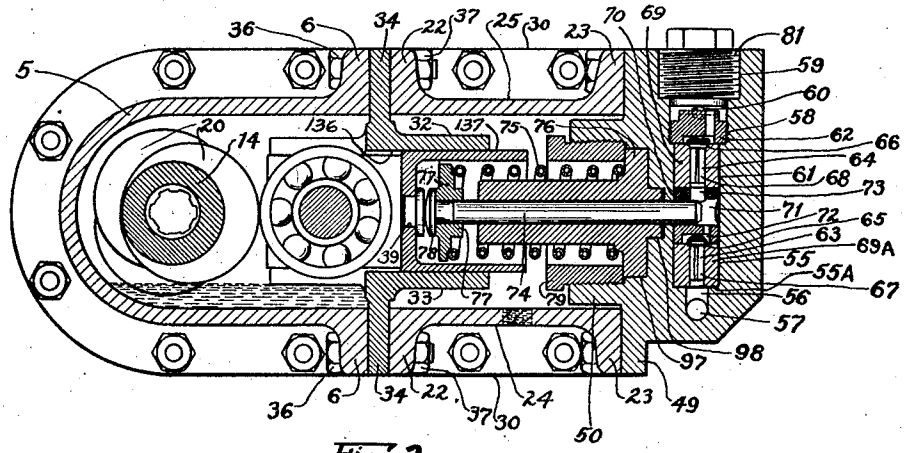


Fig 2

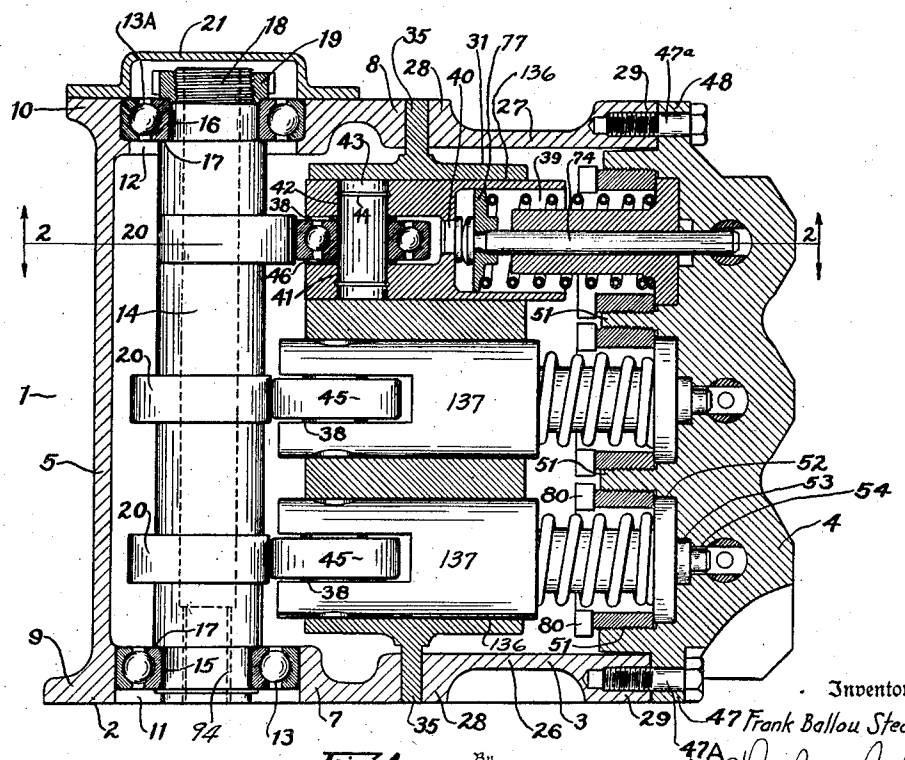


Fig 1

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FUEL PUMP FOR INTERNAL COMBUSTION ENGINES

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4 Claims. (Cl. 103—169)

This invention relates to fuel pumps, and more particularly to fuel pumps for internal combustion engines wherein liquid fuel is supplied to the engine at a substantially constant pressure.

It is an object of my invention therefore to provide a fuel pump which will efficiently supply liquid fuel at a substantially constant pressure.

It is another object of my invention to provide a fuel pump which is compact and utilizes a relatively small amount of space for the unit of fuel handled.

Another object of my invention is to provide a fuel pump which employs a minimum number of frictionally engaging parts per unit of fuel pumped.

