

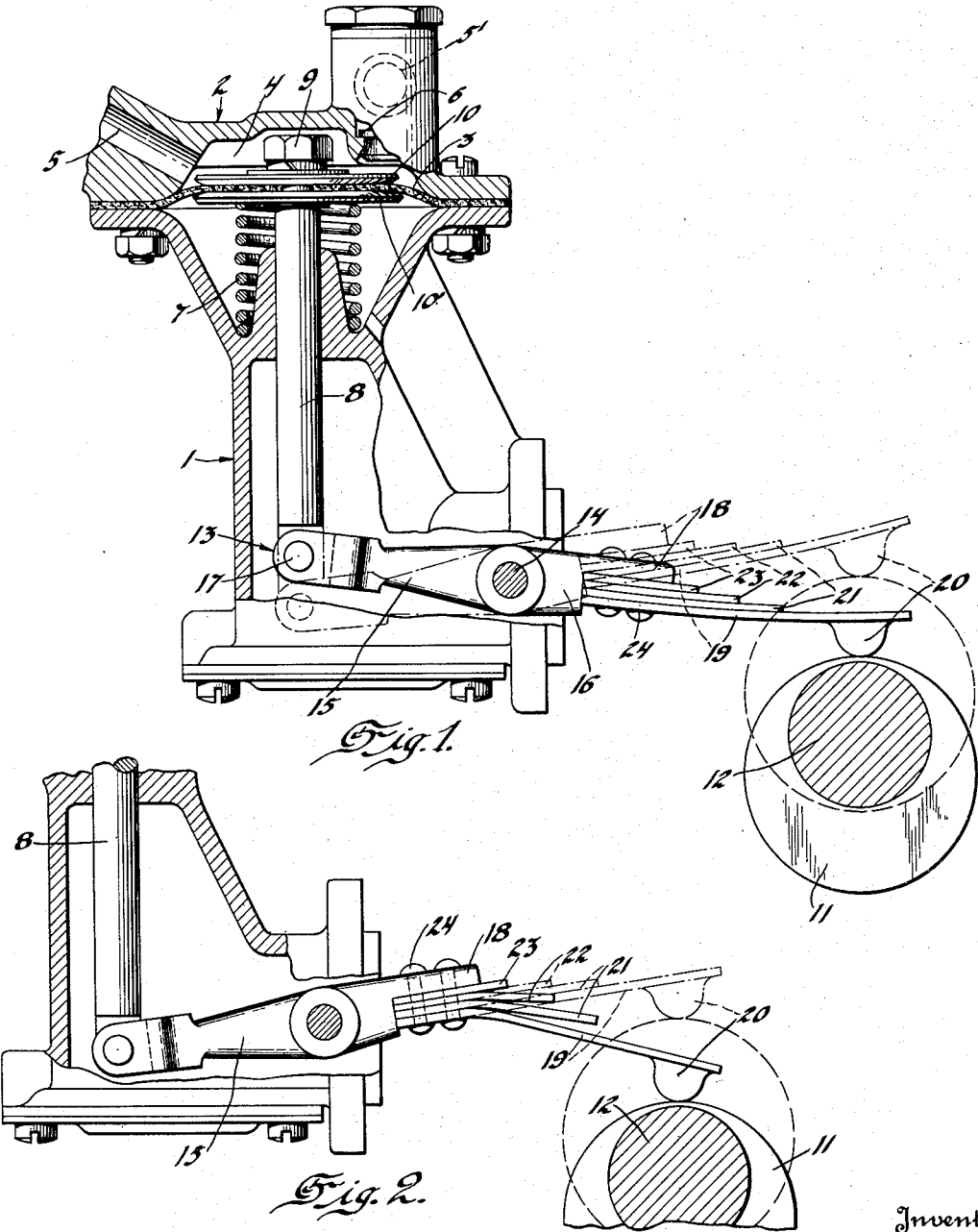
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VARIABLE STROKE FUEL PUMP

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VARIABLE-STROKE FUEL PUMP

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This invention relates to variable stroke fuel pumps suitable for use upon automotive vehicles, or elsewhere in connection with internal combustion engines or the like; and it is a particular object of this invention, in a preferred embodiment thereof, dispensing with any linkage or similar thrust-refusing intermediate means for the transmission of motion from an oscillatory lever, or the like, to a pumping element, to provide a novel and conditionally rigid lever or rocker arm, suitable for use between a reciprocatory or rotating part and a pump diaphragm stem, or the like—said lever comprising a conditionally resilient arm or section which includes a part that may so constantly engage said reciprocatory or rotating part (as, an engine crankshaft) as substantially to avoid contact noises.

