Jan. 7, 1930. F. N. NUTT 1,742,779

FUEL PUMP

Filed June 22, 1928

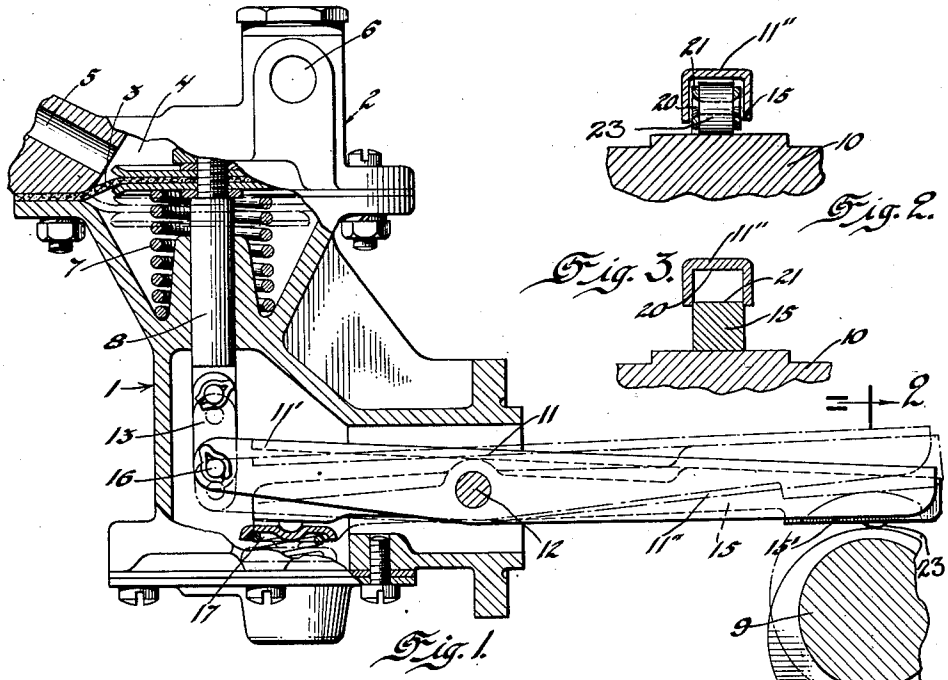


Fig. 1.

Fig. 2.

Fig. 3.

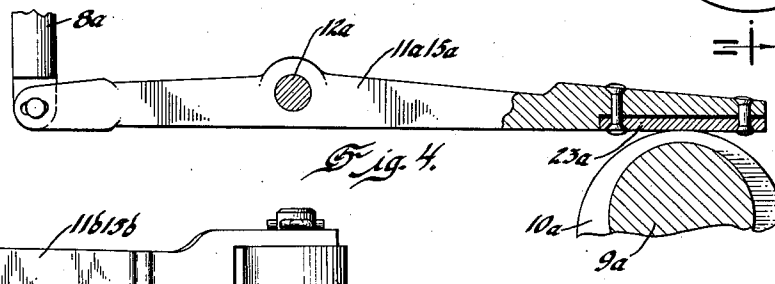


Fig. 4.

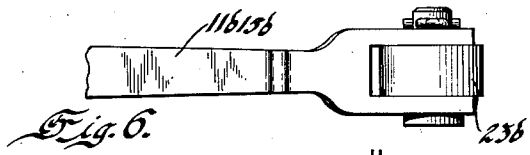


Fig. 6.

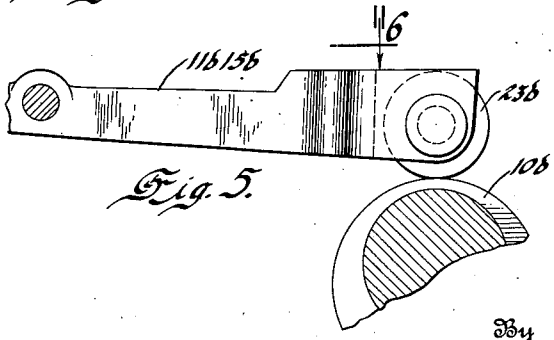


Fig. 5.