Another object of my invention is to provide a fuel pump wherein friction is reduced to a minimum through utilization of anti-friction bearings.

Another object of my invention is to provide a fuel pump which is economical of manufacture and which requires a minimum of machine operations.

Another object of my invention is to provide a fuel pump which can be economically and easily assembled and disassembled.

Another object of my invention is to provide a fuel pump the parts of which are adapted to be easily and economically machined.

Another object of my invention is to provide a fuel pump wherein the danger of air being trapped and consequent stoppage of the pump is obviated.

These and other objects of the invention will become more apparent from a consideration of the accompanying drawing in which:

Fig. 1 is a longitudinal medial sectional view of a pump embodying my invention; and

Fig. 2 shows a section taken along the line 11—11 of Fig. 1.

In the drawing I show a housing enclosing the pump and generally indicated at 1, comprising a head 2, an intermediate band portion 3, and an end member 4. The head comprises a longitudinal body portion 5 generally U-shaped in cross-section and provided with relatively thick laterally and outwardly extending feet 6, which join a radially extending flange 9 of end portion 7 and a radially extending flange 10 of end portion 8. A bearing aperture 11 is provided in end 7 and a shouldered bearing aperture 12 is provided in end 8.

Bearings 13 and 13A, preferably ball bearings, are disposed within apertures 11 and 12 preferably by press-fitting and with the outer ball race of bearing 13A abutting the shouldered recess 12 in end 8.

A preferably circular camshaft 14 is rotatably supported in the housing 2 by the bearings 13 and 13A. The camshaft 14 is provided with a generally cylindrical coaxial bore therein but having at one end a reduced inner bore with longitudinal recesses 94 therein adapted to engage a splined driving shaft (not shown). The driving shaft is preferably actuated directly from the crank shaft or a governing shaft but any desirable means may be utilized.

The camshaft 14 is preferably provided with reduced outer end portions 15 and 16 upon which the inner ball-races of bearings 13 and 13A are disposed preferably by press-fitting so as to abut shoulders 17, and a threaded end portion 18 of the cam shaft 14 is adapted to receive a nut 19 whereby the inner race of bearing 13A may be securely held intermediate the shoulder 17 of the said shaft and the nut 19. The camshaft 14 is therefore limited in longitudinal movement by the nut 19 and the shoulder 17 abutting the ball-races.

Preferably circular cams 20 are integrally secured to the cam shaft 14 and are disposed preferably in equal angular and longitudinal relation thereon. It is desirable that the throw of each of the cams be the same to ensure a generally uniform fuel pressure. It is also desirable that the cams be circular in contour since such a structure in combination with a relatively equal angular disposition about the shaft axis and equal throw of the cams ensures that a substantially uniform pressure will be maintained at all of the cylinder fuel injection valves.

A cap 21 is preferably disposed around the nut 19 to serve as an oil retainer and to protect it from damage and may be secured to the head 2 in any suitable manner.

The intermediate band portion 3 is generally rectangular in shape and is provided with relatively thick laterally and outwardly extending flanges 22 and 23 at the top and bottom portions of the band side walls 24 and 25. The band end walls 26 and 27 are provided with outwardly extending flanges 28 and 29 at the top and bottom portions respectively. The end wall 27 is further provided with vertical outwardly flaring flanges 30 joining the top and bottom flanges 28 and 29.

A guide block 31 having generally horizontal upper and lower faces 32 and 33 and generally oval shaped is disposed intermediate head 2 and band 3. The guide block 31 is provided with outwardly extending flanges 34 at the sides thereof which are interposed between flange 22 of band

3 and flange 6 of head 2, and outwardly extending end flanges 35 which are interposed between the bottoms of end walls 7 and 8 of head 2 and flanges 28 of band 3. I show a plurality of bolts 36 which are disposed in aligned perforations in head 2, guide block 31, and band 3, and having nuts 37 threaded thereon for securing the members together but it is understood that any suitable means may be used.

Horizontal cylindrical bores 136 are provided in the guide block 31 within which are slidingly disposed generally cylindrical guide heads 137 formed with a U shaped transverse slot 38 in the head thereof, a co-axial recess 39 in the bottom, and a smaller co-axial aperture leading therefrom within which is rigidly secured a shouldered button 40 preferably by force-fit.

