

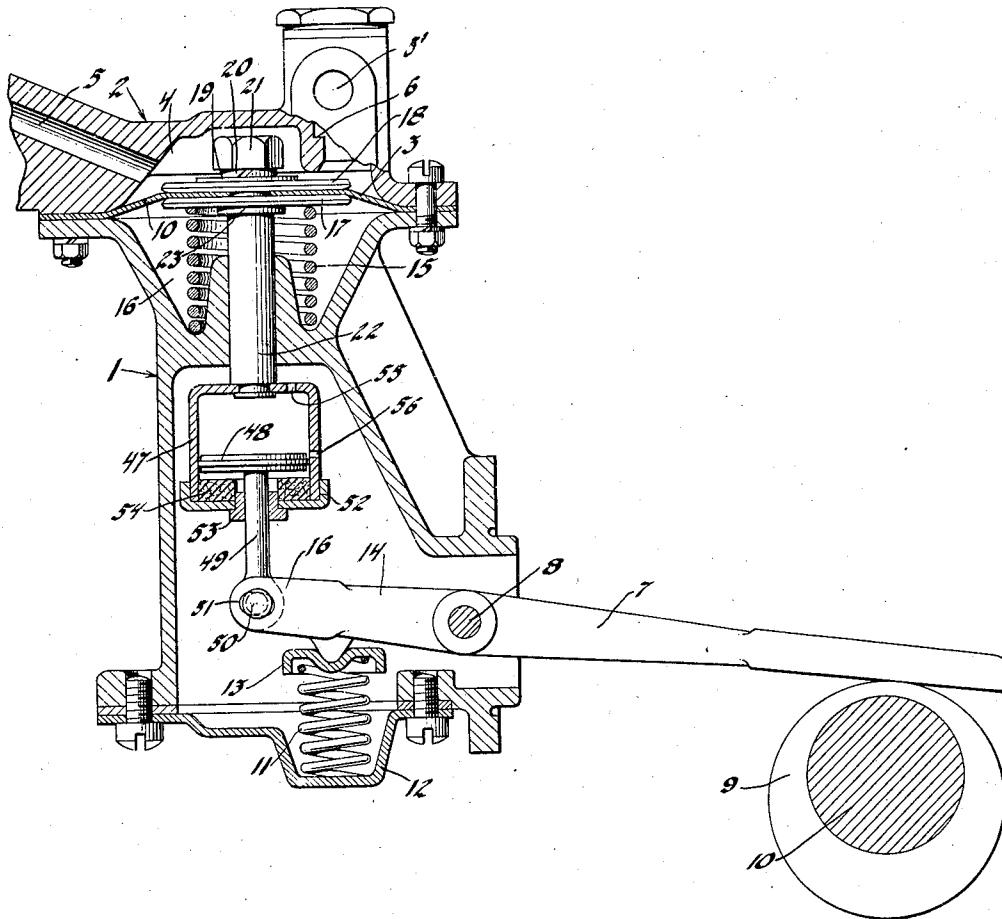
March 4, 1930.

J. ZUBATY

1,749,367

ACCELERATING MEANS FOR FUEL PUMPS

Filed June 18, 1928



Inventor
Joseph Zubaty

By *Blackmore, Spencer & Flint*
Attorneys

UNITED STATES PATENT OFFICE

JOSEPH ZUBATY, OF FLINT, MICHIGAN, ASSIGNOR TO A C SPARK PLUG COMPANY,
OF FLINT, MICHIGAN, A COMPANY OF MICHIGAN

ACCELERATING MEANS FOR FUEL PUMPS

Application filed June 18, 1928. Serial No. 286,361.

Although the present invention is referred to as providing accelerating means for fuel pumps, it should be understood that said invention relates more particularly to fuel pumps such as are currently employed, upon automotive vehicles and elsewhere, in connection with internal combustion engines; and that it is a particular object of this invention to provide simple and unique intermediate means insuring efficiency in the transmission of motion, at high speeds, from a pump actuating element, such as any suitable rocker arm or oscillating lever, to a pumping element such as a flexible diaphragm,—said intermediate means being incapable of transmitting thrust at slow or “normal” speed but increasingly capable of such transmission at higher speeds.

