Jan. 9, 1934. L. COATALEN 1,943,162

FUEL PUMP

Filed Dec. 23, 1930 8 Sheets-Sheet 1

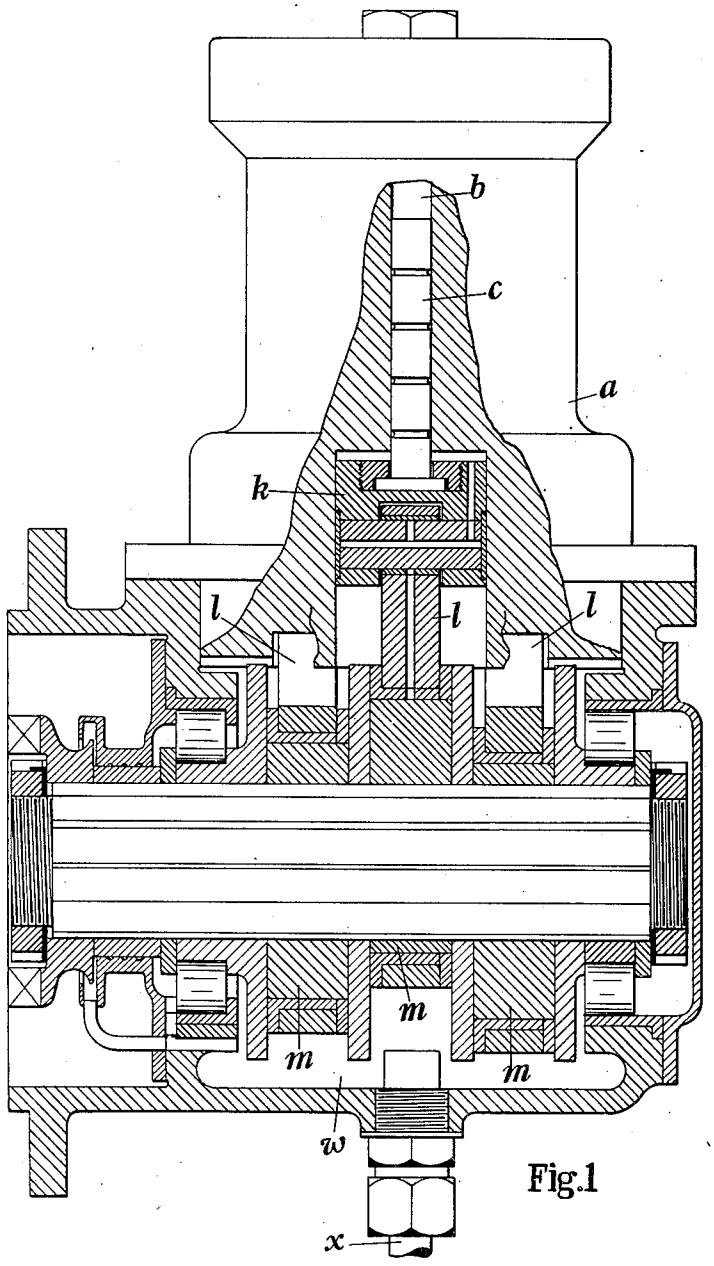


Fig.1

L. Coatalen
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By: Marks & Clerk
Attys.

Jan. 9, 1934. L. COATALEN 1,943,162

FUEL PUMP

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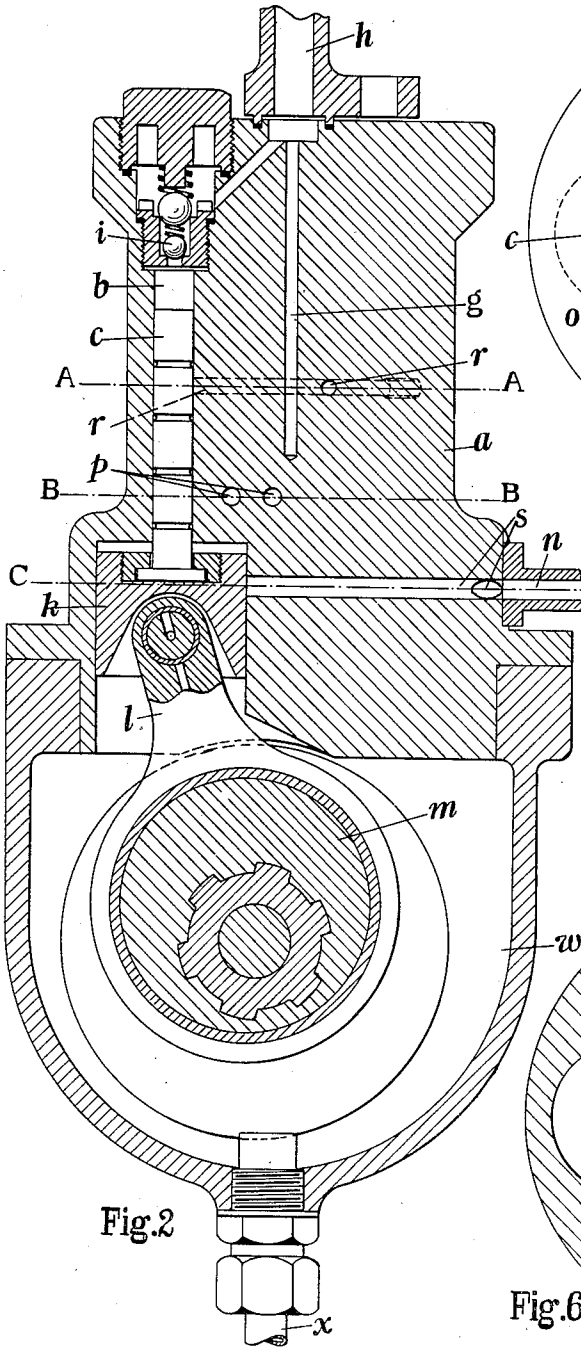