Transverse vertical aligned apertures 41 and 42 are provided in the guide heads and within which is secured a pin 43 which is prevented from longitudinal movement by the circular springs 44 engaging transverse grooves in pin 43 and complementary grooves in apertures 41 and 42.

A cam follower 45, preferably a ball bearing unit as indicated, is rotatably supported by pin 43 and is kept centrally disposed within the transverse slot 38 by washers 46 provided on either side of the cam follower.

The end member 4 comprises a generally rectangular block formed with end flanges 47 and 48, and a flange 49 at one side thereof, generally rectangular in cross-section and provided with a laterally disposed narrow portion 50. The member 4 is secured to band 3 by bolts 47A which are disposed in apertures provided in flanges 47 and 48 and engage threaded recesses in flanges 29 of band 3. Horizontal threaded recesses 51 are co-axially aligned with and terminate in slightly reduced recesses 52 which in turn are co-axially aligned with pairs of reduced bores 53 and 54 in member 4.

Vertical bores 55 in the top face of the block intersect the horizontal bores 54 and extend a substantial distance beyond the said bores. Fuel supply ports 56 extend axially from bores 55 to a common horizontal fuel supply line 57 extending longitudinally through the block and adapted to be connected to a fuel reservoir (not shown).

The bores 55 are each coaxially aligned with successively enlarged internally threaded recesses 58 and 59. A horizontal cylinder fuel discharge line 60 runs longitudinally of the block and joins the upper portions of the recess 58.

A ported member 61 is disposed in each bore 55 and abuts the shoulder 55A between bore 55 and port 56, and is retained in position by a member 62 threaded within recess 58.

The member 61 is composed of three axially aligned cylindrical elements 69—70 and 69A. The upper and lower cylindrical elements 69 and 69A are provided with coaxial valve bores 63 and 64 having outwardly flaring shoulders at the upper ends of the bores to form frusto-conical valve seats 65—66 for vertically reciprocable, headed valves 67 and 68 disposed axially within the bores 63 and 64 respectively. The valves are provided each with a stem portion which bears upon the wall of the bores 63 and 64 at a distance from the head to ensure that the valves will remain in coaxial alignment with the bores 63 and 64 and seats 65 and 66.

Each intermediate cylindrical element 70 has a transverse cylinder bore 71 axially aligned with the bore 54 communicating upwardly with the valve bore 64 and downwardly with the valve bore 63. The member 62 and cylindrical element 70 have downwardly open recesses for enclosing the valve heads to guide them and limit vertical throw thereof.

A pump plunger 74 contacts each button 40 and is held in spring-pressed relation therewith by a normally compressed spring 75 which seats upon a plunger sleeve 76 and at one end the spring end convolutions bear upon a member 77 which abuts a head 78 on plunger 74. It will be noted that the head 78 is provided with a top rounded portion which contacts button 40 thereby ensuring that the thrust motion will be transmitted in axial alignment with the plunger. The spring 75 is of sufficient compressive strength to ensure that the plunger head will always be in contact with the button 40 at any engine speeds which might be attained.

The plunger sleeve 76 is a cylindrical member provided with a lateral peripheral flange 97 upon which the other end convolutions of the spring seat and a boss 98 which fits a recess provided therefor in end member 4. A central bore therein is adapted to slidingly engage the plunger 74. The plunger sleeve 76 is held in position by a nut 79 provided with a central bore adapted to provide clearance for spring 75 and externally screw-threadedly engaging the laterally disposed portion 50 of the end member 4. A head 80 preferably hexagonal in shape is provided on nut 79 whereby it may be easily rotated.

Valves 67 and 68 and cylindrical elements 69, 70 and 69A may be assembled within the bore 65 and placed in position through recesses 58 and 59 and secured by member 62. A threaded plug 81 is then inserted in recess 59 to prevent the escape of fuel. This provides an efficient and easy method of assembling the valve units. Lubricant is fed to the pump through the hollow bore in cam shaft 14 and thence into retaining cap 21; it then lubricates bearing 13A and drops to the bottom of head 2, thereby forming a lubricant reservoir as indicated in Fig. 2. The rotating cams dip into the lubricant and thereby lubricate cam-follower and the reciprocating guide heads 37.