Inventor
Frank N. Nutt

By Blackmore, Spencer & Fleit

Attorneys

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UNITED STATES PATENT OFFICE

FRANK N. NUTT, OF FLINT, MICHIGAN, ASSIGNOR TO A C SPARK PLUG COMPANY, OF FLINT, MICHIGAN, A COMPANY OF MICHIGAN

FUEL PUMP

Application filed June 22, 1928. Serial No. 287,623.

This invention relates to variable stroke fuel pumps suitable for use, upon automotive vehicles and elsewhere, in connection with internal combustion engines; and it is a particular object of this invention (greatly reducing or entirely dispensing with thrust-refusing linkages or similar intermediate means for the transmission of motion from an oscillatory lever to a pressure-responsive reciprocatory pumping element) to provide such pumping elements with novel actuating means, suitable for direct interposition between a reciprocating or rotating engine part (such as a cam) and a diaphragm stem, a plunger rod, or the like,—said actuating organization comprising a lever or interfitting levers and some special contact member, as hereinafter described.

In a preferred embodiment of this invention, said actuating organization may include a channel-shaped or outer lever and an interfitting lever, the former being connected with a diaphragm stem or the like, and the latter being so engaged by said eccentric or cam as substantially to avoid contact noises,—said levers being optionally provided with a common pivot.

Although the present invention is herein described with particular reference to a diaphragm pump having substantially the general character of that claimed in a pending application of Abraham M. Babitch, Serial Number 123,370, filed July 19, 1926, it should be understood that the principles of this invention are believed to be applicable to other reciprocatory pumps in which provision may be made for the use of resilient means to effect an expulsion stroke of the pumping element, the intake stroke thereof being variable in length and so effected, through the mentioned novel actuating means, as to diminish as pressure is built up within a pump chamber.

Other objects of this invention, all forms of which may involve the use of at least one lever and a special contact member, may be best appreciated from the following description of illustrative embodiments thereof, taken in connection with the appended claims and the accompanying drawings.

Figure 1 may be referred to as substantially median section, showing parts of a pump illustrating one embodiment of the present invention.

Figure 2 is a detail cross-sectional view taken substantially as indicated by the line 2—2 of Figure 1.

Figure 3 is a view similar to Figure 2 but showing the parts in different relative positions and omitting an optional roller.

Figure 4 is a fragmentary view corresponding to a lower portion of Figure 1 but showing a modified or alternative form, with parts broken away, parts in section, and parts in elevation.

Figure 5 is a view corresponding to the right-hand portion of Figure 1 or Figure 4, but showing a further modification;

Figure 6 is a view comparable to Figure 5 but taken substantially as indicated by the arrow 6 of Figure 5.

Referring first to conventional parts of the fuel pump illustrated, a main structural element in the form of a body casting 1 and a subsidiary element in the form of a cover casting 2 are shown as co-operating in the retention of a flexible diaphragm 3,—adapted to serve as a reciprocatory pumping element by varying the cubic contents of a pump chamber 4, which may be provided in the cover casting 2. The cover casting is provided with a valved inlet passage 5 and with a valved outlet passage 6; resilient means in the form of a compression spring 7 tend constantly to effected expulsion strokes of the diaphragm 3; and intake strokes thereof may be effected through means such as a flexible or inflexible but substantially inextensible tension-transmitting member such as a diaphragm stem 8.

Reciprocatory or rotating means such as a revolving shaft 9, provided with a cam or eccentric 10, may serve incessantly to rock at least one member of a novel actuating or rocker arm assembly to be next described with a view to its protection herein, said assembly preferably comprising an outer lever 11 (oscillable upon a pivot 12, to impart intake strokes to the diaphragm 3,—as by means of a pin-and-slot connection or a link 13) and comprising also some form of contact element for engagement by a cam or the like.

