

Sept. 22, 1931.

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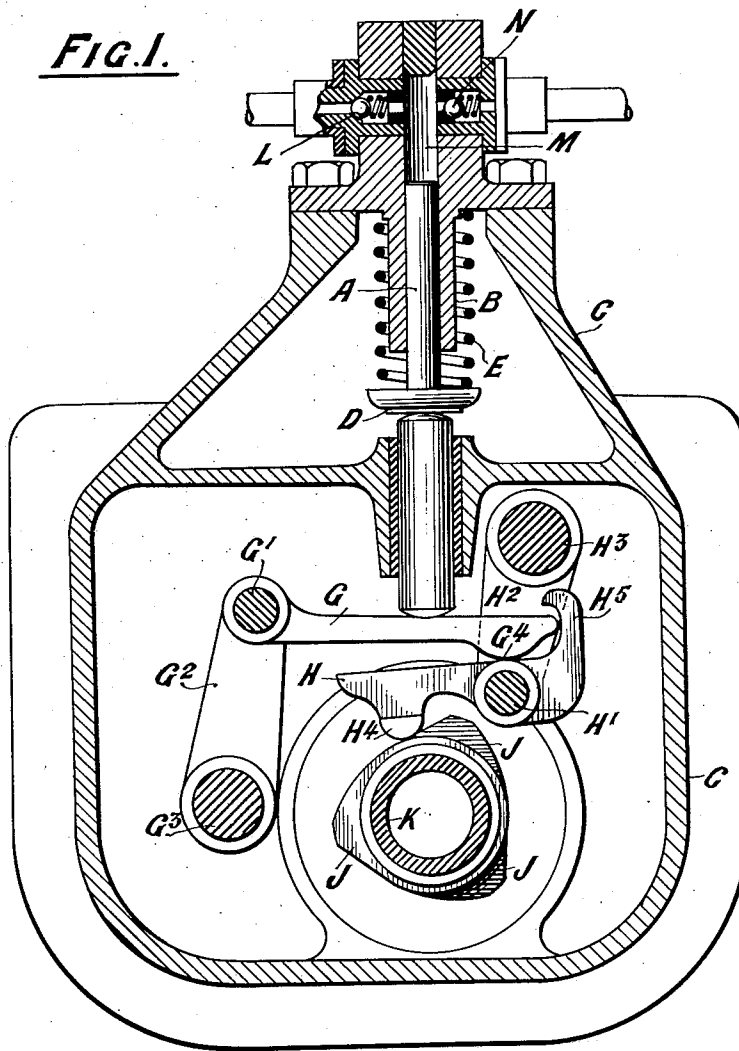
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FUEL PUMP

Filed Dec. 16, 1929

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FIG. 1.



