

May 8, 1934.

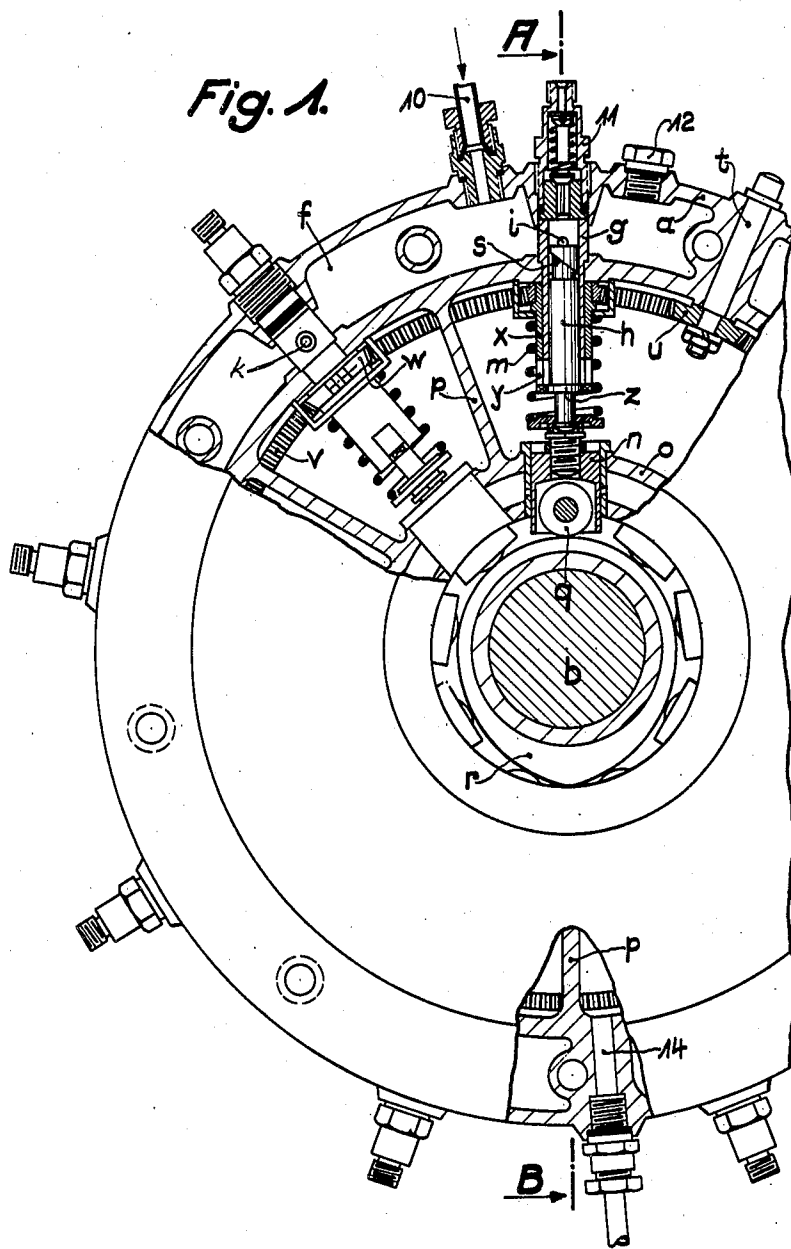
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1,957,435

