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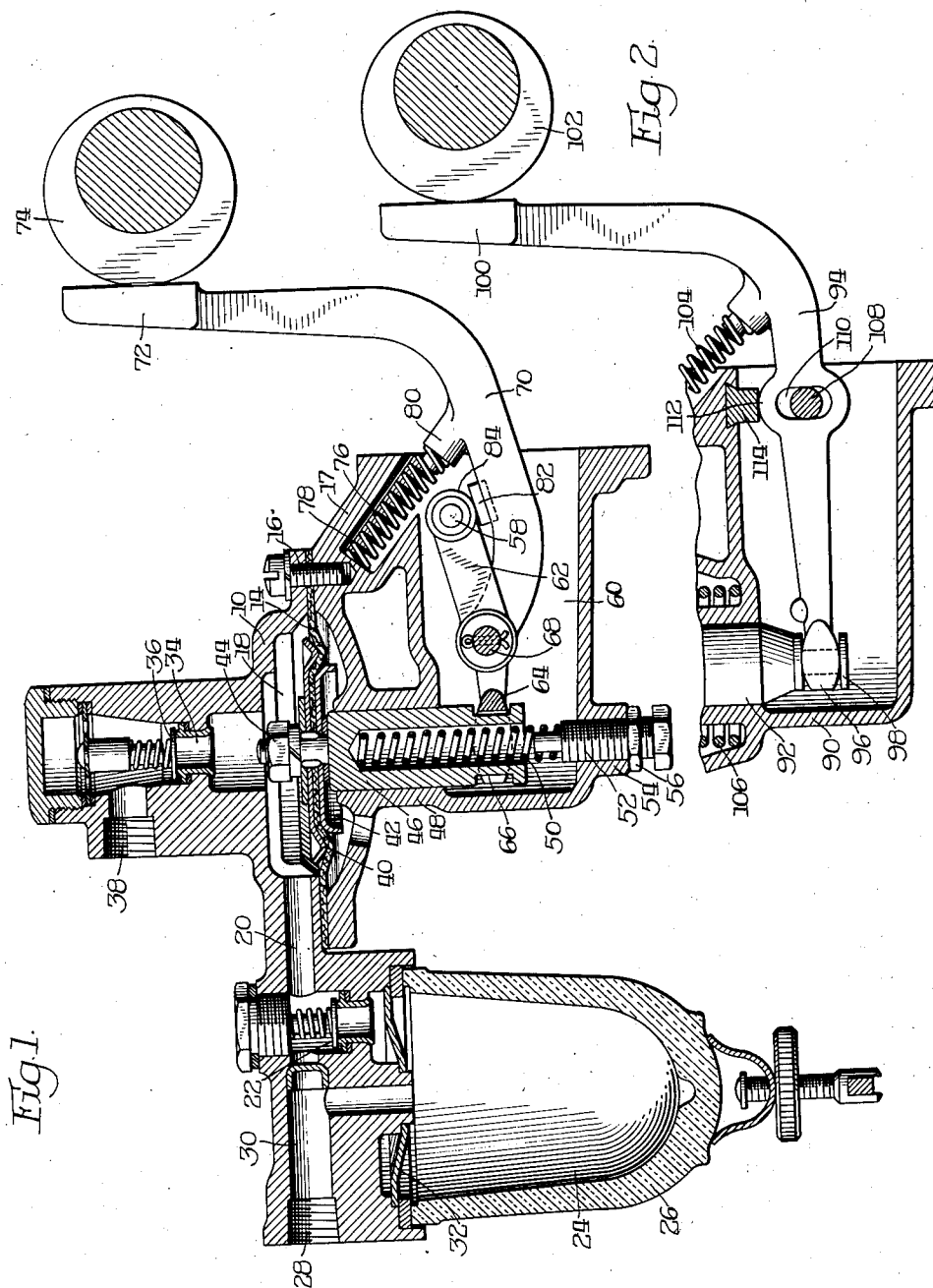
E. A. ROCKWELL

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FUEL PUMP

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UNITED STATES PATENT OFFICE

EDWARD A. ROCKWELL, OF CHICAGO, ILLINOIS

FUEL PUMP

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This invention relates to improvements in actuating means for fuel pumps of the type in which the pumping diaphragm may have a resiliently variable discharge stroke in accordance with the delivery pressure.

It is now common practice to actuate the flexible pumping diaphragm of the fuel pump through a lever which is continuously held in contact with a driving cam within the engine casing and to provide some form of connection between the cam actuated lever and the pumping diaphragm in order that the pumping diaphragm may remain stationary while the lever continues to receive its full stroke through movement of the cam.

It is an object of the present invention to provide an improved construction of the actuating means in which the relative movement between the pumping diaphragm and the cam actuated lever is permitted by causing the lever to remain in contact with the cam for movement about a fulcrum at its connection with the diaphragm.