In operating the pump, oil is fed from a reservoir to the pump entering by means of line 57, thence through port 56 in member 4 to valve 67 and thence to chamber 71, which will be accomplished as the plunger 74 is moving outwardly thereby relieving the pressure in chamber 71. The pressure of the fuel injected into the engine may vary up to 20,000 lbs. per square inch which will be acting on valve 68 thereby ensuring that it will remain closed on the outward stroke of plunger 74 and the oil pressure in the chamber 71 will become less than that in oil reservoir whereby oil will be supplied to the chamber. Upon the inward stroke or compressive stroke of the plunger, the valve 67 will be forced closed and when sufficient pressure has been built up within the chamber 71, the valve 68 will be forced open thus supplying oil to the fuel injection valve at the cylinder. It will be observed that a plurality of plungers may be employed, in this instance three, and the oil fed to a common line 60 and thence to a plurality of cylinders. It is essential that a substantially constant pressure be maintained to each cylinder and also during all stages of the working stroke.

By utilizing a common supply line in combination with valves 68 which do not open until the supply pressure is in excess of that in the

common supply line such a condition is assured. Further, by employing a plurality of cams, preferably three in number, a substantially constant pressure may be maintained in the common cylinder supply line. I have found that by using three cams circular in contour employing the same length throw, and being equally disposed angularly about the cam shaft axis that a substantially constant pressure can be maintained on a common cylinder supply line. However, it is understood that each cylinder may utilize an individual pump or any combination of cylinders may be fed from one pump.

Although I have described an embodiment of my invention I contemplate that various other embodiments may be used by those skilled in the art without departing from the spirit and scope of my invention or the claims thereof.

Having thus described my invention what I claim is:

1. In a fluid pump, a dished housing member having a peripheral flange, an intermediate generally tubular housing portion flanged at opposite ends, a cylinder and valve housing comprising a peripherally flanged body portion secured by its flange to the flange at one end of the intermediate housing member, the cylinder and valve housing having a portion projecting into the intermediate housing and spaced from the wall thereof, a guide head comprising a body portion disposed within the dished and intermediate housing members and having a peripheral flange adapted to be disposed between adjacent flanges of the dished housing member and the flange at the other end of the intermediate member, securing means for securing all three said flanges together to support the guide head body portion within the housing, the guide head in its supported position being spaced peripherally from the inner wall of the housing members, the guide head having a plurality of parallel guide bores therein, a drive shaft rotatably supported in the dished housing portion, and the said cylinder and valve housing being provided with a plurality of pump cylinders and a plurality of pump pistons operatively reciprocable in the cylinders, and a plurality of guides reciprocable in the guide bores by the rotatable shaft, and communicating reciprocatory motion to the pump pistons.

2. In a fluid pump, a valve housing having an internally threaded recess therein, a pump cylinder communicating with the recess, a tubular piston guide having a bore aligned with the pump cylinder and having an end portion sealingly engageable with the recess bottom, a plunger in the bore, a head on the plunger externally of the bore, a spring abutting the head and said guide end portion and surrounding the tubular guide, a hollow nut surrounding the guide and spring and threaded into the recess and clamping the guide end portion sealingly upon the recess bottom.

3. In a fluid pump, a valve head provided with an aperture, four valve housing elements in the aperture disposed one upon the other in serial relation, a passageway through all of the housing elements, the first and third elements having upper faces, frusto-conical valve seats in said faces, a pump cylinder in the second element transversely of the passageway, a piston reciprocable in the pump cylinder, valves on the valve seats, the fourth element being threaded in the aperture and clamping the housing elements sealingly upon each other with the first element supported by the aperture bottom and sealed with respect thereto, and a fifth element sealing the open end of the aperture, recesses in the second and fourth elements respectively enclosing the valves and limiting movement thereof.

4. In a fluid pump, a dished housing member having a peripheral flange, an intermediate generally tubular housing portion flanged at opposite ends, a cylinder and valve housing comprising a peripherally flanged body portion secured by its flange to the flange at one end of the intermediate housing member, the cylinder and valve housing having a portion projecting into the intermediate housing, a guide head comprising a body portion disposed within the dished and intermediate housing members and having a peripheral flange adapted to be disposed between adjacent flanges of the dished housing member and the flange at the other end of the intermediate member, securing means for securing all three said flanges together to support the guide head body portion within the housing, the guide head having a plurality of parallel guide bores therein, a drive shaft rotatably supported in the dished housing portion, and the said cylinder and valve housing being provided with a plurality of pump cylinders and a plurality of pump pistons, operatively reciprocable in the cylinders, and a plurality of guides reciprocable in the guide bores by the rotatable shaft, and communicating reciprocatory motion to the pump pistons.

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