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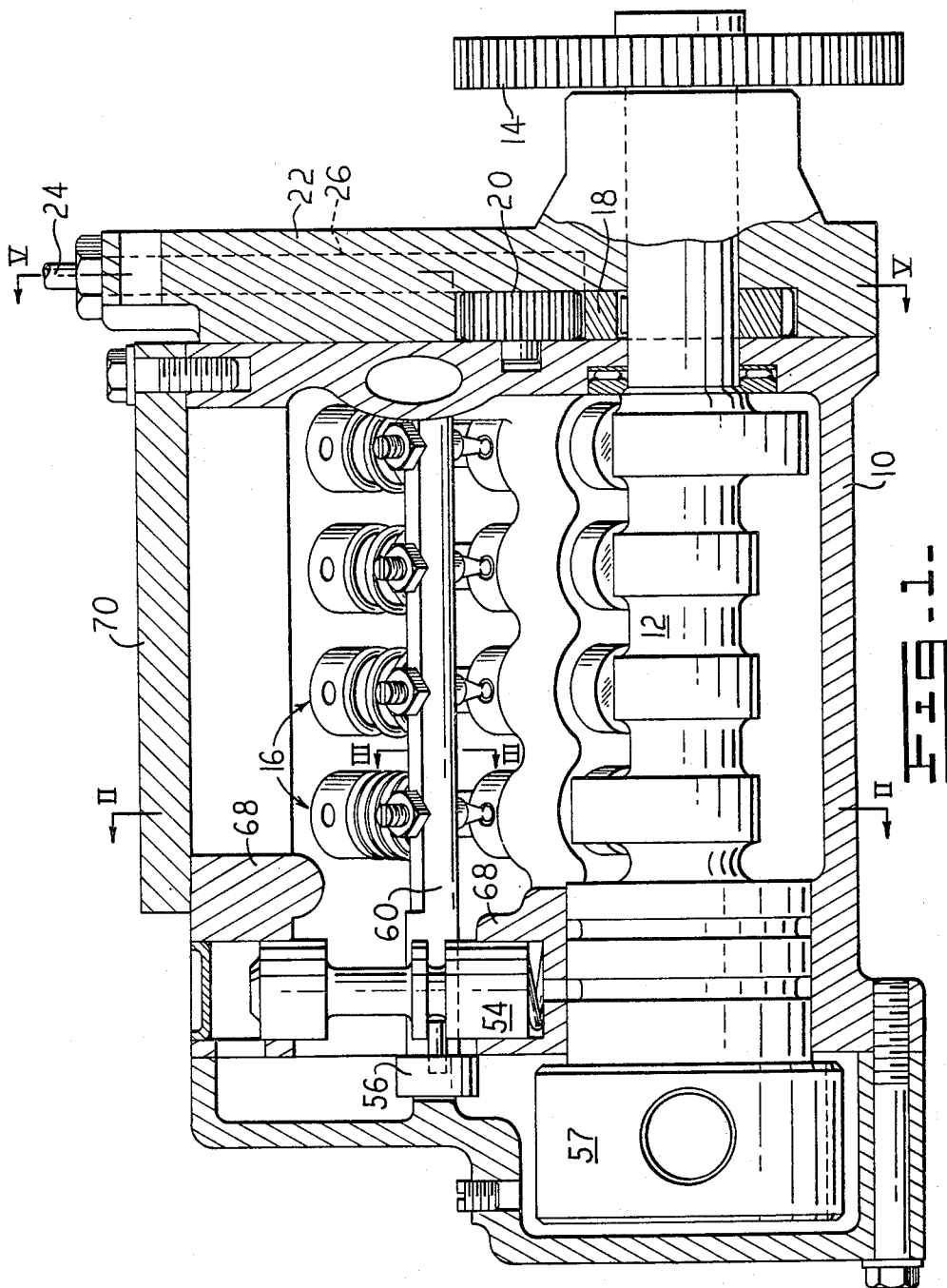
J. H. PARKS

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MULTI-PLUNGER ENGINE FUEL OIL PUMP

Filed March 7, 1967

3 Sheets-Sheet 1



INVENTOR  
JOHN H. PARKS

BY *Fryer, Ginnwald, Fritz + Phillips*  
ATTORNEYS



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3 Sheets-Sheet 3

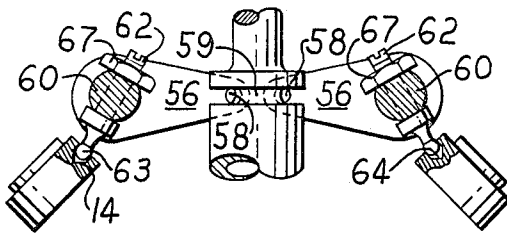


FIG. 3.



FIG. 4.

