Jan. 9, 1968 W. A. BRADLEY 3,362,250

FUEL PUMP WITH LEVER WEAR SHOE

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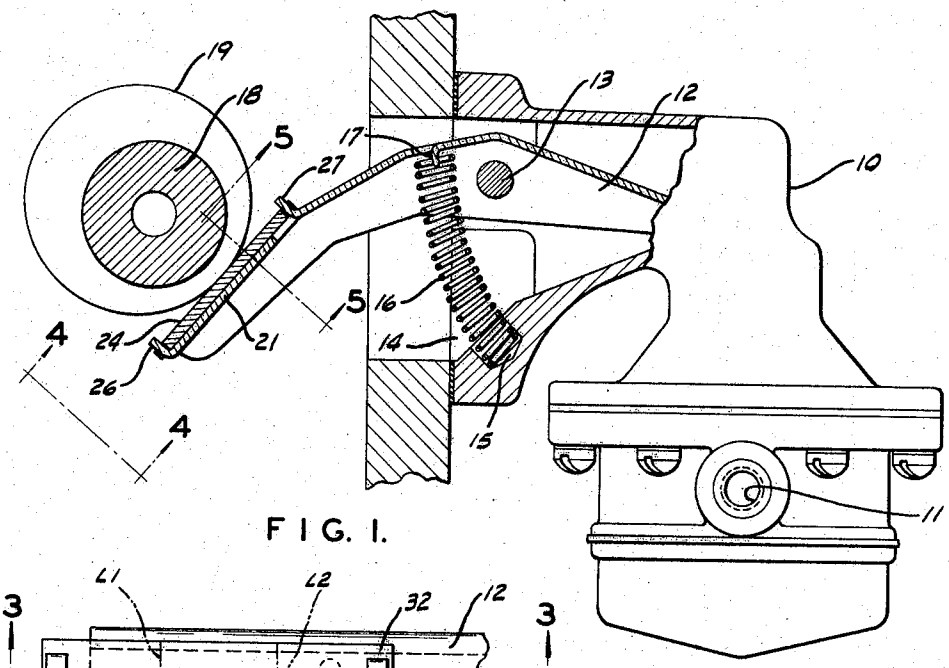


FIG. 1.

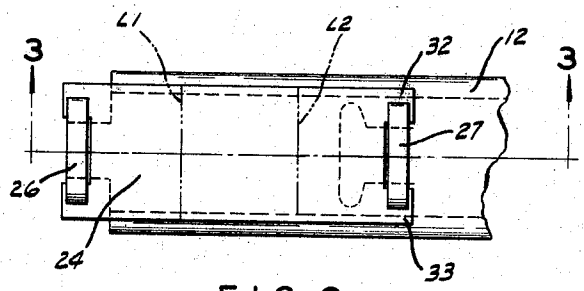


FIG. 2.

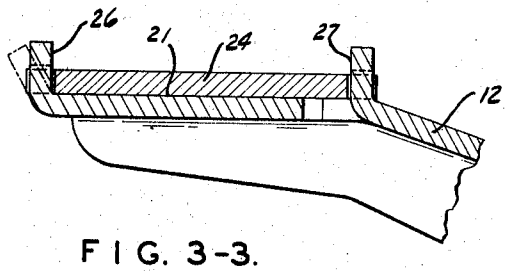


FIG. 3-3.

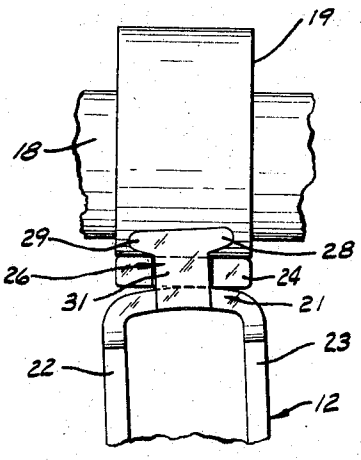


FIG. 4-4.

