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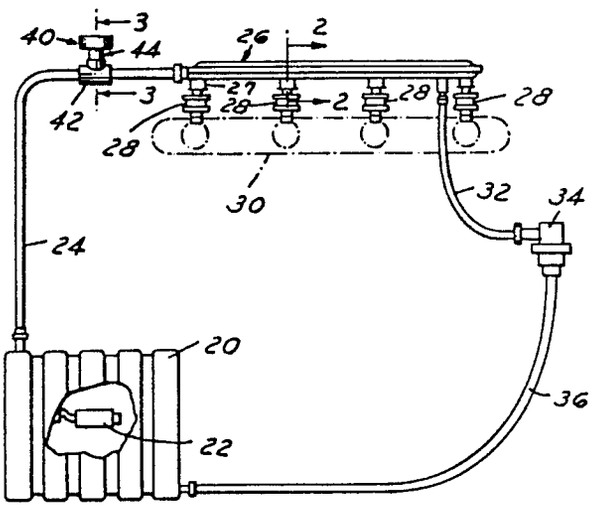
(54) Engine manifold pulse dampener.

(57) A fuel system utilizing a fuel source, a fuel pump delivering from said source to an internal combustion engine fuel rail in which fuel injectors deliver fuel to an engine manifold. A pulse dampener to smooth out the pulses in the manifold resulting from the fuel pump and the fuel injectors is interposed in the fuel system presenting a flexible diaphragm backed by a pressure chamber to the fuel supply to reduce noise in the fuel rail and smooth the flow of fuel to the engine.

FIG.1



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ENGINE MANIFOLD PULSE DAMPENER

Reference to Related Application

Reference is made to my copending application, Serial No. 836,539, filed March 5, 1986, now U. S. Patent No. 4,649,884, entitled Fuel Rail for Internal Combustion Engines.

Filed of Invention

Dampening of pulses in a fuel rail of an internal combustion engine having fuel injection.

Background and Objects of the Invention

In furnishing fuel to a multiple cylinder engine utilizing a multiple point injection unit, that is, one injector at each cylinder, it is common to use a fuel manifold with a fuel inlet near one end and a fuel outlet near the other end. Fuel is furnished to the inlet from a fuel pump and is discharged to a pressure regulator which returns fuel to the tank.

It has been found that pressure pulses in the fuel manifold due to the fuel injection action have interfered with the furnishing of fuel to the respective cylinders in equal quantities. Also, these pressure pulsations created by the injectors cause a noise called "injector rap" which travels back through the fuel supply line and proves to be objectionable to passengers in a vehicle. U. S. Patent No. 4,649,884 discloses a fuel rail with a built-in pulse dampener.

It is an object of this invention to provide a pulse dampener which can be applied to a fuel system with a standard fuel rail and which will materially reduce the undesirable pulsations in the fuel available to the individual fuel injectors and smooth out the fuel flow to make it available at each injector in reasonably equal quantities. It is a further object to provide an inexpensive unit which an be applied to an existing fuel rail in a simple operation either as original equipment or as an add-on accessory.

Other objects and features of the invention will be apparent in the following description, accompanying drawings, and claims in which the invention is described together with details to enable persons skilled in the art to practice the invention, all in connection with the best mode presently contemplated for the invention.

Brief Description of the Drawings

DRAWINGS accompany the disclosure and the various views thereof may be briefly described as:

FIG. 1, a diagrammatic view of a fuel circuit used in an internal combustion vehicle.

FIG. 2, a sectional view of a fuel rail taken on line 2--2 of FIG. 1.

FIG. 3, a sectional view of a dampener construction taken on line 3--3 of FIG. 1.

FIG. 4, a sectional view of a modified form of a pulse dampener.