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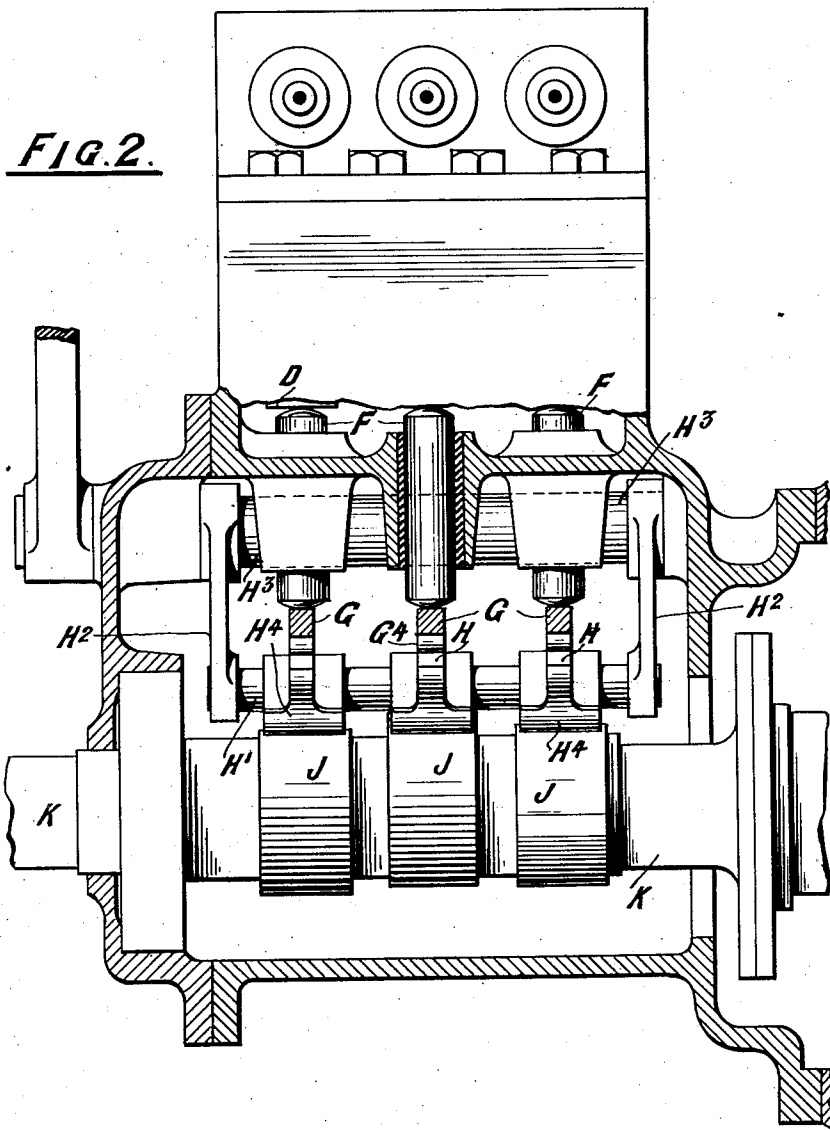
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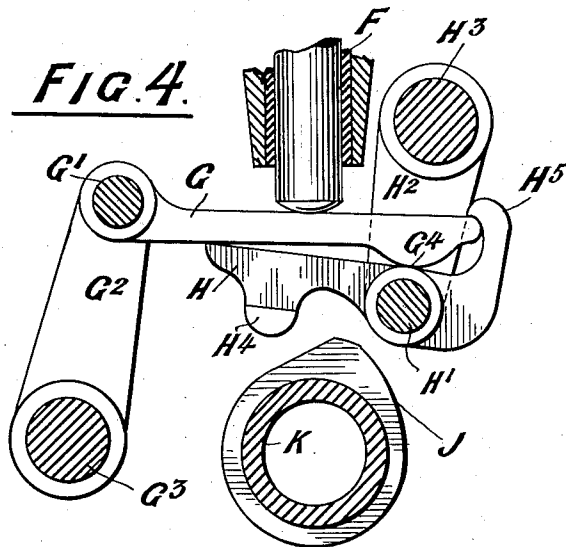
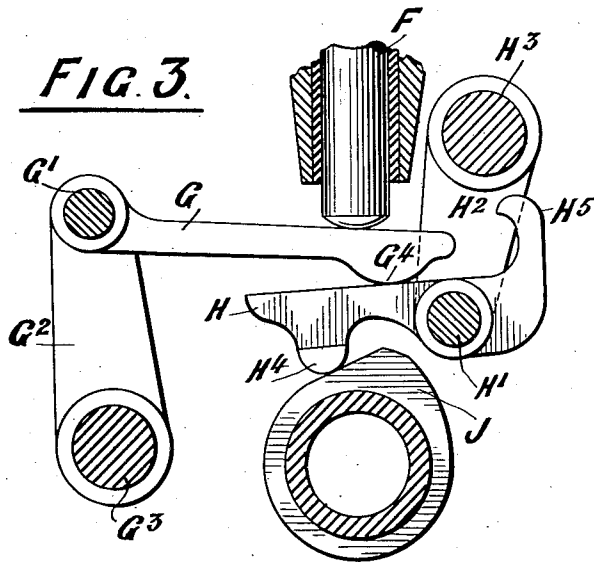
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UNITED STATES PATENT OFFICE

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FUEL PUMP

Application filed December 16, 1929, Serial No. 414,514, and in Great Britain January 18, 1929.