PUMPING MECHANISM

Filed Nov. 12, 1929

4 Sheets-Sheet 1



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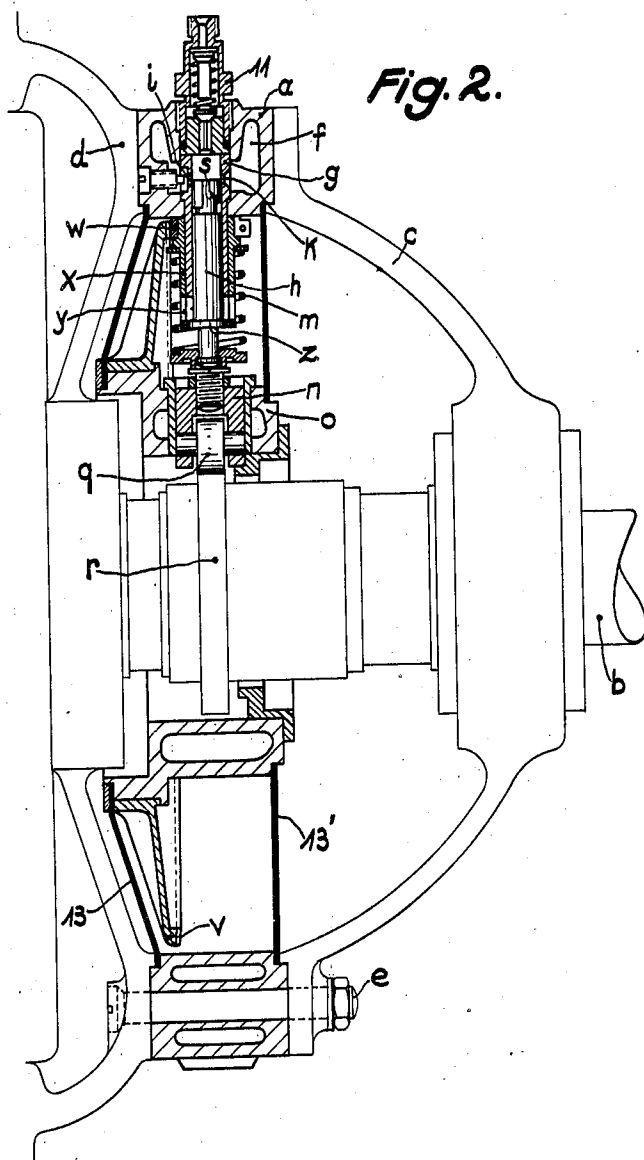
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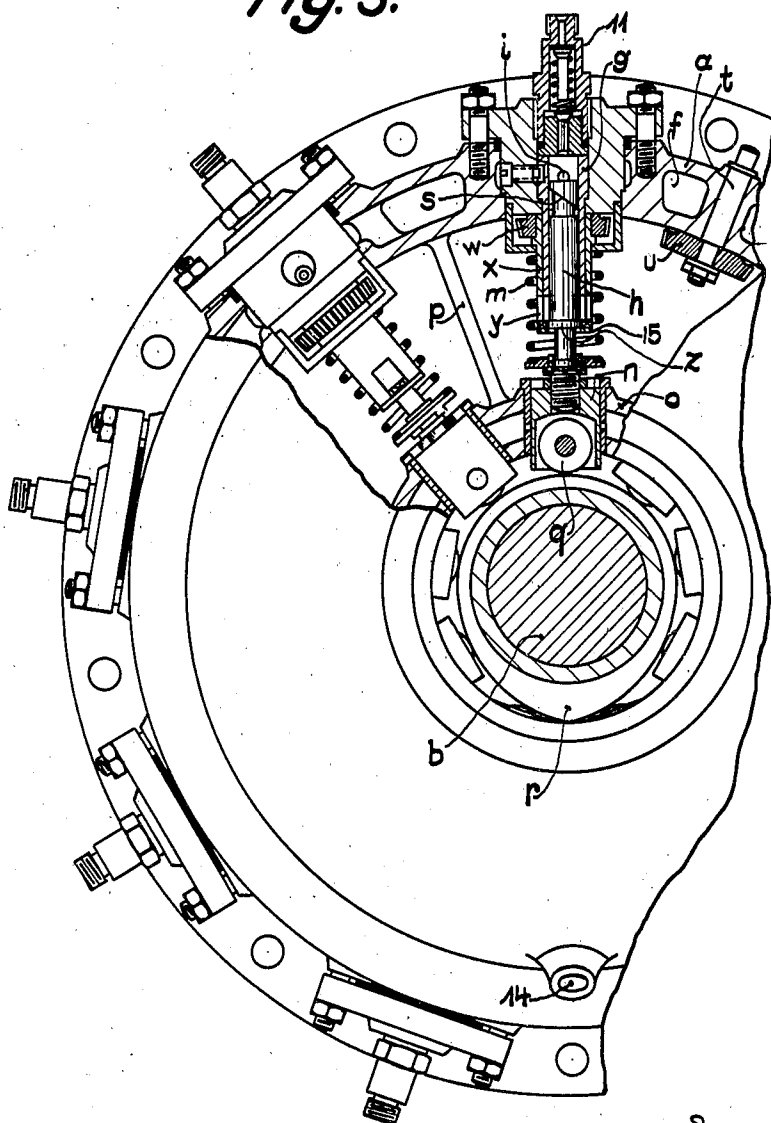
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Fig. 3.



