

Sept. 17, 1940.

M. HURST

2,214,766

INJECTION PUMP FOR INTERNAL COMBUSTION ENGINES

Filed Oct. 7, 1938

3 Sheets-Sheet 1

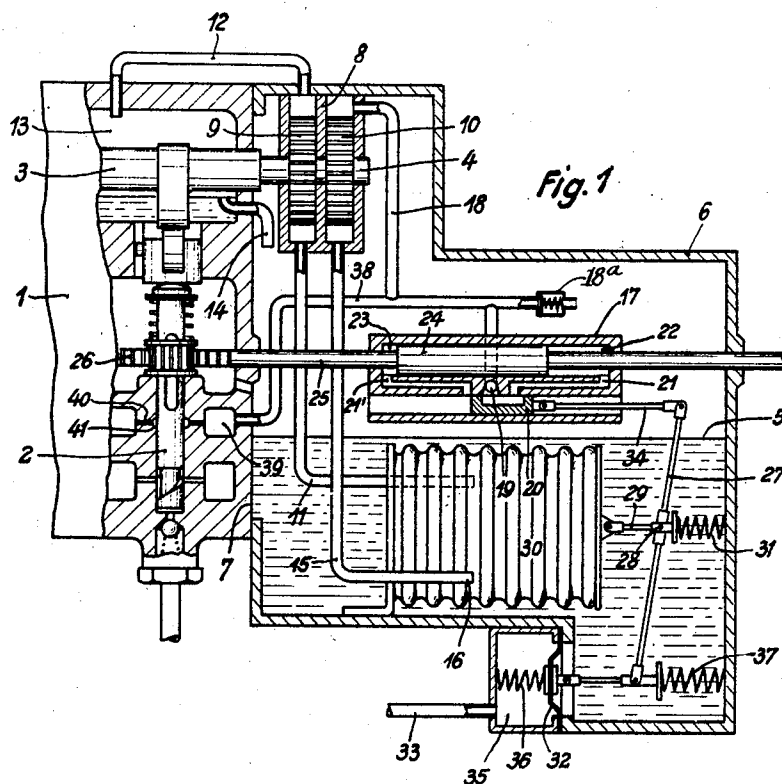


Fig. 1

Inventor
Max Hurst
by Roy F. Steward
his attorney

Sept. 17, 1940.

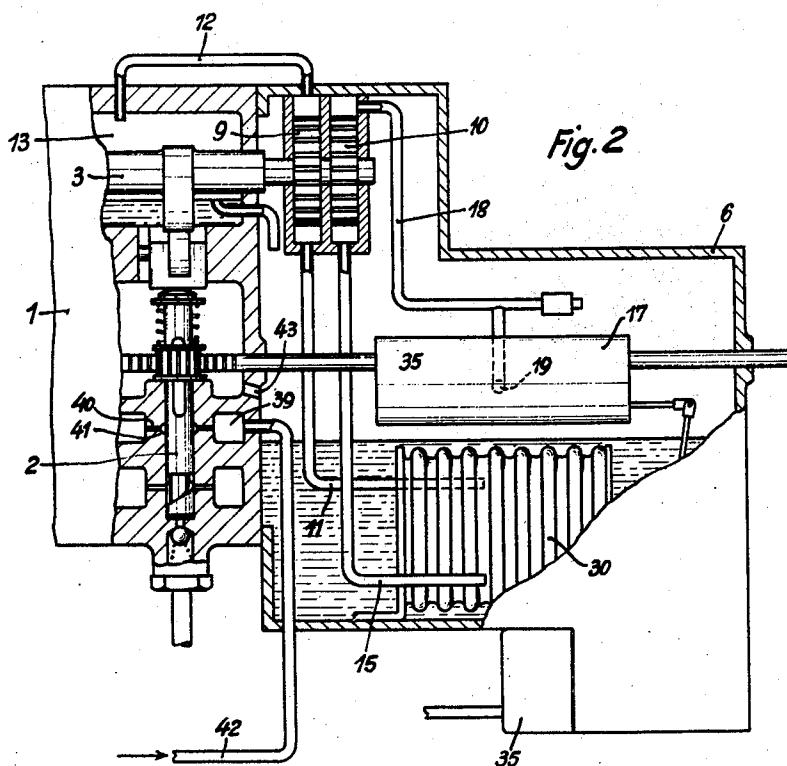
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3 Sheets-Sheet 2