Fig.2

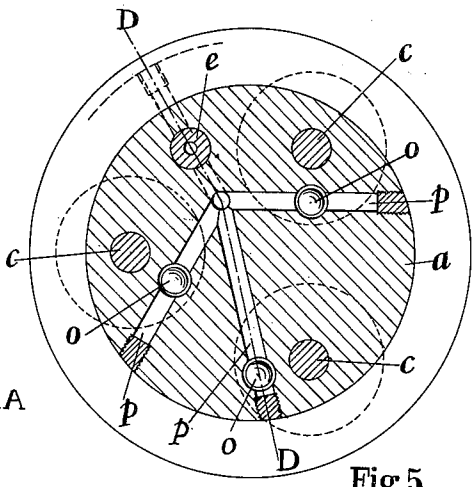


Fig.5

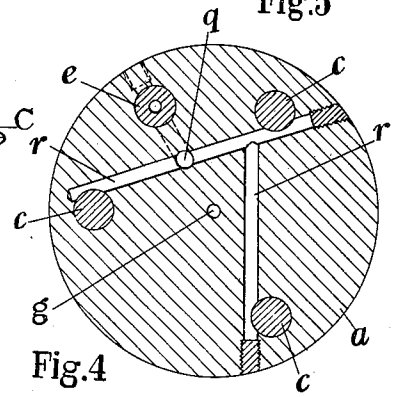


Fig.4

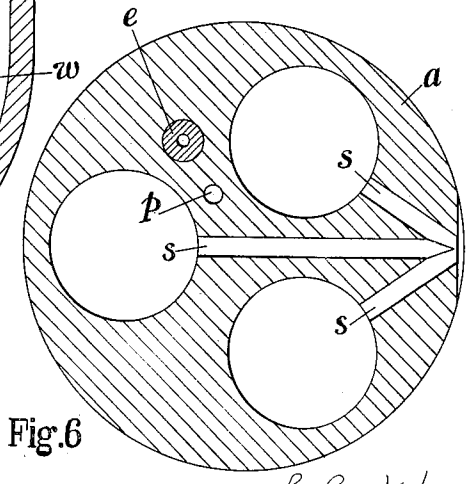


Fig.6

L. Coatalen
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By: Marks & Clark
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Jan. 9, 1934. L. COATALEN 1,943,162