Although the present invention is herein described with particular reference to a diaphragm pump similar to that described and claimed in a pending application of Abraham M. Babitch, Serial No. 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 is made for the use of resilient means to effect expulsion strokes, the intake strokes thereof being variable in length and being effected through the mentioned resilient arm or a like part and being diminished in length as pressure is built up within a pump chamber; and it is a particular object of this invention to provide pump operating means which may not only obviate avoidable noises, such as are incidental to the operation of known types of thrust-refusing intermediate mechanism, but also substantially obviate all necessity for any rocking of the mentioned lever, or its equivalent, after a sufficient pressure has been built up within a pump chamber.

Other objects of this invention, most or all forms of which may involve the use of a lever or a rocking or other reciprocatory member which becomes increasingly inflexible as increased pressures are applied to an initially resilient part thereof, may be best appreciated from the following description

of an illustrative embodiment of said invention, taken in connection with the appended claims and the accompanying drawings.

Fig. 1 may be referred to as a substantially median section through one fuel pump illustrative of this invention.

Fig. 2 is a partial view corresponding to the lower portion of Fig. 1, but showing a condition and relationship of parts that may result from the building up of a pressure within a pump chamber.

Referring first to conventional parts of the fuel pump selected for purposes of illustration, 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 cooperating 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. This chamber is shown as provided in the cover casting 2, and said cover casting may be provided with a valved inlet passage 5 and an outlet passage 5', shown as valved at 6. Resilient means in the form of a compression spring 7 may tend constantly to effect expulsion strokes of the diaphragm 3; and intake strokes may be imparted thereto through a flexible or inflexible but substantially inextensible tension-transmitting element such as a slidable rod or so-called diaphragm stem 8,—which may be rigidly connected with the diaphragm 3 or other reciprocatory pumping element by means such as a nut 9 and oppositely concave clamping elements or plates 10 and 10'.

A cam 11 upon a shaft 12 (which may be, for example, a crankshaft, or a camshaft, or the like) is intended as representative of any reciprocating or rotating part having a suitable throw, whether uniform or variable, indirectly to impart reciprocatory movement to the rod or stem 8; and the present invention should be understood to relate particularly to the structure and use of a novel actuating element, (shown as an oscillatory lever 13 comprising a resilient part) and a member, such as the rod or stem 8, attached to a reciprocable but pressure-responsive pumping element. For example, the actuat-

ing lever 13, shown as pivoted at 14 to the casting 1, may comprise a rigid inner arm 15 and a composite outer arm 16. A pin-and-slot connection being indicated at 17, the outer and composite arm 16 is shown as comprising a rigid part 18 and a flexible part including a leaf spring 19, optionally provided with a contact shoe 20,—the result being a lever which is substantially rigid under certain conditions and notably resilient under other conditions.

As best indicated in Fig. 2, the resilient part 19, or its equivalent, is intended, in the illustrated embodiment of the present invention, to be so biased toward an angular relationship to the longitudinal axis of the arm 15, that, the leaf 19 being adapted to serve as a spring finger, the contact shoe 20, if employed, may constantly engage the cam 11,—even at times when a pressure built up within the pump chamber 4 may hold the rod or stem 8 in such a depressed position as to render the rotation of cam 11 temporarily ineffective to impart further reciprocatory movement thereto.

This construction obviates contact noises; and unless the part 18, assumed to be substantially rigid, is of such length as finally to be completely contacted or pressed upon by the free end of the spring finger 19 (as, when the longitudinal axis of the latter is brought into substantial parallelism with the longitudinal axis of the arm 15) in order to render the composite arm 16 substantially unyielding and highly efficient for a pumping effect during those periods of normal operation in which the reciprocatory pumping element 3 is desired to receive a full stroke (the pressure within the chamber 4 being then insufficient to hold said pumping element depressed) additional bent and stepped leaf springs or spring sections may be interposed, as suggested by 21, 22 and 23, between the mentioned spring 19 and the rigid part 18,—means such as rivets 24 being employed to hold the mentioned parts in their intended relationship.