Inventor
Max Hurst
by Roy F. Steward
his attorney

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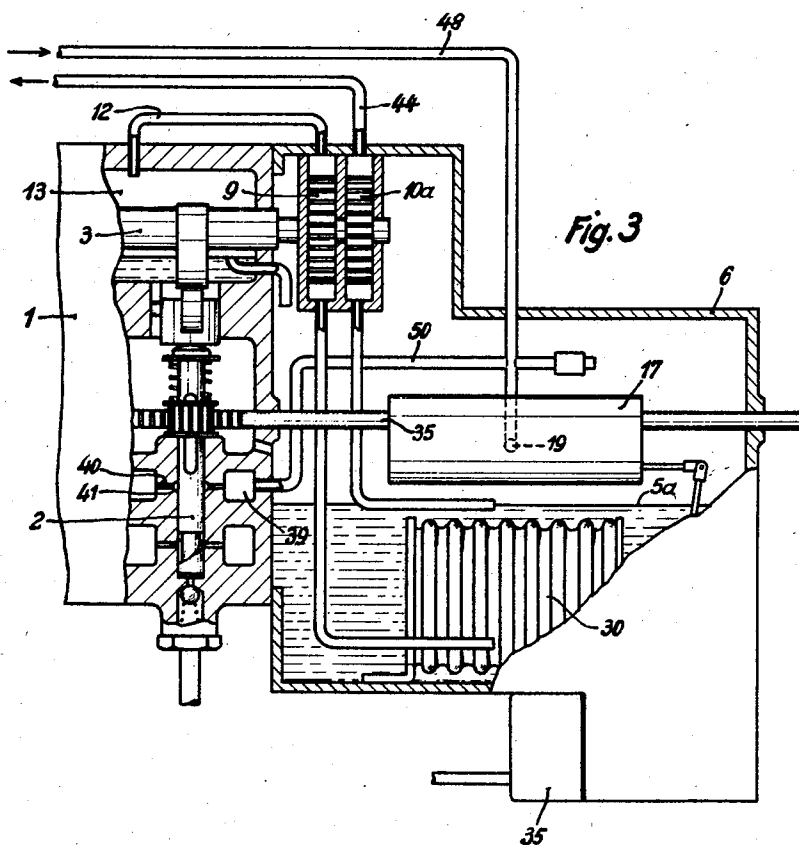
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INJECTION PUMP FOR INTERNAL COMBUSTION ENGINES

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Inventor
Max Hurst
by Roy F. Steward
his attorney

UNITED STATES PATENT OFFICE

2,214,766

INJECTION PUMP FOR INTERNAL
COMBUSTION ENGINES

Max Hurst, Stuttgart, Germany, assignor to
Robert Bosch Gesellschaft mit beschränkter
Haftung, Stuttgart, Germany

Application October 7, 1938, Serial No. 233,845
In Germany October 19, 1937

5 Claims. (Cl. 123—140)

The present invention relates to injection pumps for internal combustion engines, of the type wherein a cam shaft, which is located above the oil level in a lubricating oil reservoir, is fed with lubricating oil by means of a delivery pump driven by the fuel injection pump or a part thereof.

According to the present invention, the delivery pump disposed within the oil reservoir is associated with a second delivery pump which may, if desired, have a higher delivery pressure than the first delivery pump and which likewise takes the oil sucked in by it from the oil reservoir in a simple manner, whereby without taking up much space and at minimum expense, it is possible to connect at least one additional oil consumer to the oil reservoir.

According to the present invention it is appropriate to construct the delivery pumps as gear pumps which are coaxially disposed in side by side relationship and which are located on one end of the cam shaft of the injection pump. With this method of construction, it is possible to use a light weight injection pump with the two delivery pumps. The second delivery pump may be used with advantage for supplying oil under pressure from the oil reservoir to operate a booster or servomotor, for adjusting the control rod of the injection pump.

Preferably the end of the suction pipe is disposed low down in the oil reservoir and in fact, lower than the end of the suction pipe of the first pump, since it is desirable that the servomotor shall never be without oil, but shall continue to function reliably even when in a considerably inclined position, for instance, when the engine is mounted on a vehicle travelling over steep gradients.

Again with the arrangement according to the invention in the case of petrol injection pumps, it is also further advantageous to connect to the pressure pipe of the second delivery pump a pipe from which lubricating oil is passed for the purpose of preventing petrol leaking along the pump pistons and for lubricating the paths of the pistons. However, if it is preferred not to feed a so-called leakage preventor of this type from the second delivery pump, this leakage preventor can also be provided with oil under pressure directly from the lubricating system of the engine, the oil trickling through or leaking along the pump pistons from the oil preventor to the oil reservoir being then sufficient, roughly, to balance the quantities of oil lost in the reservoir.