FUEL PUMP

Filed Dec. 23, 1930 8 Sheets-Sheet 3

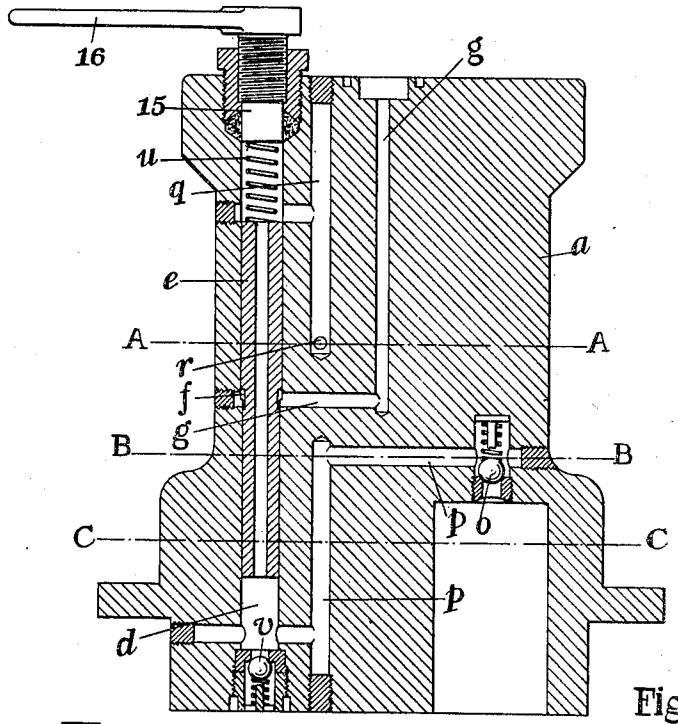


Fig.7

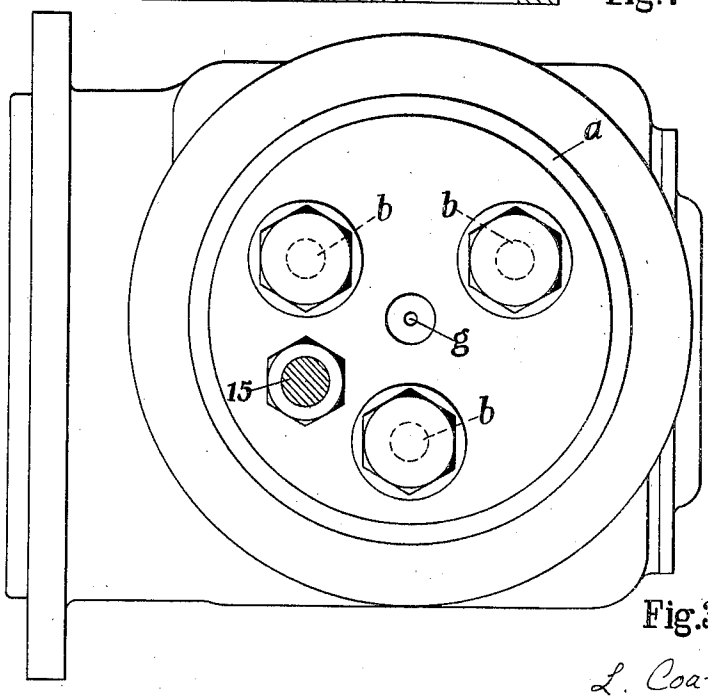


Fig.3

L. Coatalen INVENTOR

By: Marks & Clerk Attys.

Jan. 9, 1934. L. COATALEN 1,943,162

FUEL PUMP

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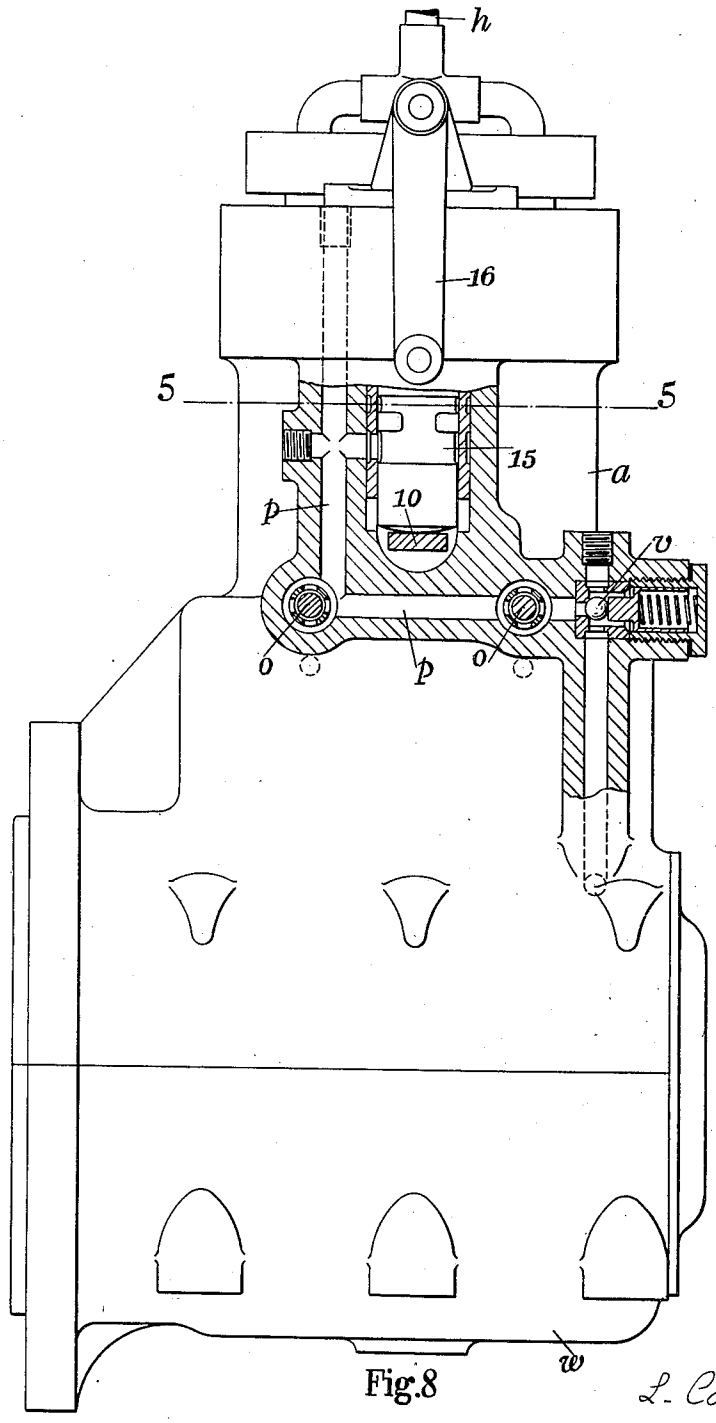