It is further an object of the present invention to provide a more simplified construction of the operating means which enables a relatively more compact construction than in present types of fuel pumps.

Further objects and advantages of the present improvements will be more readily apparent from the following description taken in connection with the attached drawings in which several embodiments of the invention are illustrated.

In the drawings:

Figure 1 is a vertical section of a fuel pump showing an improved form of actuating means;

Figure 2 is a partial vertical section showing a modified construction of the actuating means;

Figure 3 is a partial vertical section of a fuel pump illustrating an additional modification of the actuating means;

Figure 4 is a partial vertical section similar to Figure 3 showing a still further modification;

Figure 5 is a detail section taken on the plane indicated 5-5 in Figure 3, showing

the slotted connection of the lever to the diaphragm, and

Figure 6 is a partial plan view illustrating the manner in which the lever is supported from the fixed pivot.

In the design of fuel pump shown in Figure 1, the pump casing in the usual manner consists of a pair of upper and lower casing parts 10 and 12 which serve to clamp therebetween a pumping diaphragm 14. The casing parts are secured by a screw bolt 16. The pumping diaphragm, on its upper side, cooperates with a pumping chamber 18 into which extends an intake passageway 20 provided with a spring-pressed inlet check valve 22 and leading from a fuel receiving and sediment trapping chamber 24. The chamber 24 is included within the removable bowl 26. The inlet pipe connection is made at 28 communicating with a passage 30 which leads into the chamber 24. The fuel flowing upward into the intake passage 20 past the inlet check valve is filtered by the filter screen 32. The fuel is delivered from the pumping chamber through the vertical outlet passageway 34 provided with a spring-pressed outlet check valve 36. The outlet pipe connection is made at 38 in communication with the vertical passageway 34 above the outlet check valve.

The pumping diaphragm 14 has clamped to its upper surface a metallic disk member 40 formed to take up the slack of the diaphragm and cooperating with a metallic disk member 42 clamped to the under side of the pumping diaphragm. The disk members 40 and 42 are secured to the central portion of the diaphragm by means of a nut 44 which threads on to a reduced extension of a reciprocable pump stem 46 guided for vertical reciprocation by the bearing 48 of the lower casing part. In the form shown, the stem 46 has a hollow portion for receiving a compression spring 50 held at its lower end by an adjustable threaded plug 52 which screws into a boss 54 of the lower casing part and is provided with a lock nut 56. It will be understood that the spring 50 normally acts to produce the discharge stroke of the pumping dia-

phragm in accordance with the delivery pressure.

A fixed pivot 58 is mounted within the lower cavity 60 of the casing part 12 and carries a pivoted lever 62 which has a yoke-shaped end 64 for engaging a recessed portion 66 of the pump stem 46. The lever 62 serves to support a pivot pin 68 between the pivot 58 and the yoke-shaped end 64. An operating lever 70 has one end connected to the movable pivot 68 and is formed at its other end with a thrust-receiving portion 72 engaging a driving cam 74 within the usual engine casing. The lever 70 is continuously held in contact with cam 74 by means of a follower spring 76 which reacts between the closed end of an obliquely disposed spring pocket 78 and a boss 80 formed on the lever 70. The lever 70 is provided with an abutment 82 which may be of suitable shock-absorbing material and which normally engages the hub 84 of the lever 62.

The operation of the fuel pump, as shown in Figure 1, will be readily apparent. During the active phase of the cam, the lever 70 and the lever 62 will tend to rotate as a unit about the fixed pivot 58 thereby transmitting a positive suction stroke to the pumping diaphragm. The follower spring 76 will act during the passive phase of the cam to return the lever 70 and the discharge spring 50 will cooperate with the follower spring 76 in causing the lever 62 to follow the movement of the lever 70. However, should the delivery pressure become sufficiently high to resist a further expansion of the spring 50, the full delivery stroke of the pumping diaphragm will be prevented and a relative movement will occur between the lever 62 and the lever 72 by reason of their pivotal connection 68. For example, if the pumping diaphragm is held at the limit of its suction stroke, the lever 70 will be moved by the cam about the pivot 68 and the abutment 82, which is carried by the lever 70, moves towards and away from the hub 84 of the lever 62. The abutment 82 is required so that the pumping diaphragm will be positively returned for its suction stroke after each discharge stroke, otherwise the lever 70 might be moved without imparting any movement to the pumping diaphragm.

It will be understood that many modifications may be resorted to in designing the fuel pump actuating means based upon the operation as described in Figure 1, and in the remaining figures of the drawings I have illustrated several modified constructions.