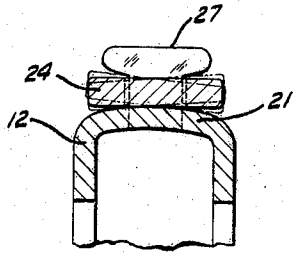


FIG. 5-5.

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FUEL PUMP WITH LEVER WEAR SHOE

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This invention relates to contact shoes for eccentric and follower mechanisms and in particular to a contact shoe having a flat contact face, and means for maintaining the face in constant uniform registry with the eccentric or cam surface.

Fuel pumps and vacuum booster pumps of the diaphragm type used on automotive vehicles, are commonly actuated by a follower lever resiliently urged into contact at one end with a rotating eccentric on the engine camshaft. In the conventional mechanism, a flat surface of the follower lever preferably makes line contact with the face of the eccentric at the point of tangency. As a result of the limited contact, and the constant service to which mechanisms of this type are put, wear on the lever is severe, so that the service life of the lever is relatively short.

Heretofore, the problem of excessive or even ordinary wear on the pump lever has been encountered, and in many instances overcome by the provision of a suitable wear surface so positioned on the lever to achieve a particular function. For example, U.S.P. 2,829,541 illustrates a wear device engageable with a pump lever in such manner to permit multi-directional movement of the wear device along the lever surface. U.S.P. 2,733,618 illustrates a similar pump lever arrangement having a wear device, or shoe, adapted to accommodate a rotating eccentric.

U.S.P. 2,027,332 illustrates a further embodiment of a wear shoe or the like carried on a pump lever in such manner as to permit relative movement between the eccentric and the device by means of a pivotal connection between the shoe and the lever.

It has been found found nonetheless, that with respect to the above-noted pump lever wear devices, and similar devices designed to overcome excessive wearing away of particular parts, that the problem is not entirely overcome.

This problem is of course initiated and further aggravated to a large extent through unavoidable mechanical structure and manufacturing tolerances.

For example, the pump lever or follower arm is normally fabricated as a matter of practical economics as a stamped sheet metal member having sufficient structural rigidity to actuate the pump diaphragm. The lever is then pivotally carried in the pump casing. Often, however, the pump casing is mounted to an engine block in such manner that the lever is sufficiently offset or misaligned as to prohibit making the desired line contact with the eccentric surface. Further, it has been found that in many instances, the eccentric or cam itself is sufficiently out of alignment with the co-operating lever such that there is merely a point contact established between engaging members. Thus, as the eccentric rotates, an area of concentrated wear will be established on the lever arm, the cam surface may similarly become worn primarily along one edge.

It is therefore an object of the invention to provide a pump structure adapted particularly to overcome or avoid excessive wear to the pump actuating lever.

Another object of the invention is to provide a substantially flat, inexpensive wear surface for eccentric and follower mechanisms with means for maintaining line contact between the face of the wear surface and the eccentric surface to minimize wear, and the need for replacement of either of said surfaces.

A further object is to maintain a suitable line contact to establish uniform wear characteristics betwen the eccentric and the wear surface regardless of mechanical misalignment of the fuel pump or the pump mechanism with the eccentric.

A still further object is to provide a pump lever having a lever arm including a readily replaceable wear pad which is loosely carried on the arm to provide automatic adjustment to the contacting relationship between the pad and the eccentric surfaces.

These and other objects of the invention not specifically delineated are achieved by providing a portion of the pump lever most normally susceptible to wear, with a self-aligning replaceable member to absorb such wear as a primary function, and to adjust on the surface of the lever in a manner to overcome misalignment present in either the pump mechanism or in the cam surface.

In the drawings,

FIGURE 1 is an elevation in partial cross section illustrating an automotive fuel pump attached to a crankcase wall and co-operatively engaging an engine rotatable eccentric.

FIGURE 2 is a segmentary view on an enlarged scale illustrating the end portion of the pump lever positioned adjacent the eccentric.