Fig.8

L. Coatalen
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By: Marks & Clerk
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Jan. 9, 1934. L. COATALEN 1,943,162

FUEL PUMP

Filed Dec. 23, 1930 8 Sheets-Sheet 5

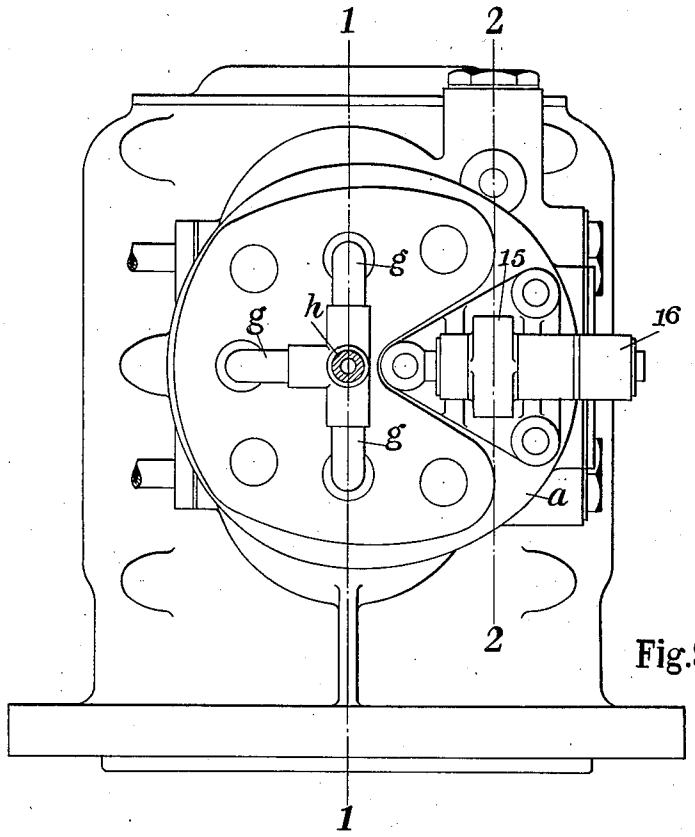


Fig.9

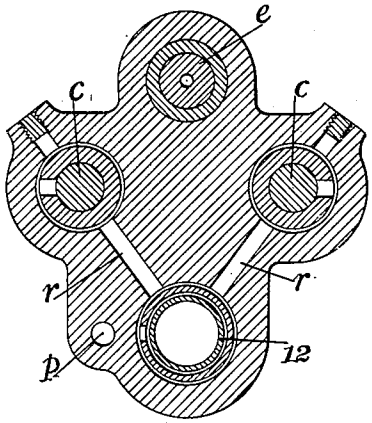


Fig.13

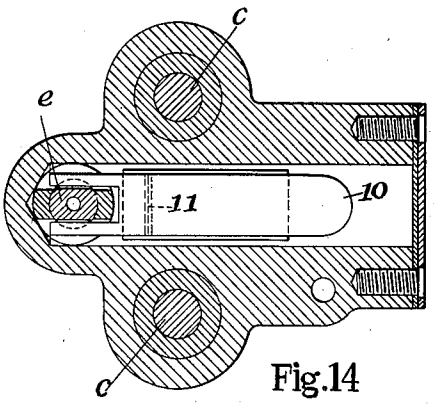


Fig.14

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Jan. 9, 1934. L. COATALEN 1,943,162