It is further advantageous to accommodate

these two oil delivery pumps in an oil reservoir which is preferably flanged with an open side to an end wall of the injection pump and which apart from the booster or servomotor may also house a governor for the amount of oil delivered. In the event of the booster being connected directly to the lubricating system of the engine with this arrangement, the second delivery pump can be used in a specially advantageous manner for pumping back to the lubricating system of the engine that amount of superfluous oil present in the reservoir which at any time exceeds the desired oil level therein.

Three forms of construction of the invention by way of example, are shown in the accompanying drawings, in which each of Figures 1, 2 and 3 is a longitudinal section through an oil reservoir built on to an injection pump, with the parts accommodated in the said reservoir.

The petrol injection pump 1 shown in Figure 1 has a plurality of pump pistons 2, of which only a single one is shown. The pump pistons 2 are driven by a cam shaft 3 which, at the end 4, extends into a reservoir 6 partially filled with oil. The reservoir is flanged on to an end wall 7 of the injection pump 1. The oil level 5 in the reservoir is lower than the normal position shown of the cam shaft 3. On the cam shaft, and separated from each other only by a thin wall 8, are situated, side by side, two gear pumps 9, 10 of a known type of construction, and which take up a small space in the casing.

One gear pump 9 sucks oil from the reservoir 6 through its suction pipe 11 and delivers it through its outlet or pressure pipe 12 into a chamber 13 in which the cam shaft 3 rotates. Superfluous oil is returned to the reservoir 6 from the chamber 13 through an overflow pipe 14.

The other delivery pump 10 has a suction pipe 15 of which the suction end 16 lies adjacent the base of the reservoir, so that the pump 10 can still deliver oil even when the fuel level 5 in the reservoir has dropped very low. This is necessary in that oil from the pump 10 is required for a servomotor or booster 17 which provides in known manner the adjusting force for governing the fuel delivered to the engine by the injection pump 1 and which must still function reliably even if the reservoir is not filled to the correct oil level. In such event, the delivery pump 10 will still operate even when the delivery pump 9 has ceased constantly to pump fresh oil to the cam shaft chamber 13.

The delivery of oil under pressure to the servomotor 17, is effected by reason of the fact that

the delivery or pressure pipe 18 of the pump 10 has its mouth 19 in the servomotor, which mouth can be brought into communication with one side 22 of a piston 24 through a duct 21 or with the other side 23 of said piston 24 through a duct 21' according to the position of a slide valve 20. The control rod 25 of the fuel delivery adjustment governor which is connected with the piston 24 is thus moved in one direction or the other in order to rotate, through rack means 26, the pump pistons 2, which are provided in known manner with obliquely cut off control surfaces, in order to vary the amount of fuel to be injected by the pump into the engine.

The adjustment of the slide valve 20 is effected from a rod 34, which is pivotally connected to a lever 27 of the first order. The lever 27 is pivoted approximately at its mid-point at 28 on a rod 29 which is connected with one end of an aneroid capsule 30 or the like pressure sensitive device.

On decrease of the air pressure in the reservoir 6, which is connected with atmosphere through an opening (not shown), the capsule 30, one end of which is fixed by a bracket on the base of the reservoir, expands against the action of a spring 31 and in so doing moves the slide valve 20 to the right or, on increase of the air pressure, transmits an opposite motion to said slide valve. Movement of the slide valve 20 to the right will likewise occur when the lower end of the lever 27 moves to the left. This occurs in the event of a pressure decrease in that chamber 35 of the casing which is located on the left of a diaphragm 32 the opposite sides of which are acted upon by springs 36, 37, which chamber is in communication through a pipe 33 with the induction pipe of the engine, which is not shown, but is provided for pneumatic governing of the injection fuel amount.

There is further connected to the delivery pipe 18 of the delivery pump 10, a spring loaded back pressure valve 18a and a pipe 38 which leads to a chamber 39 which is in communication through small openings 40 with annular grooves 41 surrounding the pump pistons 2. By charging these annular grooves 41 with oil under pressure, the pistons 2 are lubricated and are so sealed that no leaking petrol or other fuel can escape along the pistons. This arrangement for sealing of the pistons is hereinafter, for short, referred to as a leakage barrier.

Figure 2, which illustrates another form of construction of the present invention, differs from Figure 1, only in that the pipe 38 of the latter is discarded and in place of it the leakage barrier 39, 40, 41 is connected through a pipe 42 to the lubricating system (not shown) of the engine itself. This arrangement has the advantage that oil trickling upwards from the leakage barrier along the piston, which oil can flow into the reservoir 6 at 43, is sufficient approximately to balance the loss of oil in the reservoir 6. As with the construction according to Figure 1, this modified arrangement also renders it practically unnecessary to supervise the oil level in the reservoir 6.