This invention relates to improvements in pumps for the supply of fuel to internal combustion engines, and is particularly suitable for use in internal combustion engines of the type in which the fuel is sucked through a valve by the outward stroke of a plunger and is expelled by the plunger on its return stroke through another valve to the atomizer. The invention is of particular service in Diesel and like engines burning heavy oils.

The object of this invention is to provide means for operating the plungers of pumps of this kind, in which all lag and backlash are minimized or eliminated, and in which the timing of the charge and regulating the quantity of the charge admitted at each stroke may be controlled without dismantling the pump and may be effected during the running of the pump without stopping the engine.

According to this invention, the plunger of the pump for injecting the oil is operated through mechanism in which no blows or taps are struck, and in which throughout the entire engine cycle, the plunger, the intermediate connections, and the cam by which the plunger is operated, are maintained in close elastic contact with each other.

In carrying the invention into effect, the plunger reciprocates in a casing with which two non-return valves communicate, one for admitting the fuel and the other for permitting of the discharge of the said fuel to the atomizer. The plunger is resiliently pressed outwards by a suitable spring or springs and is forced into the casing in the opposite direction by positive mechanical means such as by cam action. The outer end of the plunger contacts with a slide or spindle movable in the direction of the axis of the plunger. The other end of such slide or spindle contacts with the surface of a lever, the pivot of which is adjustable to control the amount of the charge of fuel to be admitted to the casing. The said lever also contacts with a rocking finger, the pivot of which is adjustable to

control the timing of the admission of the charge of fuel. The finger also contacts with a cam mounted on a cam shaft driven by the engine.

The regulation of the timing of the charge is effected by adjusting the finger in its position in the cycle described by the cam, so as to advance or retard the movement when the shoulder of the cam contacts with and operates the finger. The regulation of the amount of the charge to be admitted is effected by adjusting the position of the pivot of the lever so as to alter the position of its contact with the slide and with the finger and thus alter the length of the stroke imparted to the plunger. These adjustments of the lever and finger are effected by adjusting their centres of oscillation transversely to the plane containing the axes of the plunger, spindle and cam shaft. The adjustments of the lever and finger have mutual influence on each other, and it may be necessary in order to adjust one, to make appropriate adjustment in the position of the other.

In order that the invention may be clearly understood, an example of construction of a pump made in accordance with this invention is illustrated in the accompanying drawings. Such example illustrates a three-plunger pump adapted to be used with a three-cylinder engine, and is shown in cross section at Figure 1 and in longitudinal section at Figure 2.

Figures 3 and 4 are detailed views illustrating the effect of adjustments of the lever and finger on the spindle or extension of one of the plungers.

In the drawings, A is a plunger reciprocating in the bearing B formed in the lid of a closed casing C and forming a plunger pump. The said plunger is formed with a flange or shoulder D for receiving a compression spring E which tends to keep the plunger A in an outward position. F is a slide against the end of which the plunger A

is pressed by the spring E. The slide F is most conveniently formed by a cylindrical spindle, but may consist of any other suitable slide which is free to move in the axial direction of the plunger A; or the plunger A may be extended and itself take the place of the said slide F. The opposite end of the slide F contacts with a lever G which is pivoted on a spindle G^1 carried on arms G^2 (one of which is seen at Figure 1) and which are carried by a rocking shaft G^3 . H is a rocking element in the form of a movable finger pivoted on a spindle H^1 carried on arms H^2 which are carried by a rocking shaft H^3 . By rocking the shafts G^3 and H^3 , the lever G and the finger H may be adjusted laterally relatively to the slide F. The lever G has a bulbous enlargement G^4 which bears upon the finger H, and the said finger H has a bulbous enlargement H^4 which bears upon a cam J mounted on a shaft K running in gear with the engine. The shaft K in rotating the cam J, which forms the driving element of the pump, causes the finger H to rock, and this rocking movement can be transmitted through the motion transmitting means, consisting of the lever G and also preferably the slide F, to the plunger. When the bulbous portion G^4 of the lever G is located between the spindle H^1 and the bulbous portion H^4 , the spring E not only presses the plunger A against the slide F, and the slide F against the lever G, but it also presses the bulbous portion H^4 of the finger H against the cam J on the shaft K and thus acts as means for maintaining said parts in close elastic contact with each other. By rocking the shaft H^3 , the finger H is given lateral adjustment, thus causing the bulbous portion H^4 to advance or retard its position relatively to the cam J, and thus advance or retard the action of the plunger A. Rocking of the shaft G^3 , gives lateral adjustment to the lever G, and thus adjusts the position of the bulbous portion G^4 of the lever G to or from the spindle H^1 on which the said finger H rocks. This adjustment in relation to the position in which the finger H is located, adjusts the quantity of throw of the plunger A. L is a spring-pressed non-return valve permitting fuel to enter into the chamber M beyond the plunger A, and N is a non-return valve permitting fuel forced by the plunger A to pass to the atomizer.

