United States Patent

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[54] **FUEL SYSTEM FOR NATURAL GAS TURBOCHARGED ENGINE**
5 Claims, 1 Drawing Fig.

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[50] **Field of Search** ..... 60/13, 39.11; 123/142, 119 (C), 120

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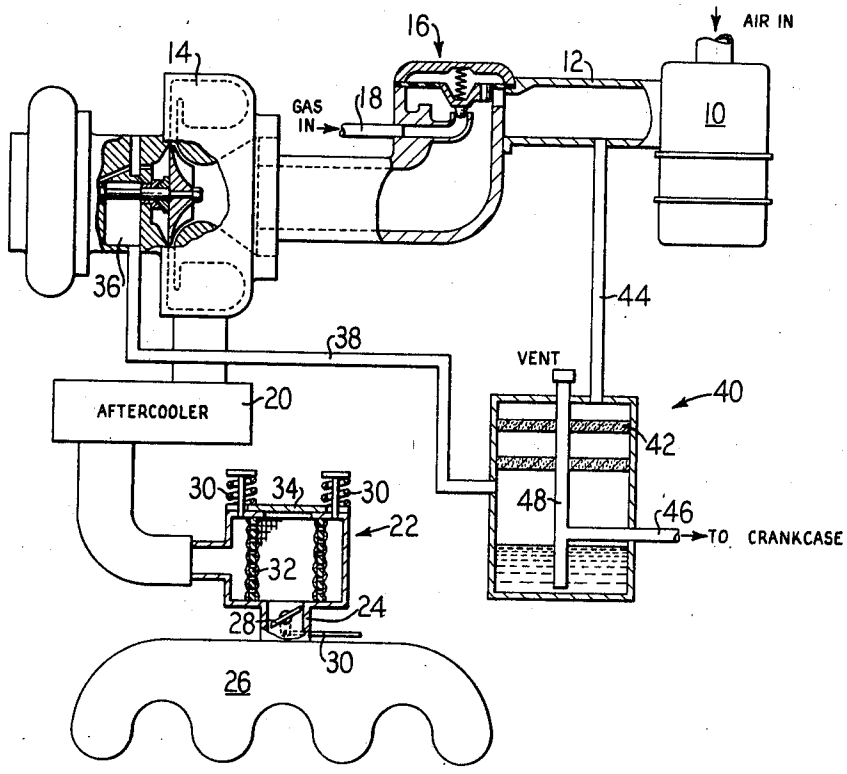
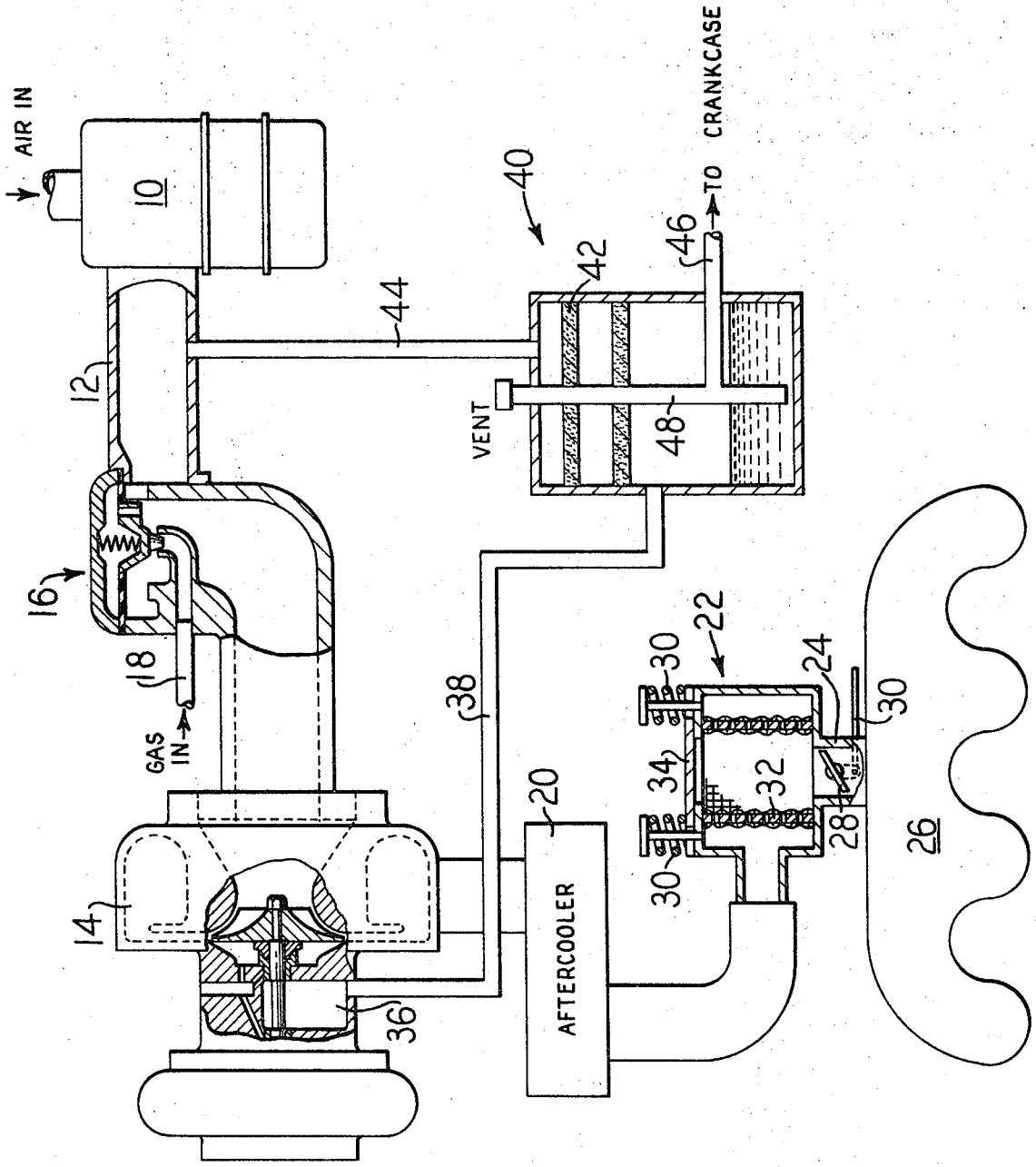
ABSTRACT: A turbocharged natural gas engine adapted for use with very low pressure gas by virtue of introducing the gas and combining it with air to provide a combustible mixture upstream of or on the low pressure side of the turbocharger. Safety means are provided to insure against damage by backfire and against admission of explosive gases to the engine crankcase.