The form of construction shown in Figure 3 is a further development of the constructions already described and makes possible automatic working of the lubricating system without the necessity of constant supervision of the oil level in the reservoir 6. In this form of construction, oil under pressure is passed from the circulation pump (not shown) of the lubricating system of the engine through a pipe 48 to the leakage barrier 50, 39, 40, 41 and at 19 to the servomotor 17, while oil from the servomotor passes into the

reservoir 6. The pump 10a then delivers that quantity of oil exceeding the desired oil level 5a back to the lubricating system of the engine through a pipe 44.

I declare that what I claim is:

1. A piston type injection pump for fuel injection in internal combustion engines, comprising control means for adjusting the fuel amounts delivered by said pump, a hydraulically operated piston-servomotor connected with said control means, a casing in which said servomotor is located, at least one inlet opening through which lubricating oil enters said servomotor for driving its piston in each of its two working directions, at least one outlet opening in said servomotor from which the used lubricating oil enters the casing, a common cam shaft for driving the pistons of said injection pump, said cam shaft being located higher than the oil level of said casing, one end of said cam shaft extending into said casing, a lubricating oil delivery pump driven by said end of the cam shaft, an oil chamber in which the cams of said shaft rotate, and a pipe connecting said chamber with the pressure side of said lubricating pump, while the suction side of said lubricating pump is connected with the lower oil containing part of said casing.

2. A piston type injection pump for fuel injection in internal combustion engines, comprising control means for adjusting the fuel amounts delivered by said pump, a hydraulically operated piston-servomotor connected with said control means, a casing in which said servomotor is located, at least one inlet opening through which lubricating oil enters said servomotor for driving its piston in each of its two working directions, at least one outlet opening in said servomotor from which the used lubricating oil enters the casing, a common cam shaft for driving the pistons of said injection pump, said cam shaft being located higher than the oil level of said casing, one end of said cam shaft extending into said casing, a pair of oil pumps of the gear pump type arranged side by side on the end of the cam shaft extending into the casing, an oil chamber in which the cams of said shaft rotate, suction pipes for said pumps extending into the lower lubricating oil containing part of the casing, and a pipe for connecting the pressure side of one of said oil pumps with the chamber in which the cam shaft rotates, whence superfluous oil may drain back into the casing.

3. A piston type injection pump for fuel injection in internal combustion engines, comprising control means for adjusting the fuel amounts delivered by said pump, a hydraulically operated piston-servomotor connected with said control means, a casing in which said servomotor is located, at least one inlet opening through which lubricating oil enters said servomotor for driving its piston in each of its two working directions, at least one outlet opening in said servomotor from which the used lubricating oil enters the casing, a common cam shaft for driving the pistons of said injection pump, said cam shaft being located higher than the oil level of said casing, one end of said cam shaft extending into said casing, a pair of oil pumps of the gear pump type arranged side by side on the end of the cam shaft extending into the casing, an oil chamber in which the cams of said shaft rotate, suction pipes for said pumps extending into the lower lubricating oil containing part of the casing, and a pipe for connecting the pressure side of one of said oil pumps with the chamber in which the

cam shaft rotates, whence superfluous oil may drain back into the casing, the pressure side of the second pump being connected to the inlet opening of the servomotor.

- 5 4. A piston type injection pump for fuel injection in internal combustion engines, comprising control means for adjusting the fuel amounts delivered by said pump, a hydraulically operated piston-servomotor connected with said control
- 10 means, a casing in which said servomotor is located, at least one inlet opening through which lubricating oil enters said servomotor for driving its piston in each of its two working directions, at least one outlet opening in said servomotor from
- 15 which the used lubricating oil enters the casing, a common cam shaft for driving the pistons of said injection pump, said cam shaft being located higher than the oil level of said casing, one end of said cam shaft extending into said casing, a pair of oil pumps of the gear pump type arranged side by side on the end of the cam shaft

extending into the casing, an oil chamber in which the cams of said shaft rotate, suction pipes for said pumps extending into the lower lubricating oil containing part of the casing, and a pipe for connecting the pressure side of one of said oil pumps with the chamber in which the cam shaft rotates, whence superfluous oil may drain back into the casing, the pressure side of the second pump being connected to the inlet opening of the servomotor, and also to a leakage barrier and to a spring loaded back pressure valve. 10

5. A device according to claim 2, in which the pressure side of one pump leads out of the casing, while its suction pipe dips into the middle of the casing so that the superfluous lubricating oil in the casing exceeding a certain amount is sucked in by said second pump and delivered out of the casing, and a supply source for supplying lubricating oil to the inlet chamber of the servomotor enclosed in the casing. 15

20 MAX HURST.