Detailed Description of the Principles of the Invention and the Manner and Process of Using It

WITH REFERENCE TO THE DRAWINGS, in FIG. 1, a fuel tank 20 has a fuel pump 22 and an outlet fuel line 24 leading to a fuel rail 26 mounting fuel injectors 28 for a four-cylinder engine. The injectors 28 introduce fuel into the engine manifold 30. The fuel rail is shown in section in Fig. 2. The fuel rail has multiple fittings 27 to mount the fuel injectors. A fuel return line 32 returns fuel to a pressure regulator 34 and thence to a tank return line 36.

In the fuel supply line 24 closely adjacent the fuel rail 26 is a pulse dampener 40 mounted on a T-connection 42. This connection can be a Schroeder fitting with a threaded nipple to mount the pulse dampener. In some cases the dampener may mount directly on a Schroeder fitting on the fuel rail.

In FIG. 3, a pulse dampener 40 is illustrated having a body 44 with a central bore 45 having a bottom threaded recess 46 to be mounted on the Schroeder fitting 42. The body has a top flange 48 which is spun at 49 over the inner walls of a collar 50 in sealing relation to a captured O-ring 52. An O-ring 54 at the top of recess 46 seals the mounting of the body.

In the collar 50 around and above the spun portion 49 is an annular recess 60 with a beveled side terminating at a flat annular rim 62 which is recessed to receive an O-ring seal 64. A diaphragm 66 has a peripheral edge overlying the rim 62 and the O-ring 64. A retaining closure cap 70 has a downturned flange 72 spun in around the base of the collar 50 to seal a chamber 74 between the flat top of cap 70 and the diaphragm 66. The diaphragm is dished to form a concavity with a flat central riser portion 76 providing the bottom wall of the sealed chamber 74. The diaphragm 66 is open

to the central bore 45 of the body 44 and is preferably formed of stainless steel.

In the assembly of the described parts, air will be trapped in the chamber 74, and pulses in the fuel pressure line resulting from the fuel pump and the fuel injectors will act against the resilience of the diaphragm and the pressure in the chamber. This action and reaction will produce a smoothing of the pulses in the manifold and result in a reduction in noise as well as a smoother fuel injection operation.

In FIG. 4, a structure similar to that shown in FIG. 3 in the form of a pulse dampener 80 in which like parts are marked with like reference characters. In this embodiment, a modified cap 82 is affixed to the body 50 in the same manner as described in connection with FIG. 3. However, the cap 82 is preferably formed with a raised crown portion 84 shown in dotted lines and assembled in this form. A formed die with a convex surface (not shown) is then used to depress the surface 84 to compress air within the chamber 86 above the diaphragm 74. The amount of compression or deflection of the cap can be calibrated to achieve the proper dampening effect for a particular operating pressure.

The operation of the embodiment of FIG. 4 is the same as that described in connection with FIG. 3.

Claims

1. In a fuel system for supplying fuel to an internal combustion engine including a fuel supply tank, a fuel pump to deliver fuel from said tank to a fuel supply line, a fuel rail adjacent an engine manifold and a plurality of fuel injectors on said fuel rail positioned to deliver fuel to the engine manifold, that improvement which includes a pulse dampener in said fuel supply system positioned adjacent said fuel rail and comprising:

(a) a body having a hollow chamber open at a first side to said fuel supply and closed at a second side,

(b) a resilient stainless steel diaphragm dividing said chamber between the said sides, said diaphragm closing said second side to form a closed air tight compartment to resist flexing of said diaphragm,

(c) said diaphragm being confined at the periphery thereof in said housing and having a dished portion curved away from said closed side of said chamber and having a flat central riser portion within said dished portion facing said closed compartment.

2. A fuel system as defined in claim 1 in which said second side of said body is deformed inwardly to compress air trapped in said compartment.