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FUEL SYSTEM FOR NATURAL GAS TURBOCHARGED ENGINE

Natural gas is often available as a low cost engine fuel, but in many cases, the source is of low pressure gas which presents a problem of introducing it into the high pressure air stream of a turbocharged engine. Compressors have been employed to solve this problem but they are costly to acquire and operate and tend to offset the advantage of the low cost fuel. Other problems arise from the use of gas as a fuel in connection with backfiring which occurs in a spark-ignited engine and also in connection with the accumulation of the highly combustible mixture in the engine crankcase.

The present invention overcomes the problems recited above as well as others and will best be understood from the following specification which makes reference to the accompanying drawing.

The drawing is a schematic view with parts in section of mechanism employed in carrying the system of the present invention into practice.

In the drawing a conventional air cleaner is shown at **10** and air flowing from the cleaner is directed through a conduit **12** to the compression section **14** of a turbocharger. A carburetor generally indicated at **16** mixes air and natural gas, the latter entering through a pipe **18**. The carburetor will not be described in detail as it is one of several such devices manufactured for the purpose of combining air and gas and maintaining a proper fuel-air ratio.

The air and gas so combined are directed to the turbocharger and thence through an aftercooler **20**, which is also of conventional design, to a backfire relief device generally indicated at **22**. A passage **24** of this device communicates with an intake manifold **26** of an engine which is not shown. A butterfly valve **34** in the passage controls the volume of combustible mixture to the engine and is adjusted as by a governor (not shown) or other simple means with which it is connected by linkeage, a part of which is shown at **30**.

The present invention incorporates two safety devices, one of which is the backfire relief device. This device has a cover **28** held in place by springs **30**, the preload upon which is such that the cover will not be raised by normal engine operating pressures, but will be lifted against the force of the springs to relieve greater pressures experienced upon engine backfire. This relief device includes a metal screen **32** through which the backfire flame would have to pass in order to travel into the vicinity of the combustible mixture being delivered to the engine.

The screen operates in this manner because the heat of the backfire is so dissipated by the large surface area of the screen that ignition of the combustible mixture would not occur to cause damage to parts upstream of the backfire relief device.

Another advantage of the present system is that it prevents accumulation of the combustible mixture in the engine crankcase. The compressor includes lubricated bearings and excess

lubricant is caught in a well **36** in its housing and conveyed through a conduit **38** to a gas liquid separator generally indicated at **40**. The separator comprises a closed container with screens **42** separating it into upper and lower sections. It has an outlet through a conduit **44** which communicates with the intake conduit **12** and gas passing upwardly through the screens **42** deposits oil entrained therewith on the screens from which the oil gravitates to a collection sump in the body of the housing. When the oil level reaches an outlet pipe **46** which communicates with a stand pipe **48**, it flows by gravity to the engine crankcase. The stand pipe **48** is vented to atmosphere at its upper end to permit oil to freely enter its lower end. Thus, gaseous fuel which may enter the chamber **36** of the turbocharger through bearings which support the blower shaft passes with the oil to the gas separator **40** and is returned into the fuel stream without danger of entering the crankcase where its ignition could be extremely dangerous.

I claim:

1. In a fuel system for a natural gas turbocharged engine; a turbocharger, conduit means directing air to the turbocharger from the upstream side thereof, in the direction of fluid flow through said turbocharger, means for admitting gas into said conduit means to provide a combustible fuel mixture upstream of said turbocharger, an intake manifold for said turbocharged engine, passage means connecting said turbocharger and said intake manifold, and a backfire pressure relief device located in said passage means between said turbocharger and said intake manifold to effectively isolate said turbocharger from the harmful effects of backfiring in said intake manifold.

2. The invention of claim **1** in which the backfire pressure relief device has a wire screen to dissipate heat from backfire gas positioned to prevent flame from moving upstream in the direction of fluid flow through the fuel system.

3. The invention of claim **1** wherein the backfire pressure relief device includes a chamber defined by walls and a cover member which directly separates the interior of said chamber from the ambient and is yieldingly urged to close off said chamber from said ambient.

4. In a fuel system for turbocharged natural gas engine; a turbocharger, conduit means directing air to the turbocharger from the upstream side thereof in the direction of flow through said turbocharger, means for admitting gas into said conduit means to provide a combustible fuel mixture upstream of said turbocharger, a crankcase for said turbocharged engine, a conduit connected between said turbocharger and said crankcase through which turbocharger lubricating oil is drained to said crankcase, and a gas-oil separator to separate any combustible fuel mixture which may pass with said lubricating oil through said conduit.

5. The invention of claim **4** with means for directing the separated fuel mixture back into the system upstream of the turbocharger.