The mentioned rocker arm assembly is shown as including, in addition to the outer lever member 11, channel shaped in cross-section, an inner and co-operating lever member 15,—this latter lever being of suitable dimensions to interfit in said outer lever with little or no friction. The levers 11 and 15 are shown as so shaped as to be conditionally capable of independent movement upon the pivot pin 12, the inner lever 15 being so cut away, as compared with the inner surface of the lever 11, as conditionally to provide for any lost motion required during such times as pressure within the chamber 4 holds the diaphragm 3 in its lowermost position, said levers co-operating variably to transmit pumping motion at other times. An "outer" end 15′ of the inner lever 15 may be provided with, or shaped to qualify said lever as, a contact element in intermittent or constant contact with the eccentric or cam 10,—against which it may be resiliently held by such means as a spring 17, shown as engaging the other (inner) end of said lever. An inner end 11′ of the channeled-shaped outer lever 11 being shown as connected to rod or stem 8 by means of the mentioned link 13, an inner surface of the outer end 11″ of the lever 11 is adapted conditionally to be engaged by an upper surface 21 of the end 15′ of the inner lever 15, the duration of such contact and the stroke imparted thereby being dependent upon the extent to which pressure may be built up within the pump chamber, the use of a single pivot pin for both of the mentioned levers being optional.

As may be seen from the foregoing, the operation of a pump of the described character, when used upon an engine, is such that whenever the usual needle valve, or its equivalent, is closed by means such as the usual float within a float chamber (none of the last mentioned parts being shown) if the carburetor requires no fuel, the diaphragm 3 may remain in substantially its lowermost or dotted line position after having been pressed thereto against the tendency of a calibrated spring 7. In this situation, the outer end 11″ of the outer lever 11 may swing upwardly into a position obviating its engagement by the lever 15,—incessantly reciprocating under or against the pressure of spring 17. The relative position occupied by the lever 11, when thus rendered exempt from the continued rocking of arm 15 is indicated by dot-and-dash lines in Figure 1 and by full lines in Figure 3.

Assuming now that the mentioned needle valve is opened by the descent of the float in the carburetor to meet a requirement of more fuel, such fuel will be forced out of the pump chamber 4 by the diaphragm as the latter is urged upward by spring 7,—such upward movement being permitted only to the extent of the amount used by the carburetor and the consequent diminution of pressure in the pump chamber. As the outer end 11″ of the lever 11 is thus brought within the path of the contact portion 15′ of the lever 15, any upward movement of the diaphragm 3, or its equivalent, thus enables the lever 15 to pick up the lever 11 during some portion of each stroke, and to thereby move the diaphragm invariably to its lowermost position so long as said diaphragm is again upwardly returned by the spring 7. The effect of the incessant rocking of lever 15 is thus limited by the distance that the diaphragm can travel upward.

That is to say, as suggested by dotted lines in Figure 1, whenever the end 11′ of the lever 11 has been partially lifted by the pressure applied to lift the diaphragm 3 to a position midway its maximum range of movement, then, during each reciprocation of the end 15′ of lever 15 it will separate from and again pick up the member 11″, moving the same through only a partial stroke.

The extent of upward reciprocation of the diaphragm from that lowermost position in which it may be held inactive thus depends roughly upon the amount of fuel used; and as the speed of the engine increases the stroke of the diaphragm may gradually decrease by reason of excess of fuel pumped over that used. Very simple and effective means are thus provided for automatically varying the amount of lost motion to maintain a predetermined amount of fuel under a predetermined pressure. Elimination of noises such as might otherwise be caused by the successive contacts of the engaging ends 11″ and 15′ of the levers 11 and 15 may be effective by the interposition of any suitable additional cushioning elements (not shown); but it is satisfactorily accomplished by the action of a mere oil film, such as will automatically accumulate from the crank case and will act by entering between the favorably shaped and disposed surfaces 20 and 21 of relatively movable elements such as 11 and 15, incidentally lubricating mentioned bearings and also a roller 23, if provided.