FIGURE 3 is a side view in cross section of the device shown in FIGURE 2.

FIGURE 4 is an enlarged end view taken along line 4—4 in FIGURE 1.

FIGURE 5 is a sectional view taken along line 5—5 in FIGURE 1.

Structurally, the lever wear pad includes a relatively hard metallic plate loosely carried on the lever arm in a position to contact the eccentric. The wear plate or pad is fixed relative the lever to avoid longitudinal movement of the plate on the lever surface, and yet permit a limited rotational or rolling movement of the plate along a convex surface of the lever thereby assuring a proper contact relationship to overcome undesired misalignment of the respective members.

The embodiment of fuel pump shown in FIGURE 1 is of the type found on many automotive engines and includes basically a body or casing **10** in which is positioned inlet and outlet ports, together with inlet and outlet check valves disposed in a passage connecting the respective inlet and outlet ports.

Liquid fuel is introduced to the inlet port **11**, communicated with a pumping chamber by way of the inlet check valve. The fuel is thereafter urged through the outlet check valve, the outlet port, neither or which is shown and to the engine carburetor or other point of use.

The pumping chamber is provided along at least one wall with a flexible member such as a diaphragm so positioned to vary the pressure in the pumping chamber and thereby achieve the flow of liqiud fuel therethrough.

The diaphragm is fixed along an air tight seal at its periphery to the pump casing, and is connected through a push rod and spring biasing means to an actuating lever **12** which is pivotally hinged by a pin **13** to the casing wall. Casing **10** includes an opening **14** adapted to register with a corresponding opening in the engine crankcase wall, through which opening at least a part of actuating lever **12** intrudes.

A biasing spring **16** is compressibly retained on actuating lever **12** and maintained in place at one end by a downwardly turned tab **17**. The other end of spring **16** is urged into a depression **15** in a wall of the casing **10** adjacent opening **14**, the effect being to normally bias the protruding end of lever **12** upwardly.

The driving engine is provided with a cam shaft including a shaft **18** so connected to the engine drive shaft to be driven at a speed proportional to the latter. An ec-

centric 19 mounted to cam shaft 18 rotates responsive to the engine speed.

Referring to FIGURES 1 and 4, the cam or eccentric 19 is provided with a relatively hard peripheral surface which normally bears against the remote end of lever 12 whereby during a single rotation of cam 19, lever 12 will be reciprocated through a full cycle in an arcuate path pivoted about the supporting pin 13.

Referring to FIGURES 4 and 5, in one form lever 12 is a stamped steel member formed preferably in a channel like construction to provide the needed structural rigidity for withstanding continuous operation and strain for long periods.

Lever 12 includes an upper connecting wall 21 terminated at its respective edges by oppositely disposed and downwardly projecting walls 22 and 23. The upper or connecting wall 21 is exteriorly shaped in such manner as to provide the upper surface with a convex or arcuate configuration.

The primary function of this convex surface configuration is to accommodate the mating flat surface of wear pad or plate 24 and supportably engage the latter in a line contact extending transversely of the longitudinal axis of the lever 12. Thus, when normally engaged, the outer peripheral surface of eccentric 19 will bear against plate 24 and form substantially line contact with the latter thereby tracing a wear surface longitudinal to the lever long axis.

The plate 24 may assume any of several positions relative the upper wall 21 of the lever and the mating surface of cam 19. In most instances, however, regardless of misalignment of either lever 12 or of the corresponding cam surface, plate 24 will assume a particular disposition as dictated by the positions of cam 19 and lever 12, a line contact will always be maintained at the upper convex surface of lever 12 and the lower flat surface of the wear plate 24.

For holding wear plate 24 non-fixedly in place on lever 12 convex surface, the latter is provided with a suitable locking means. Such locking means as shown in FIGURES 2, 3, and 4 includes at least two upstanding tabs 26 and 27, longitudinally spaced apart and formed to engage the upper surface of wear plate 24. The locking tabs may be formed from the lever by punching, deforming or similar manufacturing operation. Similarly, they could be welded or fastened to the upper convex surface of lever 12 to achieve the locking function.

