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FUEL PUMP DIAPHRAGM

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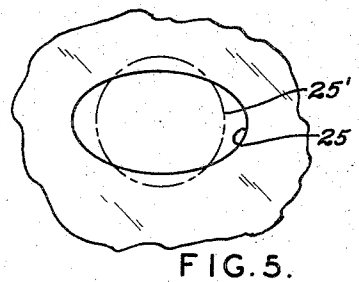


FIG. 5.

FIG. 1.

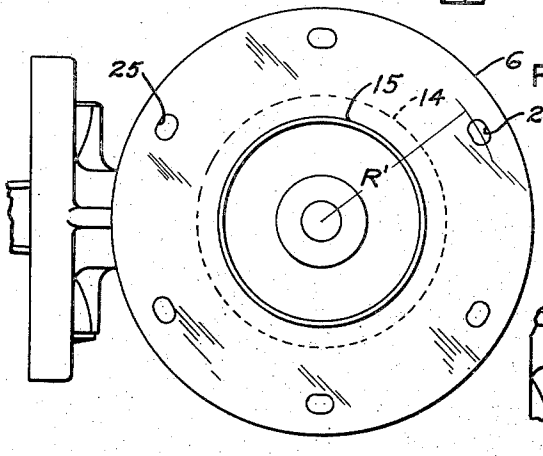


FIG. 2.

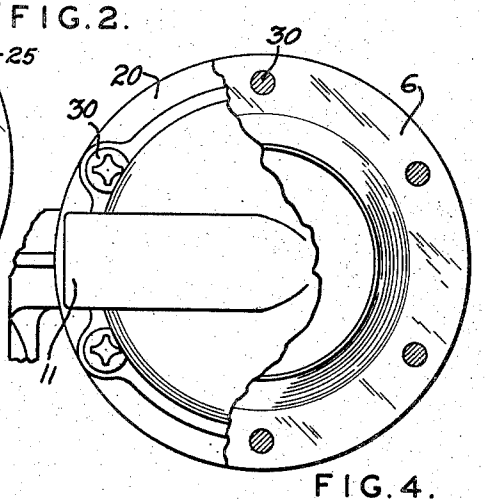


FIG. 4.

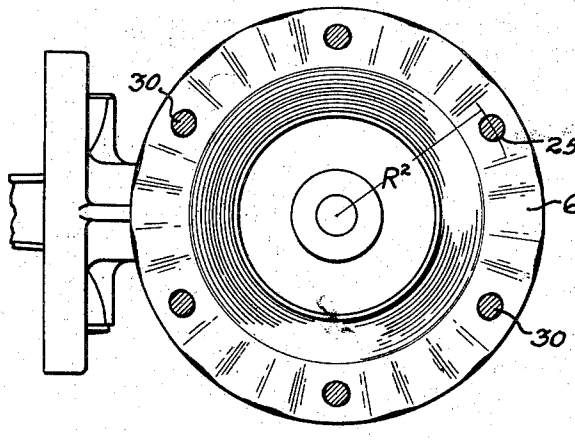


FIG. 3.

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FUEL PUMP DIAPHRAGM

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Application September 29, 1955, Serial No. 537,367

1 Claim. (Cl. 103—150)

This invention relates to engine driven fuel pumps of the diaphragm type particularly suitable for automotive use, and, more specifically, to an improvement in pump structure in order to obtain a better and more dependable seal between the diaphragm and the separable parts of the pump housings engaging the diaphragm.

It is the usual practice in the pump art to preform the holes at the periphery of the diaphragm, and then assemble the pump by presetting the loop in the rocker body. The loop setting step in the assembly provides the necessary slack to accommodate the movement of the diaphragm during the pumping stroke. While preset, the diaphragm is clamped between the rocker body and the valve casing, and the screws are inserted through the flanges and holes in the diaphragm and tightened.

Modifications in pump structure such as shown in the prior application of Johnson and White, Ser. No. 456,360, filed September 16, 1954, to obtain more capacity from the same pump size, require diaphragms made considerably larger in diameter than the flanges of the pump between which they are secured. The assembly operation reduces this diameter to that of the flanges, and, in this process, sometimes produces wrinkles in the diaphragm edge. The preformed holes in the diaphragm are necessarily located on a larger circle than are the holes in the flange. Consequently, it has been found difficult in final assembly to maintain the alignment between the holes in the diaphragm and the holes in the flange of the pump. Final testing has sometimes revealed leakage at the flange or through the diaphragm holes.