In Figure 4 is shown a modified form in which a single lever 11^a 15^a, directly actuated by an eccentric 10^a upon a shaft 9^a, may be pivotally connected to a diaphragm stem 8^a. In this form, a pin-and-slot connection being suggested, the amount of "lost motion" may depend entirely upon the position of the diaphragm 3. The lever may separate from the eccentric or cam 10^a; but the latter will always pick it up to return the diaphragm to its lowermost position unless and until the pressure built up in chamber 4 holds said diaphragm down. A noise-obviating contact shoe 23^a, formed of suitable non-resonant material (such as, for example, leather or a wear resistant fibrous composition) may be movably riveted or otherwise secured at or near

the "outer" end of the lever 11^a 15^a, assumed to be rigid,—the usual spring (shown at 17 in Figure 1) being optionally dispensed with. This construction permits a variable film of oil to enter between the lever and the mentioned contact shoe, in the same general manner as is above described.

In Figures 5 and 6 there is shown a further modified or alternative form, this alternative being similar to that shown in Figure 4 with the exception that a noise-obviating organization including a cam-engaging roller 23^b is shown as provided upon the levers 11^b 15^b for continuous or intermittent engagement by the eccentric 10^b.

In conclusion, it should be understood that the levers 11^a 15^a, 11^b 15^b may either be separately used or so formed as to permit the use thereof as inner levers, an outer lever comparable with the lever 11 and resilient means comparable with the spring 17 being optionally employed in conjunction therewith; and that although the foregoing description includes but one complete embodiment of this invention, alternative combinations being suggested, numerous additional modifications might easily be devised without involving the slightest departure from the spirit and scope of this invention as the same is indicated in the accompanying drawings and the appended claims.

I claim:

1. For use in imparting variable intake strokes from an incessantly driven part having a uniform throw to a reciprocable pumping element having a tension-transmitting member attached thereto: a composite actuating assembly including a lever element connected with said tension-transmitting member; and a noise-obviating contact element, movably connected with but variably separate from said lever and conditionally imparting movement thereto from said driven part when upwardly advanced,—said elements being shaped and disposed favorably to the entrance of an oil film therebetween, for a noise-obviating effect.

2. For use in imparting variable intake strokes from a part having a uniform throw to a reciprocable pumping element having a tension-transmitting member attached thereto: a composite actuating assembly including a lever connected with said tension-transmitting member, and a noise-obviating contact element movably connected with said lever and conditionally imparting movement thereto from said driven part,—said noise-obviating element comprising a second lever variably separable from the mentioned lever and opposed surfaces of said levers being shaped and disposed favorably to the entrance of an oil film therebetween, for a noise-obviating effect.

3. For use in imparting variable intake strokes from a driven part to a reciprocable pumping element having a tension-transmitting member attached thereto: a composite actuating assembly including a lever connected with said tension-transmitting member, and a noise-obviating contact element variably separable from said lever and engageable by said driven part, said noise-obviating element comprising a second lever pivoted relatively to said first-mentioned lever,—said levers providing surfaces which are opposed favorably to the entrance of a variable noise-obviating film therebetween.

4. For use in imparting variable intake strokes from an incessantly driven part having a uniform throw to a reciprocable pumping element having a tension-transmitting member attached thereto: a composite actuating assembly including a lever connected with said tension-transmitting member, and a noise-obviating contact element movably connected with said lever and engageable by said driven part,—said noise-obviating element comprising a second lever pivoted for movement relatively to said first-mentioned lever.

5. For use in imparting variable intake strokes from a driven part to a reciprocable pumping element having a tension-transmitting member attached thereto: a composite actuating assembly including a lever connected with said tension-transmitting member, and a noise-obviating contact element pivotally connected with said lever and engageable by said driven part,—said noise-obviating element comprising a roller on a lever and mentioned parts being shaped and disposed favorably to the variable entrance of a noise-obviating film therebetween.

In testimony whereof I affix my signature.

FRANK N. NUTT.