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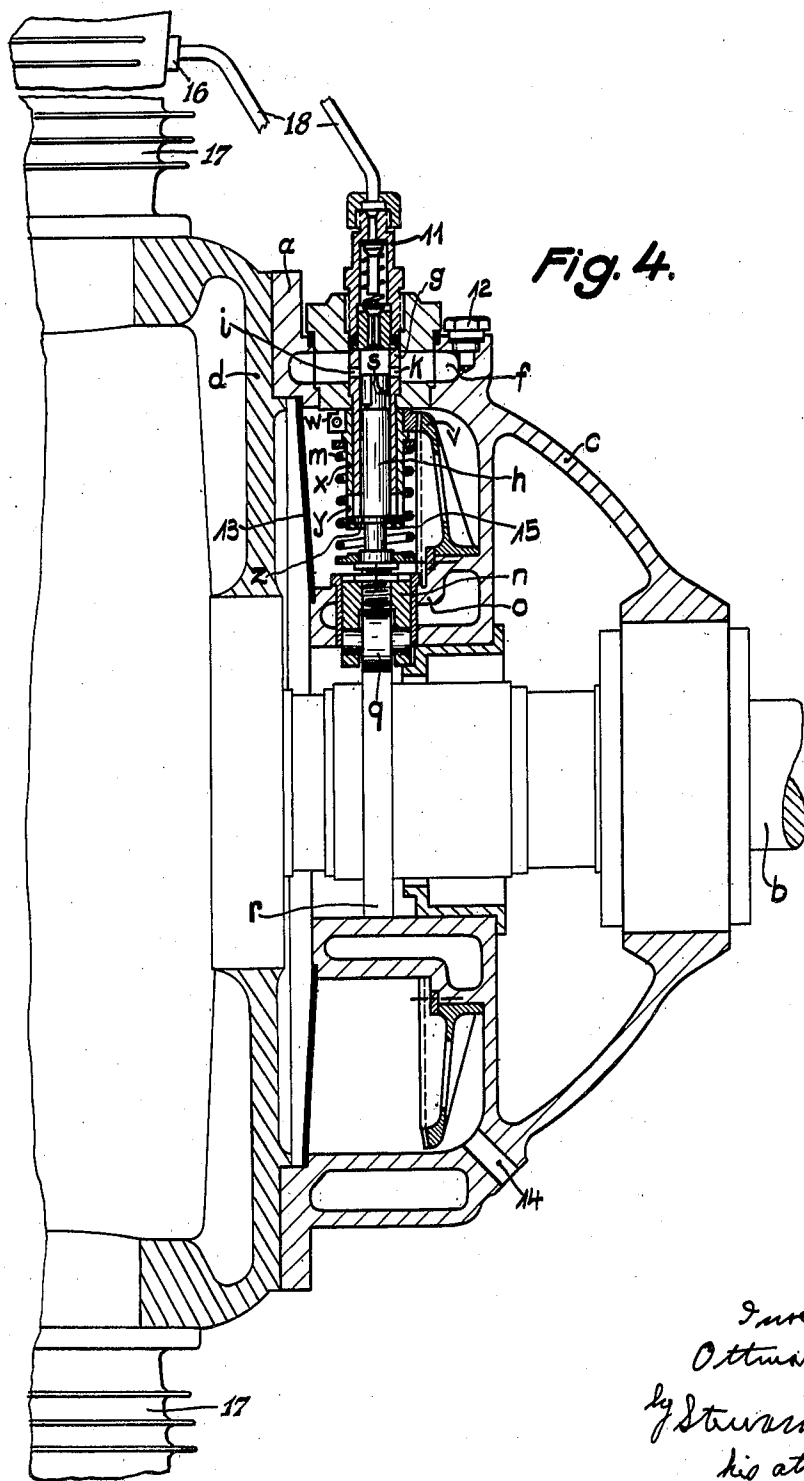
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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