Wear plate 24 is generally thin elongated in shape, and so positioned to slidingly engage the eccentric surface as the latter rotates, thereby defining a substantially rectangular wear pattern on the upper surface of the wear plate. Plate 24 is preferably formed of a relatively hard material such as 1050 grade SAE steel or the like, but being preferably less wear resistant than the cam 19 surface.

As shown in FIGURES 2, 3, and 4 one embodiment of the locking tabs 26 and 27 formed on the lever 12, includes an upstanding central body portion 31 which is positioned to register within the projecting ears 32 and 33. The respective notches at the ends of plate 24 are of sufficient depth to be contiguous with walls of the tabs 26 and 27 and permit only limited horizontal movement of wear plate 24 along the lever 12 surface.

Laterally extended portions 28 and 29 of the tab 26, bear downwardly loosely against lever 12 that the latter may be maintained in a horizontal position, or coplanar with the upper wall of the lever prior to assembly of the latter. The rear tab 27 however, is punched from the lever surface to a generally upright position. Thus, wear plate 24 is properly positioned by placing the latter on the convex lever surface such that the notch is in registry about the tab 27.

Outboard tab 26 is thereafter urged into a substantially upright position to bring the outwardly protruding ears 28 and 29 into overlying engagement with the upper surface of the wear plate 24.

With both tabs in place, wear plate 24 is confined to movement in a direction other than longitudinal along the lever surface.

More specifically, and referring to FIGURE 4, the wear plate and the lever 12 during normal operations of the engine, will maintain a substantially constant relationship. However, as eccentric 19 rotates to adjust its line contact with the wear plate, the latter will be displaced into a position on the lever, whereby line contact will be established on the lever convex surface. Thus, between the upper surface of the wear plate 24 and the eccentric, any misalignment present between the eccentric peripheral surface and the wear plate upper surface will be neutralized.

In accordance with the present invention, with wear plate 24 held non-rigidly on the lever 12 surface, as the eccentric 19 rotates, the line contact maintained with the latter will cause a substantially uniform wear of either the cam and more preferably the wear plate in a pattern substantially as shown in FIGURE 2 defined by the shaded area between lines L–1 and L–2.

It is understood that the fastening means for loosely carrying wear plate 24 on the lever may assume any of several embodiments.

For example, rivets or screws suitably attached to the lever 12 may be utilized to connect the wear plate and lever in an operable relationship.

It can be seen that because of the disclosed simple connecting arrangement wear plate 24 might readily be removed from the lever and replaced by a new plate with only slight inconvenience, and the simplest of tools.

It will be appreciated by those skilled in the art that the present embodiment of the novel device represents a preferred form thereof and that similar arrangements can be applied to the fuel pump without departing from the spirit and scope of the invention.

What is claimed is:

1. In a mechanical pump for pumping a liquid, said pump including a housing having a diaphragm forming a pumping chamber with inlet and outlet valves, means for actuating said diaphragm to effect a pumping action on said liquid in said pumping chamber, said actuating means including a lever operably connected to said housing and to said diaphragm respectively and having a remote end thereof extending from the housing to engage a rotatable drive member for displacing said lever arm to oscillate the diaphragm, the improvement therein of;

(1) a wear plate operably and loosely supported on said lever remote end, and being urged toward said rotatable drive member,

(2) said lever being provided at said remote end with an arcuate surface facing in the direction of said rotatable drive member,

(3) said wear plate having a substantially flat surface disposed in contact with said arcuate surface to permit a limited degree of rolling movement of said plate on said arcuate surface thereby permitting line contact between said plate and said arcuate surface regardless of misalignment of said lever arm with said drive member, and fastening means disposed at opposed ends of said plate to loosely guide the latter during said rolling movement of said plate across said arcuate surface and to limit the longitudinal movement of said plate along said arcuate surface.