It has been discovered that this leakage can be directly attributed to the compressive action of the flanges, which flatten and expand the diaphragm edge primarily in a radial direction. This compression produces elongation of the preformed holes in the diaphragm inwardly toward the center, leaving either insufficient surface on the inside of the flange to give an effective seal with the diaphragm or, in some rare instances, none whatsoever.

According to the present invention, the screw holes in the flange of the diaphragm are formed on a larger circle than the circle passing through the center line of the screw holes in the casings. Also, the holes, as preformed, are not round, but are elliptical, with the long axis extending circumferentially of the diaphragm. Preferably, the holes are slightly narrower in a radial direction than the diameter of the screws which they receive, but are correspondingly larger in diameter circumferentially of the diaphragm than the diameter of the screws.

During the assembly operation, the looping operation performed draws the diaphragm inwardly of the flanges until the holes in the casing are in alignment with the holes in the diaphragm. The casings are then assembled and the screws inserted. Tightening of the screws compresses the diaphragm between the flanges so that the holes in the diaphragm tightly receive the screws and become round. It is possible in the operation to modify the steps by clamping the casing parts to compress the rim of the diaphragm so that the holes become round before the screws are inserted and tightened.

Further objects and advantages will appear from the accompanying description and drawings, in which:

Fig. 1 is a vertical section through a fuel pump constructed according to the present invention.

Fig. 2 is a top view of the diaphragm before the looping operation is performed.

Fig. 3 is a top view of the diaphragm after the looping operation is performed, and with the screws inserted.

Fig. 4 is a fragmentary top view, with parts broken away, showing the diaphragm after the pump is completely assembled.

Fig. 5 is a fragmentary view, on an enlarged scale, of the diaphragm and one of the elliptical holes before assembly in the pump.

Fig. 1 shows a pump P similar to that described in the prior application above referred to. The pump P is operated by an eccentric **1** on an engine camshaft **2** which engages and operates the rocker arm **3** journaled at **4** in rocker housing **5**. Diaphragm **6** is flexed to and fro by the rocker arm by means of a connecting stem **7** and a spring **8**.

Within the valve casing **10** are suitable intake and outlet valves controlling the inlet connection **11** and outlet connection **12**. These details form no part of the present invention, and will not be specifically described here.

As described in the aforesaid application, the stem **7** carries a pair of backing plates **14** and **15** which secure the diaphragm to the stem **7** and form the connection between the two. Backing plate **14** has an outwardly turned rim **17** at its periphery. Backing plate **15** is similarly shaped with an upwardly turned rim **18**. These rims are concentrically arranged, and the diaphragm **6** is compressed so as to form an upwardly turned loop, all as described in the said prior application.

In Fig. 2, the diaphragm **6** is illustrated secured between the backing plates **14** and **15** but before assembly between the flanges **20** and **21** of the pump casings. The holes **25** are preformed on a circle R1. After the looping operation, the holes are located on a circle R2, which is considerably smaller than R1. Holes **25** are also more or less elliptical, or oval, in shape, which is illustrated in Fig. 5. In this view, the full line **25** indicates the shape of the holes before the diaphragm is compressed. The dotted line circle **25'** indicates the final contour after pump assembly.

In Fig. 3, the diaphragm **6** has been drawn in, so that the center line circle for the holes **25** corresponds with that for the holes in the casing. The diaphragm is sufficiently flexible to accommodate this reduction in diameter and permit the insertion of the screws **30**. There is a surplus of material circumferentially, however, which tends to form the small undulations shown in Fig. 3.

In Fig. 4, flanges **20** and **21** are in final assembled position in clamping relation with the diaphragm, compressing and flattening the edge of the diaphragm. Due to the compression, the material of the diaphragm flows both circumferentially and radially, so that the holes **25** become circular and tightly encircle the screws **30**.

Certain structures have been described herein which will fulfill all the objects of the present invention, but it it contemplated that other modifications will be obvious to those skilled in the art which come within the scope of the invention as defined by the appended claim.

I claim:

In a fuel pump having a pair of casing sections with opposed annular flanges, registering bolt openings formed in said flanges, a diaphragm having its marginal portion located between said opposed annular flanges, circumferentially spaced bolts extending through said bolt openings and compressing said diaphragm between said flanges,

said diaphragm comprising a disk of flexible compressible material having circumferentially spaced oval shaped holes in its marginal portion receiving said bolts, said holes having their minor axes radially disposed from the axis of the disk and being disposed about the circumference of the diaphragm on a greater diameter than the diameter of the circle of bolts, whereby upon assembly of the casing sections with the diaphragm the surplus

material of the diaphragm is drawn between the flanges and compressed by said flanges and bolts causing the holes in the diaphragm to assume circular shapes to snugly receive their respective bolts.

References Cited in the file of this patent

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