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PUMPING MECHANISM

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In Germany December 12, 1928

6 Claims. (Cl. 123—139)

The present invention relates to pumping mechanism of the type in which a plurality of plunger pumps are arranged radially of a cam driving the same. The invention is particularly applicable to fuel pumps for multi cylinder Diesel engines.

According to the invention a simple arrangement of this kind is obtained by means of a carrier ring arranged concentric with the cam shaft, in which ring the cylinder casings of the various pumps are radially inserted and secured and which contains a hollow, annular space filled with fuel into which opens the fuel feed pipe common to all the pumps and further the suction passage and if desired also a return passage of each separate pump.

Two forms of construction of the invention as applied to a fuel pump are illustrated in the accompanying drawings in which:—

Figure 1 is a view, partly in section, of a fuel pump installation for a nine cylinder airship motor.

Figure 2 is a section, on the line A—B of Figure 1.

Figure 3 shows partly in section a second form of construction, and

Figure 4 is a section on line C—D of Figure 3.

In the first construction shown in Figure 1, a supporting or carrier ring *a* is introduced between the fastening flange of a bearing cover *c*, supporting the crank-shaft *b*, and the adjacent front side *d* of the crank casing. The bolts *e* by which the bearing cover is fastened on the crank case pass through the supporting ring and hold it concentric with the crank shaft. In the supporting ring *a*, which has a hollow annular space *f*, the cylinders *g* of the various pumps are inserted radially from the outside, and are so positioned that the suction and return ports or passages *i* and *k* provided in the cylinder walls open into the annular space *f*. The ports *i* and *k* are controlled by the pump pistons *h*.

The ends of the pump pistons projecting from the cylinders *g* are constantly pressed by a spring *m* against a block *n* which is guided in a ring *o* concentrically arranged round the crank shaft. This guide ring *o* is cast integral with the supporting ring *a* by radial ribs *p* provided between the separate pumps. The rollers *q* of the blocks *n* bear against a cam *r* on the crank shaft.

Near the outer end of each pump piston, a groove, or passage is cut in the surface of the piston, and is adapted to form a return passage for the fuel from the space above the piston to