FUEL PUMP

Filed Dec. 23, 1930 8 Sheets-Sheet 6

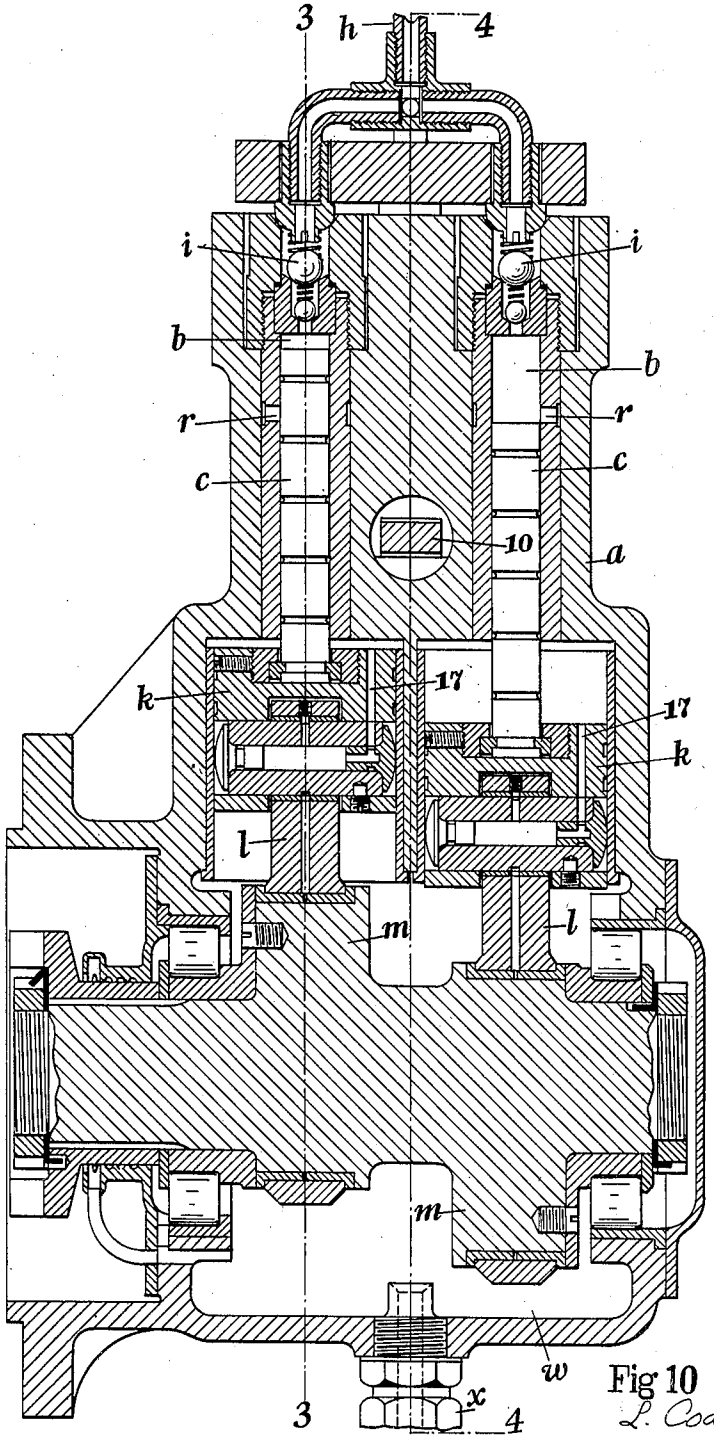


Fig 10

L. Coatalen
INVENTOR

By: Marks & Clerk
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Jan. 9, 1934. L. COATALEN 1,943,162

FUEL PUMP

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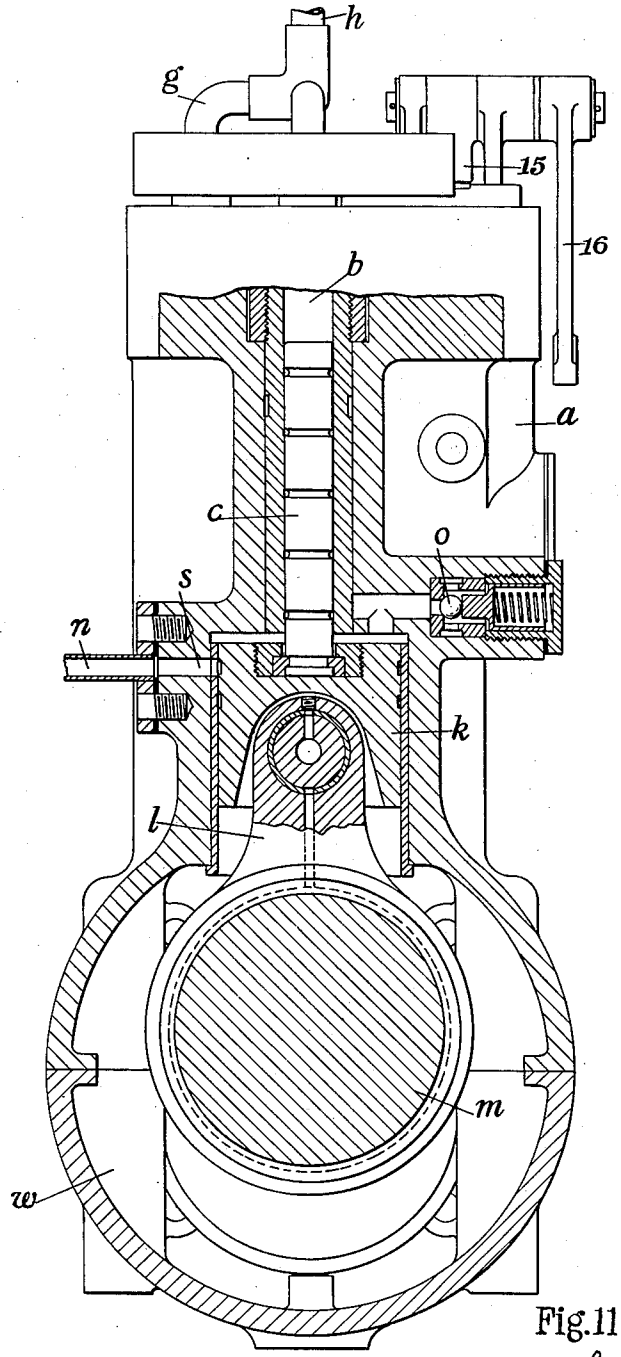