It will be understood that, even if rigidly attached to a reciprocatory pumping element, the rod or stem 8 need not be restricted to rectilinear sliding movement such as to occasion use of a pin-and-slot connection with the lever 13; but the spring 7, or equivalent resilient means for effecting expulsion strokes, is intended in all cases to be of sufficient strength to overcome the conditional resiliency of the arm 16, or its equivalent,—moving the flexible parts thereof into such a relationship that, as by reason of actual contact between the respective leaves 19, 21, 22 and 23, said composite arms may function as if rigid, and substantially as implied by the showing in Fig. 1.

When, however, such a pressure is built up within the chamber 4 as to overcome the spring 7, or its equivalent, the arm 15 of the

actuating element 13 (assuming this to be a lever) may be moved toward and kept in such a depressed position as to result in a separation of some or all of the leaves 19, 21, 22, but without causing a separation of the contact shoe 20, if employed, from the cam 11. As soon as the pressure within the chamber 4 drops, it will be understood that some or all of the spring leaves 19, 21, 22 and 23 may again be brought into mutual contact; and the composite arm 16 may again function as if rigid, substantially as suggested in Fig. 1.

It will be noted that, so far as concerns the described mode of operation, either or both of the arms 15, 16 of the actuating element 13, assuming the latter to have the form of a lever, may be composite and conditionally rigid, increasing in rigidity under increasing upward pressure at the free end or ends thereof; that the use of separate spring leaves, bent to different angular relationships to the axis of the rigid arm 15 and varying in length is essentially a preferred mode of providing a slap-preventing spring finger 19, or its equivalent, with graduated reinforcement; that contact shoe 20, if provided, may or may not be integral with the spring finger 19; and that all embodiments of this invention have, as compared with the usual collapsible linkage systems, or the like, the advantage that they require only one pivotally movable member and but few additional parts, these being compactly arranged, no separate spring being needed beneath the lever 13, and both strokes of the described pump being effected by or through resilient means.

Although the foregoing description includes a description of but one complete embodiment of the present invention, it should be understood that numerous modifications of this invention might easily be devised, without involving the slightest departure from the spirit and scope of this invention.

I claim:

1. In a fuel pump comprising a reciprocatory pumping element which is provided with resilient means for conditionally effecting expulsion strokes thereof: a tension-transmitting element attached to said pumping element; and an actuating lever adapted normally to impart intake strokes to said attached element, said actuating lever comprising a resilient part so reinforced as to increase in rigidity under pressure.

2. In a fuel pump comprising a reciprocatory pumping element which is provided with resilient means for conditionally effecting expulsion strokes thereof: a tension-transmitting element attached to said pumping element; and an actuating lever adapted normally to impart intake strokes to said attached element, said actuating lever comprising a resilient part which increases in

rigidity under pressure, and becomes substantially rigid in normal pumping operation.

3. A fuel pump comprising: a reciprocable pumping element provided with resilient means for effecting expulsion strokes thereof and with an attached handling element; and an actuating lever, for said handling element, comprising a spring finger adapted constantly to engage a moving part and provided with graduated reinforcing means to increase the rigidity thereof upon the application of increasing pressures thereto.

4. A fuel pump comprising: a reciprocable pumping element provided with resilient means for effecting expulsion strokes thereof and with an attached handling element; and an actuating element, for said handling element, comprising a spring finger adapted constantly to engage a moving part and provided with graduated reinforcing means to increase the rigidity thereof upon the application of increasing pressures thereto,—said actuating element having the form of a lever provided with a substantially rigid arm which is pivotally connected with said handling element and also with a composite arm which includes said spring finger.

5. A fuel pump comprising: a reciprocable pumping element provided with resilient means for effecting expulsion strokes thereof and with an attached handling element; and an actuating element, for said handling element, comprising a spring finger adapted constantly to engage a moving part and provided with graduated reinforcing means to increase the rigidity thereof upon the application of increasing pressures thereto,—said actuating element having the form of a lever provided with a substantially rigid arm which is pivotally connected not only with said handling element but also with a composite arm which includes said spring finger and also includes a stepped series of leaves bent to different angular relationships to the rigid arm and constituting said graduated reinforcing means.

6. A pump comprising: a reciprocable pumping element having a handling element attached thereto; and a lever comprising a conditionally resilient arm and operatively connected with said handling element.

In testimony whereof I affix my signature.
JOSEPH ZUBATY.

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