the annular space *f* by way of passage *k* when the piston reaches a predetermined position in its outward stroke. The return groove communicates with the space above the piston, and is provided with an obliquely cut wall or side *s* adapted to cooperate with the port *k* and determine the position at which the port *k* is opened as the piston travels outwardly. With the piston in its lowermost position, fuel is admitted to the cylinder *g* through ports *i* and *k*. As the piston is moved upwardly by the cam *r*, the ports *i* and *k* are closed by the upper end of the piston *h*, and the fuel above the piston is forced out of the cylinder and into the pipe 18 leading to the injection nozzle 16 of the appertaining engine cylinder 17 as shown for instance in Fig. 4. As the pump piston continues on its outward stroke, the oblique wall *s* of the return passage formed in the cylinder surface uncovers the passage *k*, and the fuel remaining in the space above the piston is thereby permitted to return to the annular space *f* through the return groove on the cylinder and port *k*. The amount of fuel supplied by the pump on each stroke may be regulated by rotating the piston *h* to change the relative position of the groove surface *s* with respect to the port *k*. In order to regulate the quantity of fuel supplied at each stroke, all the pump pistons and thereby the controlling surfaces are angularly displaced in their cylinders. This is effected by means of a spindle *t* mounted in the supporting ring and on which a bevel gear *u* is fixed which meshes with a large crown gear *v* mounted on the guide ring *o*. A toothed segment gear *w* on each of the separate pumps meshes with the gear *v*. Each of the gears *w* is clamped on a sleeve *x*, which is revoluble on the cylinder wall. A cross-piece *z* fast on the piston so projects into a slot *y* in the sleeve that on the rotation of the sleeves by the adjusting device *t*, *u*, *v*, *w*, the pistons, together with their controlling surfaces, are also turned and thereby the quantity of fuel fed is altered.

The supply of fuel to the hollow space *f* in the ring *a* takes place through an inlet 10. The pipe connections leading to the injection nozzles of the engine are connected to the nipples 11 which are screwed coaxially with the cylinders into the supporting ring and lock them in position. The annular space *f* can be freed from air through a screw 12 provided at its highest point.

The open sides of the annular space formed between the inner periphery of the supporting ring and the outer periphery of the guide-ring

- are closed by discs 13 and 13', which prevent oil leakage which accumulates in this annular space from penetrating into the crank case of the motor or other parts where it is not desired. From the lowest point of this annular space in which oil leakage between the pump pistons and their cylinders is collected, an oil outlet passage 14 is provided which passes radially through the supporting ring.
- The second form of construction shown in Figures 3 and 4 is distinguished from that just described principally by the fact that the supporting ring *a* as well as the guide ring *o* are themselves cast in one piece with the bearing box cover and do not form a special piece. Further, in this second construction each individual pump as a complete unit is inserted from the outside into the supporting ring so that each pump in itself, independently of the others, can be inserted or removed. On each adjusting sleeve *a* a stop 15 is secured; this is designed to ensure that in inserting or withdrawing the individual pumps the pistons remain in their cylinders and will not be forced out by spring *m*.
- I claim:
1. In an injection pump for multi-cylinder engines, the combination of a supporting ring, disposed concentrically with the main engine shaft, and having an annular fuel space, a plurality of pump cylinders supported radially in the inner and outer wall of said supporting ring across said fuel space, and having intake and exhaust ports directly communicating with said annular space in said ring, each cylinder being provided with a piston for controlling said ports, and a fuel inlet passage connected to said annular space.
 2. An injection pump as specified in claim 1, wherein the supporting ring is removably arranged between a front wall of the engine casing and a cover for closing the front wall, and containing the main shaft bearing of the engine.
 3. The combination in an internal combustion engine having a crank-case, a plurality of cylinders mounted on said crank-case, and pumps on said crank-case for supplying fuel to said cylinders; of fuel ducts located entirely in the wall of the crank-case and connecting the pumps, and means for supplying fuel to the ducts.
 4. The combination in an internal combustion engine having a crank-case, a plurality of cylinders projecting outwardly from the crank-case, and pumps mounted on said crank-case for supplying fuel to said cylinders; of a continuous fuel passage in the crank-case wall extending around the case connecting the pumps, and means for supplying fuel to the continuous passage.
 5. The combination in an internal combustion engine having a crank-case, and a plurality of cylinders mounted on said crank-case; of a continuous fuel passage located entirely in the crank-case wall and extending around the case, fuel pumps intersecting the fuel passage, and means for supplying fuel to the fuel passage.
 6. The combination in an engine of the character described, having a crank-case, cylinders carried by the case, and fuel pumps mounted in the case in spaced order; of means entirely embedded in the wall of the crank-case for conveying liquid fuel from one pump to another, and means for supplying fuel to said conveying means.

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