Fig.11

L. Coatalen
INVENTOR

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ATTYS.

Jan. 9, 1934. L. COATALEN 1,943,162

FUEL PUMP

Filed Dec. 23, 1930 8 Sheets-Sheet 8

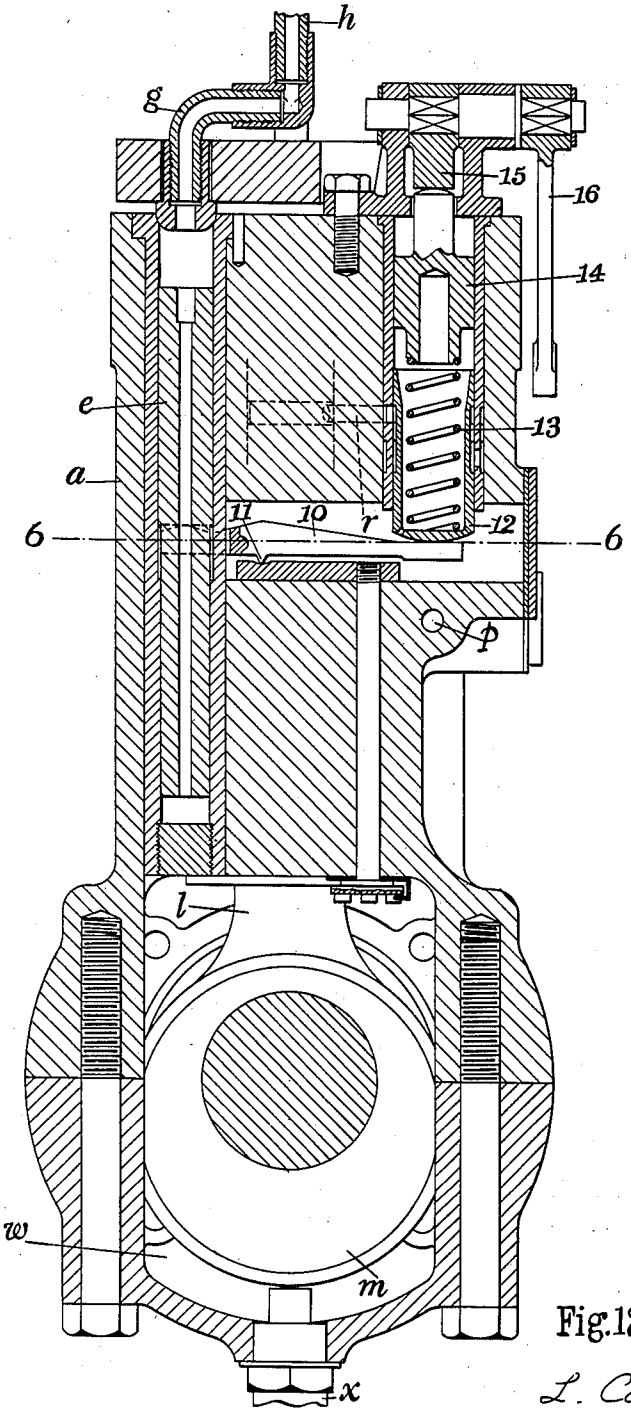


Fig.12

L. Coatalen INVENTOR

By. Marks & Clerk ATTYS.