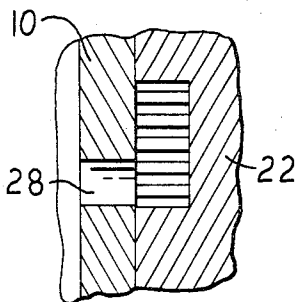


FIG. 6.

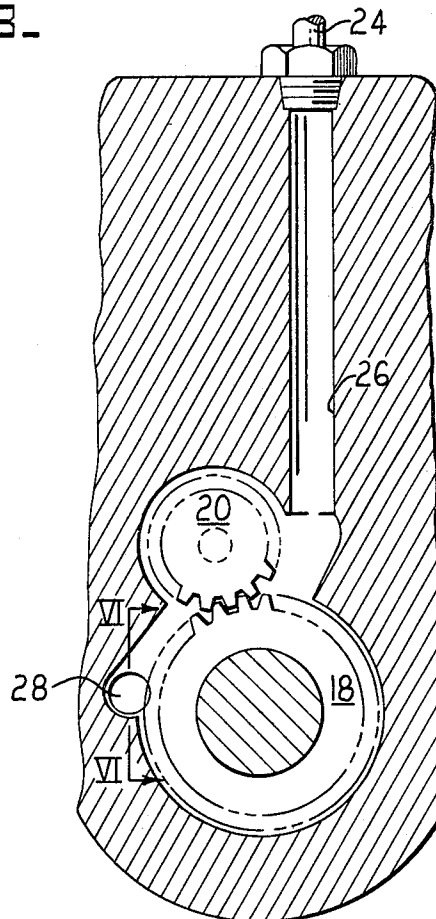


FIG. 5.

INVENTOR.  
JOHN H. PARKS

BY *Fryer, Ginnard, Zief + Phillips*  
ATTORNEYS

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**MULTI-PLUNGER ENGINE FUEL OIL PUMP**  
John H. Parks, Peoria, Ill., assignor to Caterpillar Tractor  
Co., Peoria, Ill., a corporation of California  
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1 Claim. (Cl. 103—41)

## ABSTRACT OF THE DISCLOSURE

An engine fuel pump assembly with one plunger for each engine cylinder having the plungers arranged in alignment in one or two lines and individual volume setting means for each plunger included in a simple volume control linkage between a governor actuated member and the plungers.

Reference will be made to a co-pending application of Maxwell, Miller and Parks, Ser. No. 690,242, filed Dec. 13, 1967, which discloses the details of a governor which may be used with the fuel pump of the present invention.

Fuel pumps containing individual plungers and barrels in a common housing in which the pumps are immersed in fuel oil, also serving as a lubricant for the moving parts, are known. It is also known to time and meter the flow of fuel to and from the pump barrels by ports leading through the plunger and valved by adjustable collars through which the plungers reciprocate. In the present invention, the pump assemblies are a simple economical type with fixed timing and governor control of volume per stroke delivered to the engine cylinders.

It is an object of the invention to provide in such a pump a very simple, easily adjusted means for varying the volume delivered by each stroke of each individual pump, thereby enabling all pumps to deliver uniformly throughout the range of volume demanded by a governor.

Further and more specific objects and advantages of the invention and the manner in which it is carried into practice are made apparent in the following specification by reference to the accompanying drawings.

In the drawings:

FIG. 1 is a longitudinal vertical sectional view through a pump housing showing pumps and controls therefor embodying the present invention;

FIG. 2 is a sectional view taken on the line II—II of FIG. 1;

FIG. 3 is a fragmentary detail of a portion of control mechanism shown in FIGS. 1 and 2;

FIG. 4 is a further detail of a part of the mechanism shown in FIG. 3;

FIG. 5 is a fragmentary view in the section taken on the line V—V of FIG. 1; and

FIG. 6 is a fragmentary section taken on the line VI—VI of FIG. 5.

Referring first to FIGS. 1 and 2, a pump housing 10 is shown as journaling a camshaft 12 driven by a gear 14 which may be part of an engine timing gear train not shown. The camshaft drives the plungers of a plurality of identical fuel oil pumps such as generally indicated at 16. In the present case, there are two lines of pumps arranged at 90 degrees to each other with four pumps in each line for delivering fuel in timed sequence as determined by the single camshaft to cylinders of an eight cylinder engine. The principles of the present invention will, however, apply to a single line of pumps for an engine of any number of cylinders as will be apparent upon reading the ensuing description.

The pumps and moving parts within the housing are immersed in fuel oil which is delivered to the housing by an engine driven transfer pump. In the present instance, the transfer pump comprises two pump gears 18 and 20

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shown in FIGS. 1 and 5 with the driving gear 18 keyed to the camshaft 12 and both gears housed in an auxiliary side wall or cover plate 22 of the pump housing 10. As most clearly illustrated in FIG. 5, fuel from a source of supply not shown enters through a conduit 24 and passage 26 where it is delivered by the pump gears to a passage 28 (see also FIG. 6) which enters the pump housing 10.