Although the present invention is herein described with particular reference to a diaphragm pump having somewhat the general character of that claimed in a pending patent application by Abraham M. Babitch, Serial Number 123,370, filed July 19, 1926, 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 conditionally to effect the expulsion strokes of the pumping element, the intake strokes thereof being positively effected but variable in length,—diminishing as pressure is built up within a pump chamber; and it is a particular object of this invention to provide intermediate means in the form of a sectional piston capable of alternative uses and including a dash-pot organization so interposed that the thrust-transmitting capacity of said intermediate means, and therefore the resultant stroke, increases with increase in rate of operation.

Other objects of this invention, all forms of which may involve the use of interfitting and relatively reciprocable parts between which air is so confined as ordinarily to be slowly released under pressure, said parts typically including a cylinder and a piston respectively connected to a diaphragm stem, or the like, and to an actuating lever, or the like, may be best appreciated by the following description taken in connection with the ap-

pended claims and the accompanying drawings.

The drawing may be referred to as a median vertical section of a fuel pump illustrating the principles of the present invention.

As 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, provided in cover casting 2. The cover casting may include not only a valved inlet passage 5 but an outlet passage 5', valved at 6; and an actuating element such as a rocker arm or lever comprising an outer section 7 may be pivoted at 8 to the main casting 1 in such manner as to be engageable by some cyclically moving part of an engine,—such as, for example, a cam 9 upon a cam shaft or a crank shaft 10. Means such as a compression spring 11, interposed between a cupped disc 12 (shown as secured to the bottom of the main casting 1) and an oppositely cupped disc 13, engageable by an inner end or arm 14 of the mentioned lever, may be employed resiliently and constantly to hold the outer end of said lever in engagement with the cam 9 or any other suitably rotated or reciprocating part; and the diaphragm 3, or its equivalent, may be provided with pressure-responsive means such as a calibrated compression spring 15, within a chamber 16, to impart expulsion strokes thereto, and it may be suitably secured (by means such as oppositely cupped discs 17 and 18, washers 19, 20 and a nut 21) to a threaded attachment member 22 in the form of a slidable rod or diaphragm stem provided with a shoulder 23.

In explanation of the novel intermediate means which are next to be described as interposed between the actuating arm 14, or its equivalent, and the diaphragm attached element 22, it will be noted that, as the speed of the engine comprising shaft 10 increases, the output of this pump, unless influenced by pressure built up within chamber 4, may keep

step therewith until a critical point is reached in the speed of reciprocation. At the latter speed, the action of the spring 15 may become insufficient, said spring acting somewhat sluggishly by reason of its having been calibrated with reference to a slower speed regarded as normal. To add to or replace the action of the spring 15 in pumps during operation thereof at high rates of speed, a self-rigidifying pitman, shown as comprising a dash-pot organization, is interposed between the diaphragm stem 22, or its equivalent, and any actuating element such as the inner end 14 of the mentioned lever,—said dash-pot organization displacing, and serving at ordinary speeds as the equivalent of, the usual collapsible linkage or other parts which are incapable of transmitting any thrust at any time.

A preferred arrangement for the purpose here referred to may consist of a cylinder 47, suitably secured (as by welding or swaging) to the diaphragm stem 22, and a piston 48 adapted for reciprocatory movement in said cylinder,—said piston being provided with a rod or stem 49 suitably connected (as by a pin-and-slot connection) with a fork provided upon the "inner" end 14 of the mentioned actuating lever. A pin 50 may be loosely journaled through elongated slots 51 in the legs of the mentioned fork of the rocker arm, so as to take up or allow for an arcuate motion of the rocker arm 14 due to the pivoting of the latter at 8. A suitable cover or closure element 52, shown as having flanges and as receiving a bearing bushing 53, may be provided with a flexible washer 54, formed of any suitable resilient material adapting it to act as a cushion for the piston 48. At the top of the cylinder 47 is shown a pore or opening 55, and near the lower end of said cylinder there may be provided a second pore or opening 56,—these pores being adapted for the ingress and egress of air under pressure of the piston 48 and being calibrated or standardized with reference to the intended rate of movement of air therethrough under given conditions.

As to operation, the result of the foregoing construction is that so long as a pump of the described type is operating at what may be termed "normal" or ordinary speeds, the piston 48 may affect intake strokes upon expelling the air confined therebelow,—drawing the diaphragm or other pumping element downward to (say) about the level of opening 56. The opening 55 may be sufficiently large to allow, at such times, a controlled egress of air during the subsequent upward movement of the piston in the cylinder. This provides the desired lost motion, to obviate undue pressure in the pump chamber 4 as a result of continued rocking of the lever 14.