Patented Jan. 9, 1934 1,943,162

UNITED STATES PATENT OFFICE

1,943,162

FUEL PUMP

Louis Coatalen, Wolverhampton, England

Application December 23, 1930, Serial No. 504,388, and in Great Britain June 4, 1930

2 Claims. (Cl. 103—40)

This invention has for its object to provide an improved fuel pump for use with internal combustion engines of the compression ignition type.

The invention comprises the combination with a reciprocatory plunger, of a control valve which is subjected to the fluid pressure in the delivery side of the pump and serves to regulate the amount of fuel oil which can pass to the suction side of the pump.

The invention also comprises the combination with a plurality of plungers, of a single control valve as above described.

Further, the invention comprises the combination with the plunger, or each plunger, of a piston like part of larger diameter than the plunger which moves within a cylindrical chamber and serves as a low pressure means for pumping oil from a supply tank to the plunger through or past the control valve.

Further, the invention comprises the adaptation of the low pressure part of the pump to supply oil for lubrication purposes to various parts of the pump mechanism.

Referring to the eight accompanying sheets of explanatory drawings:—

Figure 1 is a part sectional side elevation of a three-cylinder pump constructed in accordance with this invention.

Figure 2 is a sectional end view and Figure 3 a plan of the same.

Figures 4, 5 and 6 are respectively sectional plans on the lines A A, B B, and C C, Figure 2.

Figure 7 is a sectional end elevation of the upper portion of the pump on the line D D, Figure 5.

Figure 8 is a side elevation (with part in section) of a two-cylinder pump constructed in accordance with this invention, and Figure 9 is a plan of the same (the part in section in Figure 8 being taken on the line 2 2, Figure 9).

Figure 10 is a sectional side elevation on the line 1 1, Figure 9, and Figures 11 and 12 are respectively sectional end views on the lines 3 3, 4 4, Figure 10.

Figures 13 and 14 are respectively sectional plans on the lines 5 5, Figure 8 and 6 6, Figure 12.

In carrying the invention into effect as shown in Figures 1–7, I employ a main block *a* containing three cylindrical chambers *b* in which can slide the main plungers *c*, the plungers being equally spaced around a central axis. In another chamber *d*, which is parallel with the axis of the cylinder block, is arranged a hollow cylindrical control valve *e* comprising a pair of integral parts of approximately equal length but of conveniently different diameters. As will be seen in Figure 7, the lower half of the valve *e* is of slightly smaller diameter than the upper half. Around the junction of the parts of unequal diameters there is arranged in the block a chamber *f* which communicates by means of a passage *g* with the delivery pipe *h* of the pump, this pipe being preferably arranged in a central position at the upper side of the cylinder block. The delivery pipe communicates also with each of the chambers *b* containing a plunger *c* through the medium of a non-return valve *i*.

In combination with one end of each plunger *c* there is provided a cylindrical piston like enlargement *k* which can reciprocate within a cylindrical chamber in the cylinder block, the said enlargement being connected by a member *l* to a driving crank, eccentric, cam or the like *m*. The piston like part *k*, in addition to serving as a means for connecting the plunger *c* to the driving mechanism, also serves as the piston of a low pressure pump by which fuel oil can be drawn from a supply tank through a suction pipe *n* and passages *s* and delivered to the main plungers *c* through the control valve *e*.

During the first part of the delivery stroke of any of the pistons *k*, the said piston first cuts off the corresponding passage *s* through which oil flows into the cylinder. Later oil is forced by the low pressure piston *k* past a non-return valve *o* (Figure 7) through the passage *p* to the control valve *e*. After passing through the control valve the oil is delivered by passages, *q*, *r*, to those chambers containing the main or high pressure plungers *c* which are not already closed by the plungers. One at least of such chambers is always open, as the three plungers operate in succession, the cranks or the like *m* being approximately 120 degrees apart. Following the action of any one of the plungers *c*, and assuming that oil has already been supplied to the chamber containing the plunger *c* through the adjacent passage *r*, this passage is cut off by the plunger before oil is delivered to the delivery pipe *h*, as shown in Figure 2. After the cut off, the oil is forced through the non-return valve *i* to the delivery pipe *h*. So long as the pressure in the delivery pipe is below some predetermined amount, the control valve *e*, under the action of an adjustable spring *u* situated at one end of the valve, occupies the normal position in which oil can flow freely from the low pressure plungers to the high pressure plungers. (The pressure of the spring can be regulated by a screwed plug 15 actuated by a lever 16.) When the pressure in the delivery pipe exceeds that amount the fluid

pressure acting on the parts of the control valve of different diameters contained in the chamber *f*, moves the control valve against the action of the spring *u* in the direction for closing the inlet to the passage *q* leading to the high pressure cylinders. Consequently no further oil can pass to the high pressure plungers until the pressure in the delivery pipe has subsided sufficiently. Oil drawn into the pump by the action of the low pressure pistons is then caused to flow through a spring controlled relief valve *v* (Figure 7) to a chamber *w* containing the crank or other driving mechanism of the pump, where it can be used for lubricating the said mechanism. Lubrication oil may also be provided by allowing a certain amount of leakage past the low pressure piston, and by the provision in such piston of passages leading to the various parts of the pump mechanism requiring lubrication. Surplus oil is returned to the supply tank by a pipe *x*.