The construction of the several pumps which are identical is best shown by the pump illustrated in cross-section at the left hand side of FIG. 2. A pump plunger 30 is reciprocable within a barrel 32 welded or otherwise suitably secured to a bonnet 34 which is threaded into an opening in the pump housing and adapted for communication with the combustion chamber of an engine cylinder. A spring check valve 36 in the bonnet closes the pump barrel and is opened to admit oil to the combustion chamber only when pressure in the barrel attains a predetermined maximum. A spring 38 urges the plunger toward retraction from the barrel being disposed between a shoulder on the exterior of the barrel and a spring seat 40. The lower end of the plunger seats in a cam follower comprising an apron portion 42 slidable in a suitable bore formed in the pump housing and carrying an anti-friction roller 44 for engagement with a cam surface on the camshaft 12. When the plunger is retracted or in the partially retracted position shown in FIG. 2, fuel under moderate pressure from the fuel pump is admitted from within the housing through a port 46 in the pump barrel so that upon rotation of the cam and advancement of the plunger into the barrel, the port is closed trapping and compressing the fluid in the chamber above the plunger until the check valve opens and fluid is directed to the engine. In this type of fuel injection mechanism, the timing of injection is determined by the fixed position of the port 46 and injection begins shortly after closing of the port at the head end of the plunger. Volume of fuel delivered per plunger stroke is, however, controlled by a spill port extending transversely through the plunger as indicated in dotted lines at 48 and communicating with a longitudinal passage 49 which extends through the head end of the plunger. A collar 50 surrounds the plunger and closes the spill port 48 during the effective stroke. However, upon upward movement of the plunger to the position where the port 48 is uncovered, pressure at the head end of the plunger is vented into the housing and the check valve 36 closes. This concludes the delivery of fuel to the combustion chamber and determines the volume delivered per stroke so that adjustment of the collar longitudinally of the plunger determines the volume of fuel delivered per stroke.

This adjustment may be accomplished manually or automatically in response to engine requirements as sensed by an engine governor. A rectilinearly movable engine governor element is illustrated at 54 in FIGS. 1 and 2 and this element is extended and retracted from a governor mechanism generally shown at 57 in FIG. 1, the construction and operation of which is fully disclosed in the co-pending application of Maxwell, Miller and Parks hereinabove referred to. As disclosed in said application, the governor member 54 moves downwardly in response to demands for additional fuel and in doing so swings downwardly a pair of levers 56, best shown in the detail of FIG. 3, which have pins 58 engaged in a groove 59 of the member 54. These levers are secured to a pair of shafts 60, one of which is also shown in FIG. 1, and the shafts carry control pins or links 62 extending through and rotatable with respect to the shafts. Each link has a ball like end 63 eccentrically positioned with respect to the axis of the link as is most readily apparent in FIG. 4, so that adjustment of the link by rotation thereof varies the position of the end 63 in a direction lengthwise of the plunger. The ends 63 of the links are received in notches

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64 of the collars so that oscillation of the pins with their supporting shafts 60 slides the collars longitudinally of the plungers and varies the time at which the spill ports 48 are opened. For example, when the governor member 54 moves downwardly, the shafts 60 are rocked in directions to move the pins and slide the collars upwardly, thus a greater advancement of the plungers into the pump barrels is required before the spill ports are opened and injection is discontinued. Conversely, upward movement of the governor element slides the collars 50 away from the pump barrel and a lesser volume of fluid will be delivered to the engine.

In FIG. 2, a partial partition shown at 68 (see also FIG. 1) formed by governor housing elements is partially broken away to show the full relationship of one of the levers 56 with the shaft 60 and links 62. The adjustment of the links 62 enables the attainment of equal volume delivery by each of the several pump plungers. Upon rotation of the link, the effective position of the end 63 is adjusted to slightly vary the time of opening the spill port and the volume of delivery, and each link may be fixed in its adjusted position by tightening of a nut 67. Access to the links for adjustment is easily attained by removal of a single cover plate 70 on the housing 10.

I claim:

1. In a multi-plunger engine fuel pump of the kind having a spill port in each plunger closed and opened dur-

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ing plunger strokes by a relatively stationary collar surrounding the plunger and having linkage means operable by a governor or the like for adjusting the collars simultaneously on a plurality of aligned plungers to vary the volume of fuel delivered per plunger stroke, the improvement which comprises means included in said linkage means for effecting independent adjustment of each plunger to insure equal volume delivery of all plungers during simultaneous adjustment, said linkage means including a shaft supported for rocking movement, a link between the shaft and each collar, said link extending radially of the shaft and engaging the collar whereby rocking of the shaft slides the collars on the plungers, each link being rotatable and having connection with its collar at a point eccentric to its axis of rotation, and means to rotate the link and lock it in an adjusted position to determine the position of the collar with respect to the plunger.

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ROBERT M. WALKER, *Primary Examiner*.  
LAURENCE V. EFNER, *Examiner*.