2. In a mechanical pump for pumping a liquid, said pump including a housing having a diaphragm forming a pumping chamber with inlet and outlet valves, means for actuating said diaphragm to effect a pumping action on said liquid in said pumping chamber, said actuating means including a lever arm operably connected to said housing and to said diaphragm respectively and having a remote end thereof extending from the housing to engage a rotatable drive member for displacing said lever arm

to oscillate the diaphragm, the improvement therein of;

(1) a wear plate operably and loosely supported on said lever remote end, and being urged toward said rotatable drive member,

(2) said lever being provided at said remote end with an arcuate surface facing in the direction of said rotatable drive member,

(3) said wear plate having a substantially flat surface disposed in contact with said arcuate surface to permit a limited degree of rolling movement of said plate on said arcuate surface thereby permitting line contact between said plate and said arcuate surface regardless of misalignment of said lever arm with said drive member, and including fastening means carried on said lever and overlying at least a portion of said elongated plate to loosely position the latter on said convex surface.

3. In a mechanical pump for pumping a liquid, said pump including a housing having a diaphragm forming a pumping chamber with inlet and outlet valves, means for actuating said diaphragm to effect a pumping action on said liquid in said pumping chamber, said actuating means including a lever arm operably connected to said housing and to said diaphragm respectively and having a remote end thereof extending from the housing to engage a rotatable drive member for displacing said lever arm to oscillate the diaphragm, the improvement therein of;

(1) a wear plate operably and loosely supported on said lever remote end, and being urged toward said rotatable drive member,

(2) said lever being provided at said remote end with an arcuate surface facing in the direction of said rotatable drive member,

(3) said wear plate having a substantially flat suarface disposed in contact with said arcuate surface to permit a limited degree of rolling movement of said plate on said arcuate surface thereby permitting line contact between said plate and said arcuate surface regardless of misalignment of said lever arm with said drive member, wherein said plate includes;

(a) a notch formed in opposed ends thereof,

(b) a projection depending outwardly from each side of said notch,

(c) said lever including spaced apart tabs depending from the surface thereof at opposed ends of said plate, and being loosely positioned between and overlying said respective notch projections, thereby limiting horizontal movement of said plate on said convex surface.

4. The combination in a follower arm for a rotatable cam having a peripheral contact surface which includes;

(1) said arm having a remote end disposed adjacent to said cam peripheral surface, said remote arm end

being provided with an arcuate configuration on the surface thereof facing said cam and in a plane normal to the longitudinal axis of said arm,

(2) a wear plate having opposed flat sides, and loosely engaging said arm end, said plate being interposed between said arm and said cam,

(3) one of said flat opposed sides bearing against said arcuate surface to establish line contact therewith, and,

(4) locking means carried on said remote ends to loosely position said wear plate to permit a relative rolling movement between said wear plate and said arcuate surface and to avoid relative longitudinal movement therebetween,

(5) said locking means including a pair of upstanding tabs spaced longitudinally apart on said arcuate surface, each of said tabs including a portion spaced from and overlying said wear plate to permit said rolling movement of said plate along said arcuate surface.

5. The combination in a follower arm for a rotatable cam having a peripheral contact surface which includes;

(1) said arm having a remote end disposed adjacent to said cam peripheral surface, said remote arm end being provided with an arcuate configuration on the surface thereof facing said cam and in a plane normal to the longitudinal axis of said arm,

(2) a wear plate having opposed flat sides, and loosely engaging said arm end, said plate being interposed between said arm and said cam,

(3) one of said opposed sides bearing against said arcuate surface to establish line contact therewith,

(4) locking means on said remote arm end to loosely position said wear plate and to permit relative rolling movement between said wear plate and said arcuate surface and to avoid relative longitudinal movement therebetween,

(5) said wear plate including a notch formed at opposed ends thereof, an upstanding tab on said arcuate surface being disposed in each of said respective notches to limit longitudinal movement of said wear plate along said arcuate surface.

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