The essential feature of my invention resides in the combination with the main plunger or plungers, of an automatic control valve as above described acting upon the oil supplied to the plunger. Whilst I prefer to combine the low pressure pump or pumps directly with the high pressure plunger or plungers, it may be convenient for some purposes to provide a seperate low pressure pump or pumps for feeding the oil past the control valve, and I desire it to be understood that this modification is included within the scope of my invention.

Figures 8–14 illustrate a two cylinder pump constructed in accordance with the invention. The pump is essentially similar to that above described, and the main features will readily be recognized from the previous description. The principal difference (apart from the fact that two cylinders are used instead of three) resides in the mode of controlling the delivery of oil from the low pressure pistons *k* to the high pressure plungers *c*. A control valve *e* is used, as before, but the pressure oil is arranged to act on the opposite ends of the two parts of the valve instead of on the central part. The chamber containing the valve receives oil from the delivery pipe *h* through a pipe or passage *g*. At or near the centre of the control valve I connect to it a lever 10 pivoted at 11 and arranged to act on a supplementary control valve 12 which controls the flow of oil from the pistons *k* to the plungers *c* through passages, *p*, *r*. This valve 12 is acted on by a spring 13, and the pressure of the spring can be regulated by a sliding piece 14 which is operated by a cam 15 actuated by a lever 16. The cranks, cams or the like *m* which operate the pistons *k* are arranged at 180 degrees apart.

Considering the action of either of the pistons *k*, oil is drawn into the cylinder containing the piston from the inlet pipe *n*. During the delivery stroke, the piston first cuts off the passage *s* to which the pipe *n* is connected. Afterwards oil is delivered from the cylinder through the non-return valve *o* to a passage *p* leading to the supplementary valve 12. Normally this valve allows the oil to pass along the passages *r* to one or other of the cylinders containing the plungers *c*.

Assuming that a quantity of oil has been delivered to one of the cylinders *b*, the first part of the movement of the plunger *c* is to cut off the passage *r*. Oil is afterwards delivered by the plunger through the non-return valve *i* to the delivery pipe *h*. From the delivery pipe oil can also pass through the pipe *g* to the control valve *e*. So long as the pressure is normal no movement is effected in the valve, but when the pressure exceeds a predetermined limit the valve *e* responds to the pressure, and causes the lever 10 to move the valve 12 in the direction for closing the passages *p*, *r*, and so preventing further supply of oil to the cylinders *b*. Oil delivered by the pistons *k* now passes through the valve *v* (Figure 8) to the crank case *w*, and thence through the pipe *x* to the supply tank. Oil collected in the case *w* serves to lubricate the actuating mechanism of the pump. Passages 17 in the pistons *k* serve to allow oil to pass through the pistons *k* to the various bearing surfaces associated with the parts *k* and *l*.

The invention is not limited to the examples above described and subordinate details can be varied to meet different requirements. If desired the pump may be constructed with a single low pressure piston and high pressure plunger, but a plurality of such parts are usually to be preferred.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:—

1. In fuel pumps, the combination of a plunger, a piston of larger diameter than the plunger, separate chambers containing the plunger and piston and arranged in communication with each other, a control valve subject to pressure of the fluid in the pump outlet for controlling the passage of fluid from one chamber to the other, which control valve comprises a cylindrical member having two parts of different external diameters and a passage therethrough through which fluid can flow and which establishes communication between the opposite ends of the said parts, a spring acting on the valve, and means for by-passing liquid from the chamber containing the piston when the control valve is closed, substantially as described.

2. In fuel pumps, the combination of a plunger, a piston of larger diameter than the plunger, separate chambers containing the plunger and piston and arranged in communication with each other, a passage between the chambers, a control valve for controlling the passage of fluid from one chamber to the other, which control valve comprises a hollow cylindrical member having two parts of different external diameters and subject at both ends to fluid pressure in the pump outlet, a supplementary valve arranged to control the passage between the chambers containing the piston and plunger, a lever for transmitting motion to the supplementary valve from said cylindrical member, a spring acting on the supplementary valve so as to oppose motion of the cylindrical member under fluid pressure, and means for by-passing liquid from the chamber containing the piston when the control valve is closed, substantially as described.

LOUIS COATALEN.