FIG.1

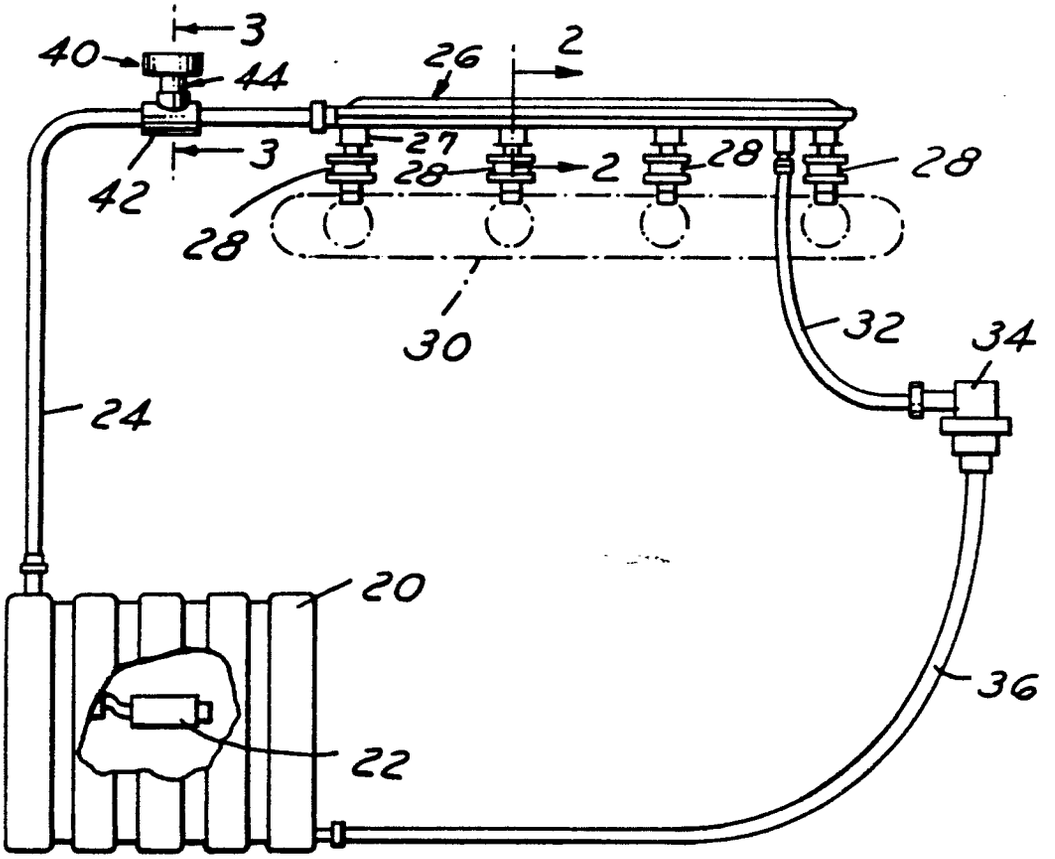

FIG.2

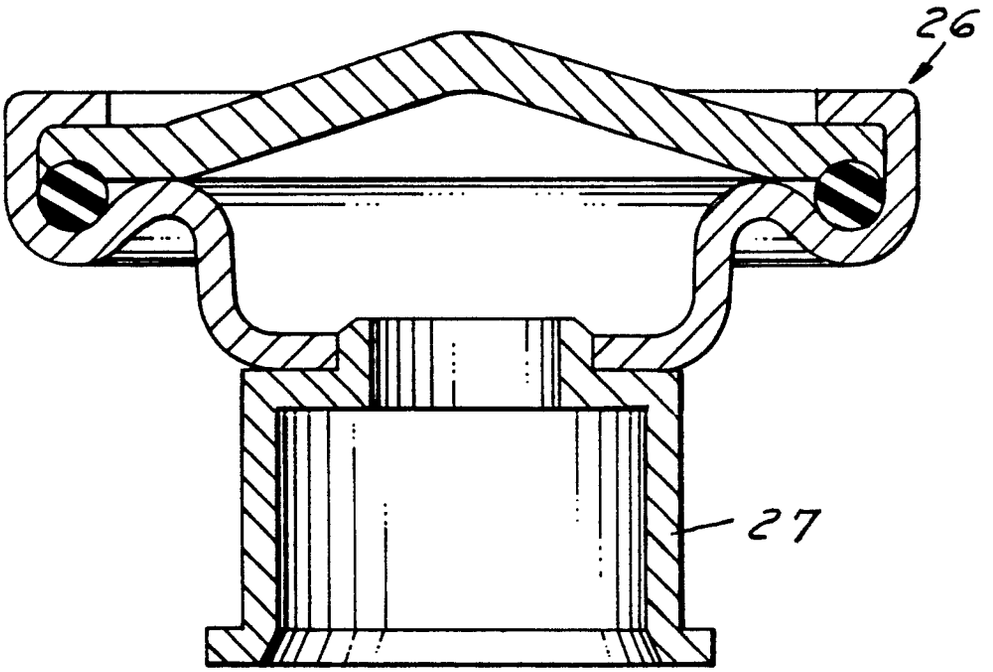