In Figure 2 there is shown the lower part 90 of a pump casing which guides a vertical reciprocable pump stem 92 actuated by a lever 94 which has a yoke-shaped end 96 connected to the yoke-shaped extension 98 of the pump stem and having a thrust re-

ceiving portion 100 continuously engaging the driving cam 102. The lever 94 is held in contact with the cam by the follower spring 104. A resilient discharge spring 106 is partially shown seated in the casing 90. A fixed pivot pin 108, in this form of the invention, is received in a slotted opening 110 of the lever 94 and the enlarged portion 112 of the lever 94 which has the slotted opening 110 normally contacts with the resilient abutment 114 carried by the casing part 90 immediately above the pivot 108. During positive movement of the lever 94 by the cam transmitting a positive suction stroke to the pumping member, the lever will rock on the abutment 114. If the pumping member is prevented from taking its full discharge stroke, the lever 94 is separated from the abutment 114 and will shift its position with respect to the pivot pin 108. It will be readily apparent that the operation is quite similar to that of the actuating means shown in Figure 1 except that only a single lever is required.

Figures 3 and 4 illustrate further modifications of the actuating means for a fuel pump in which a single lever extends from the cam to the pumping member and which is supported from a fixed pivot pin by a link pivoted to the lever. The lever is preferably formed in two parts which are rigidly fastened together in order to reduce the cost of construction and make it possible to standardize one part while the other may be constructed in different shapes in accordance with the different types of engine upon which the fuel pump is to be mounted.

In Figure 3 the lower part of the pump casing is indicated 120 and has a flexible diaphragm 122 secured to its upper side at the marginal edge thereof. In this design the spring immediately beneath the diaphragm, as in Figure 2, may be eliminated and the casing part brought up close to the diaphragm with only a small annular recess 121. The opening 123 through the casing into communication with the engine casing does not require, in this design, machine bearings since the reciprocable pump stem is eliminated by attaching the lever directly to the diaphragm. To the opposite sides of the diaphragm are attached a pair of conforming disk-members 124—125. The lower disk 125 has a flanged annular portion received in the recess 121 of the casing. The disks are secured to the diaphragm by the bolt 126 and nut 127. Between the head of the bolt and the disk 125 is a spacing washer 128, enabling the connection to be tightened but leaving a space into which the end of the lever may be received.

The lever is formed in two parts, the inner part 129 being preferably formed of pressed metal and of standard design for a particular size of pump while the exterior

part of the lever 130 may be cast in suitable shape to protrude into the engine casing and engage at the proper point on a driving cam 131. The pressed metal member 129 has a slotted bent end 132 extending beneath the head of the bolt 126 and thereby is free to have a slight sliding movement to accommodate for inaccuracies. The other end 133 of the member 129 fits into the slotted end of the cast member 130. The lever 130 is provided with an opening extending from the slot to the top of the lever, as indicated at 134 and the end 133 of the member 129 has a similar opening whereby a securing plug 135 may be forced through the opening 134 in the cast lever until it engages the opening in the member 129 and holds the member 129 in place. The plug 135 may be preferably of shock-absorbing material for a purpose to be described. In order to further secure the two parts of the lever together, the pressed-metal member 129 at its end 133 is slightly wider than the part 130 and the overlapping ends are swaged upwardly as at 136.

The part 130 carries a transverse pivot pin 137 positioned intermediate the ends of the part and slightly in back of the connection between the parts. A pivot pin 138 is mounted on the casing part 120 and the lever is hung from the fixed pivot 138 through a link 139 which has its ends curled around the pivot pins, as at 140.

The pivoted link 139 is substantially H-shaped in plan, as seen in Figure 6, in order that the portion of the pivot pin 138 between the side portions of the link 139 may engage the shock-absorbing abutment 135. The sides of the member 130 may be slightly recessed, as at 141 in Figure 4 so as not to contact with the curled ends of the pivoted link. A compression spring 142 is mounted between the projection 143 of the part 130 and a fixed abutment 144 formed in the casing. The spring 142, as shown, transmits a component of pressure to the lever causing it to contact at the shock-absorbing abutment with the pivot pin 139 and upon movement being imparted to the lever by the cam, the lever tends to remain in contact with the pivot pin throughout its reciprocable movement until the discharge pressure becomes excessive whereupon the diaphragm will be prevented from movement and the lever will be reciprocated about its connection with the diaphragm and relative lost motion will take place between the abutment 135 and pivot pin 138.

In the form illustrated in Figure 4 the construction is quite similar to Figure 3 except that the abutment 144' for the follower spring 142' is closer to the axis of the pumping diaphragm to accommodate a longer spring.

It is obvious that the improved design of casing together with the novel manner of

mounting the lever enables a more compact and simplified construction.