The cam acts to reciprocate the pump periodically and due to the form of the cam the reciprocating movement is gradual.

The finger H is provided with a horn H^5 against which the end of the lever G may be thrust when it is desired to throw the pump out of action. This is best seen at Figure 4.

Instead of pivoting the lever G and the finger H on spindles supported on arms carried by rocking shafts, they may be pivoted on other supports sliding or having other trans-

verse adjustment which will permit the proportion of leverage of the lever, and the relation of the finger to the cam, to be adjusted.

In the three-plunger pump seen at Figure 2, the plungers A are each driven by their own cams J. The cams J may be fixed on the shaft K and are preferably made integral therewith. In operation, when the parts are in the position shown at Figure 3, the finger H is held with the bulbous enlargement H^4 in the position in which its cam J will rock the finger H at the required moment. This position is determined by the position given to the spindle H^1 on which the finger H rocks, such position of the spindle H^1 being determined by the angular adjustment given to the shaft H^3 , the end of which extends outside the casing. The rocking of the finger H is communicated to the lever G by the bulbous enlargement G^4 which rests on the finger H, and the amount of the movement given to the said lever G is dependent on the distance at which the bulbous enlargement G^4 is located away from the spindle H^1 on which the finger H rocks. The rocking of the lever G in turn imparts end movement to the slide F. If this end movement of the slide F is found excessive, it may be reduced by angular adjustment of the shaft G^3 which also projects outside the casing. Such angular adjustment, by rocking the arms G^2 , moves the bulbous enlargement G^4 nearer to the centre of the axis of oscillation of the finger H, until if moved to the extent shown in Figure 1, no movement at all would be imparted to the slide F by the rocking of the finger H under the influence of its cam J. Additional further angular movement of the shaft G^3 , shown at Figure 4, rocks the finger H into an inoperative position where the bulbous enlargement H^4 is not operated on by the cam J.

It will be readily understood that the bulbous enlargements of both the lever G and the finger H may be of roller bearing type.

What we claim as our invention and desire to secure by Letters Patent is:—

In a liquid fuel supply for internal combustion engines, the combination of a plunger pump, a cam, a cam rocked element having a cam engaging arm at one end and an upstanding horn at its other end and a plunger rocking element, said elements being mounted on pivots which are remote from each other, the cam engaging arm of the cam rocked element bearing on the cam and the free end of the plunger rocking element bearing at one side on the cam rocked element, and at its other side against the plunger, means for laterally adjusting the cam rocked element so as to vary the timing of the plunger with respect to the cam, and means for laterally adjusting the plunger rocking element from a position in which its free end engages with the upstanding horn to move the cam rocked element off the cam, when movement of the plunger is

stopped, to a position away from the horn so
as gradually to increase the amount of move-
ment imparted to the plunger as the free end
of the plunger rocking element becomes dis-
5 tanced from the upstanding horn and gradu-
ally to decrease the amount of movement of
the plunger as the free end approaches the
upstanding horn.

10 In witness whereof we have hereunto set
our hands.

MAURICE ORMONDE DARBY.
ARTHUR ALEXANDER SIDNEY.

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