FIG.3

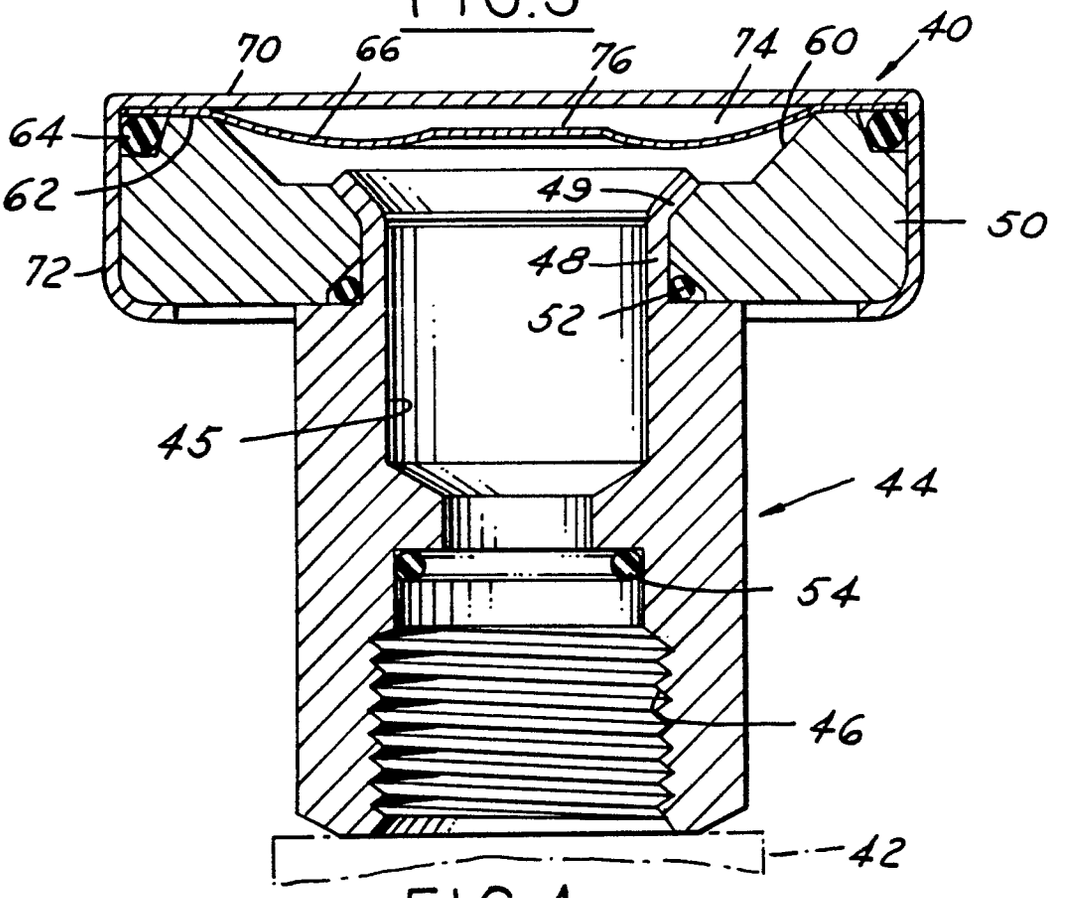
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