I claim:

1. In a fuel pump having a pump casing, a flexible pumping diaphragm secured at its marginal edge to said casing, an operating lever supported within said pump casing and having a thrust-receiving arm protruding therefrom, a rotatable cam in thrust engagement with said protruding arm of said lever, a follower spring reacting between said casing and said lever to continuously maintain contact between said cam and lever, a fixed pivot in said pump casing, a link pivotally connected to said pivot and to said lever, an abutment carried by said lever normally engaging said pivot causing the lever and link to rotate as a unit with respect to said fixed pivot in both directions and a motion-transmitting connection between said lever and link and said diaphragm whereby excessive resistance to discharge movement of said diaphragm produces relative movement between said lever and link and relative separation of said abutment from said pivot.

2. In a fuel pump having a pump casing, a flexible pumping diaphragm secured at its marginal edge to said casing, an operating lever supported within said pump casing and having a thrust-receiving arm protruding therefrom, a rotatable cam in thrust engagement with said protruding arm, a follower spring reacting between said casing and said lever to continuously maintain contact between said cam and said lever and to impart movement to said lever in a discharge direction, a motion transmitting connection between said lever and said diaphragm, abutment means within said pump casing normally causing said lever to rotate about a fixed pivot, said lever being free to move laterally with respect to the fixed pivot when excessive resistance occurs during discharge movement of said diaphragm.

3. In a fuel pump having a pump casing, a flexible pumping diaphragm, an operating lever having a thrust-receiving portion and a tension transmitting portion, a cam engaging the thrust-receiving portion of said lever to produce movement thereof in one direction, said tension transmitting portion being connected to said pumping diaphragm, a fixed pivot in said casing, an abutment on said lever normally engaging said fixed pivot whereby said lever is positively moved about said pivot by said cam to produce a suction stroke of the pumping member, a follower spring arranged between said casing and said thrust receiving portion of said lever to continuously hold said lever in contact with said cam and a supporting link for said lever pivotally connected to said fixed pivot and to said thrust receiving

portion of said lever whereby said lever and supporting link are normally turned as a unit about said pivot in both directions but the pumping diaphragm may take a variable discharge stroke permitted by relative separation between the abutment carried by said lever and said fixed pivot and relative movement between said lever and said supporting link with respect to the pivotal connection between said link and lever.

4. In a fuel pump having a pump casing, a flexible pumping diaphragm, a lever connected at one end to the pumping diaphragm and adapted to be cam-actuated at the other end in one direction, a spring reacting between the casing and the lever for holding the lever continuously in contact with the cam, a fixed pivot in said pump casing, an abutment carried by said lever normally engaging said fixed pivot and a supporting link pivotally connected to said fixed pivot and pivotally connected to said lever at a point between the abutment carried by said lever and the contact of the lever and the cam.

5. In a fuel pump having a pump casing, a flexible pumping diaphragm, a lever connected at one end to said pumping diaphragm, a cam for engaging the other end of said lever to produce movement thereof in one direction, a fixed pivot carried by said casing, an abutment on said lever normally engaging said fixed pivot intermediate the connection of the lever to the diaphragm and the contact of the cam and lever, a follower spring reacting between the casing and a portion of the lever intermediate the abutment and the contact between the cam and lever, a supporting link for said lever carried by said fixed pivot and pivotally connected to said lever at a point intermediate the abutment and the contact between the cam and lever whereby relative angular movement between the lever and link with respect to the pivotal connection therebetween may occur during the spring-pressed movement of the lever to permit a variable discharge stroke.

6. In a fuel pump having a pump casing, a flexible pumping diaphragm carried by said pump casing, an operating lever connected at one end to said diaphragm having its other end protruding from said casing, a cam engaging the protruding end of said lever to produce movement thereof in one direction, a fixed pivot in said casing, an abutment carried by said lever normally engaging said fixed pivot whereby, during the cam actuated movement of said lever the abutment acts as a stop to cause said lever to move above said fixed pivot, a spring reacting between the casing and said lever to continuously maintain the contact between the cam and lever and to produce the discharge movement of the pumping dia-

phragm, a supporting link pivotally carried by said fixed pivot and pivotally connected to said lever whereby said lever turns with respect to the pivotal connection between the lever and link when the pumping diaphragm is prevented from taking its full discharge stroke.

7. In a fuel pump, a pump casing, a reciprocable pumping diaphragm marginally secured to said casing, a motion transmitting lever operatively connected to said diaphragm, a cam acting upon said lever to impart movement thereto in one direction and to transmit a positive suction stroke to said diaphragm, a single compression spring reacting between said casing and said lever effective to maintain contact between said lever and cam at all times and to impart a resiliently variable discharge stroke to said diaphragm, and a fulcrum for said lever fixed with respect to said casing, said lever being normally maintained in engagement with said fulcrum by the reaction of said spring but separable therefrom when the full discharge stroke of said diaphragm is limited by excessive discharge pressure.

Signed at Chicago, Illinois, this 4th day of June, 1931.

EDWARD A. ROCKWELL.