When, however, the speed of the pump so increases as to pass the "normal" rate of re-

ciprocation with reference to which the spring 15 may have been calibrated, the piston will ordinarily act substantially as an accelerator in that, since the openings 55 and 56 will permit only a gradual escape of air, the piston will increasingly partake of the motion of the cylinder, or vice versa, so that the described dash-pot organization will tend to impart strokes of increasing length until it may be said to act almost like a solid rod between the diaphragm stem and the rocker arm, or equivalent parts,—the action here referred to involving a gradual change, dependent on the speed of the revolving shaft 10, although obviously also dependent upon the dimensions of the respective openings 55 and 56. The opening 56 is preferably placed slightly above the cylinder bottom (whether or not the cushion 54 is dispensed with) so that a quantity of air may be so confined between the piston and the bottom as to serve as an air cushion.

Although the foregoing description has included but one illustrative embodiment of the present invention, including optional features, it will be obvious that numerous additional modifications may be made without involving the slightest departure from the spirit and scope of this invention, as the same is indicated above and in the following claims; and the described pitman, comprising a complete-movement section and a partial-movement coaxial section, is believed to be suitable to alternative uses as an intermediate means gradually increasing in over-all longitudinal rigidity and suitable for a special transmission of motion to effect a thrust-refusing connection at slow speeds and a thrust-transmitting or "accelerating" connection at higher speeds.

Depending upon what working length it may be considered desirable, in a given instance, to give a sectional pitman of the above character, it will be noted that one or the other of a pair of openings, such as the pores 55, 56, or equivalent passages for air, may be made slightly larger than the other (or safety valves, not shown, may be provided) in view of the difficulty of so proportioning any vents that a piston 48 will invariably "float" to and remain near a central zone, as a result of its rapid reciprocation: e. g. pore 56 may be slightly larger than pore 55. But the described pump obviously cannot build up a pressure greater than that required to hold down both the spring 15 and the spring 11, since depression of the latter implies removal of arm 7 of the actuating lever from cam 9.

I claim:

1. In a variable-stroke fuel pump driven by a cyclically moving part: a reciprocable pumping element conditionally movable relatively to a pump chamber; a pump actuating element engageable by said cyclically moving part; and intermediate means there-

between capable of imparting only intake movements to said reciprocable pumping element when running at relatively slow speeds but becoming capable of transmitting expulsion strokes also when running at relatively high speeds.

2. A fuel pump as defined in claim 1 in which said means comprises a cylinder provided with pores respectively near the top and the lower end thereof.

3. In a variable stroke pump driven by a cyclically moving part: a reciprocable pumping element movable relatively to a pump chamber; a pump-actuating element engageable by said cyclically moving part; resilient means for imparting expulsion strokes to said reciprocable pumping element; and motion-transmitting means interposed between said reciprocatory element and said actuating element and including means for increasing the length of the strokes effected therethrough with increase in rate of operation.

4. In a variable stroke pump driven by a cyclically moving part; a reciprocable pumping element movable relatively to a pump chamber; a pump-actuating element engageable by said cyclically moving part; resilient means for imparting expulsion strokes to said reciprocatory pumping element; motion-transmitting means interposed between said reciprocatory element and said actuating element and including means for increasing the length of the strokes effected therethrough with increase in rate of operation,—all of said means being subject to limitation by a building up of pressure within said pump chamber.

5. A pump comprising: a pumping element which is reciprocable within a pump chamber; a reciprocatory actuating element; intermediate means for transmitting motion from said actuating element to said pumping element; means therein for increasing the efficiency of such transmission with increase in rate of operation; and means rendering said means responsive to pressure built up within said chamber.

6. A pump comprising: a pumping element which is reciprocable within a pump chamber; a reciprocatory actuating element; intermediate means for transmitting motion from said actuating element to said pumping element; means therein for increasing the efficiency of such transmission with increase in rate of operation; means rendering said means responsive to pressure built up within said chamber; and resilient means tending constantly to advance said actuating element and said pumping element.

In testimony whereof I affix my signature.

JOSEPH ZUBATY.