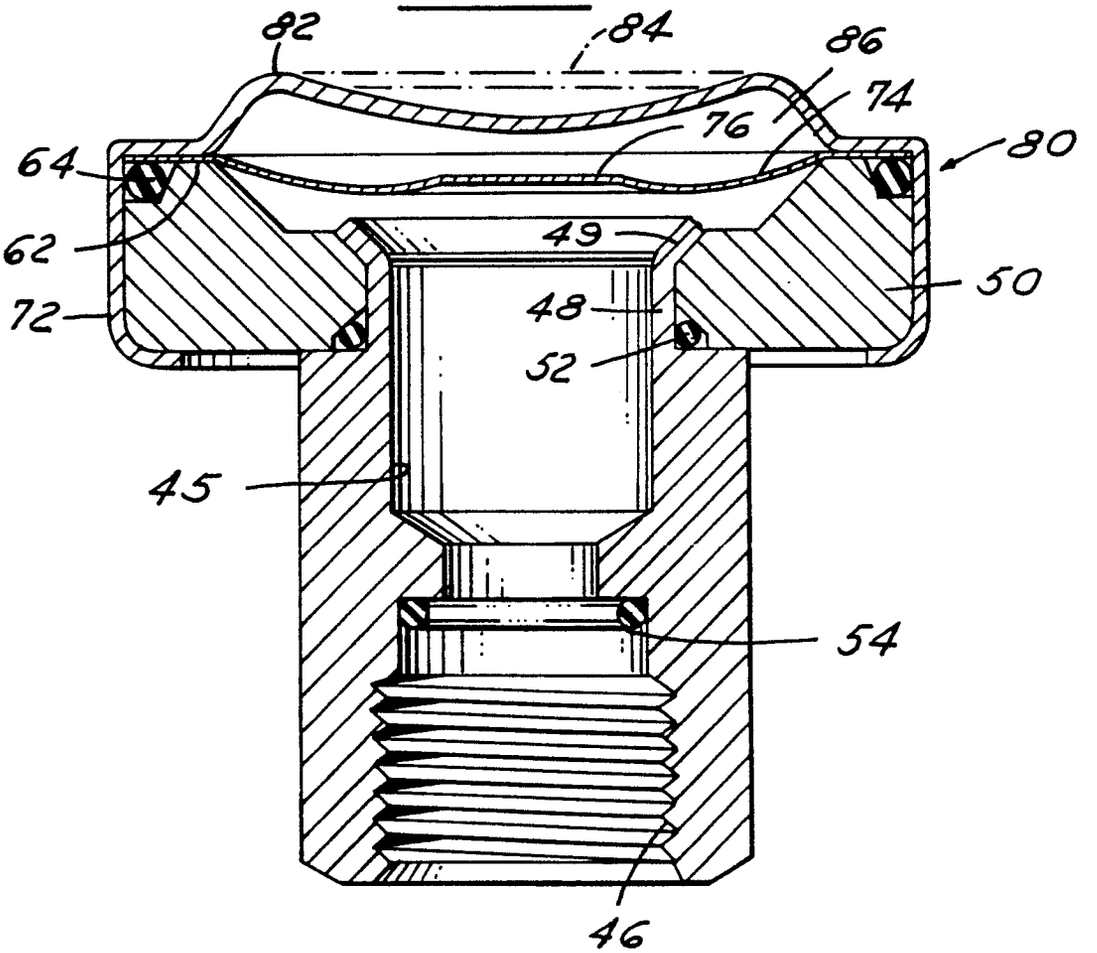
FIG.4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