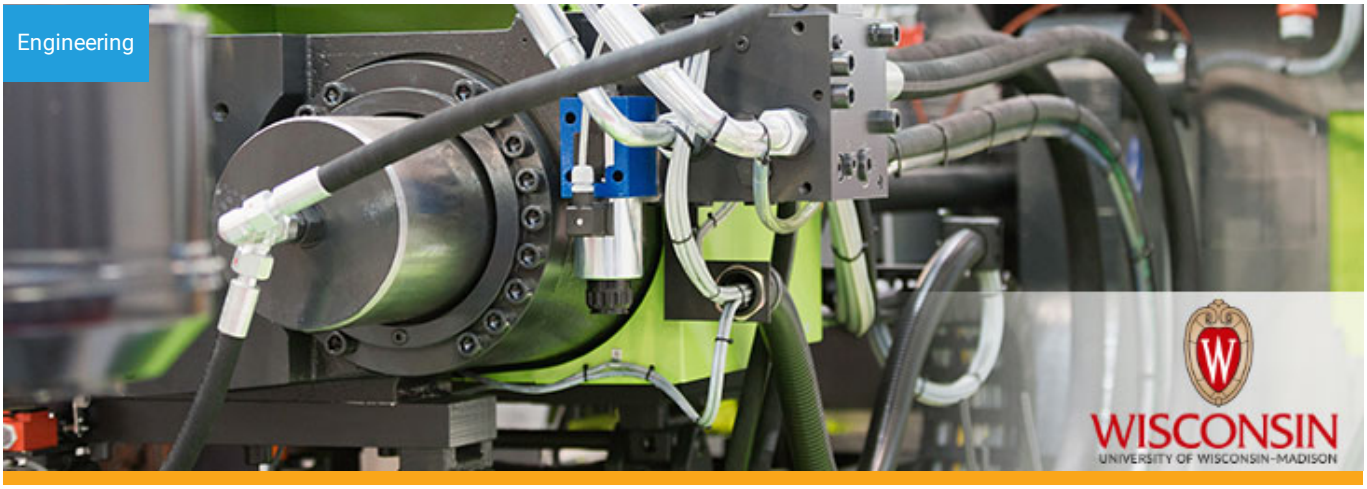
Engineering




# Improved Engine Carburetion with Porous Walled Fuel Tube

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**WARF: P06186US**

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**The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a porous fuel tube design for a carburetor that improves fuel efficiency and lowers emissions while maintaining low production cost.**

## Overview

A carburetor is used to generate the air/fuel mixture in engines by drawing air through a venturi during the intake stroke of an engine. The influx of air lowers the pressure, drawing fuel from a small reservoir through a small tube and into the venturi, where fuel mixes with air. The air/fuel mixture flows into the intake manifold and eventually into the engine's cylinder.

Due to the compressibility of the air, the flow of fuel through the small tube is not linearly proportional to the flow of air flowing through the venturi. Emulsion tubes contain small holes custom-designed for the engine to allow air pressure to "bleed" into the fuel tube and deliver fuel at a rate proportional to the flow of air. The tube may be designed to allow the air and fuel to mix and create a fine mixture of foam-like bubbles, which encourages the formation of small droplets as the mixture enters the venturi to improve combustion. Current carburetor fuel tube designs do not create an emulsion or the distribution of small droplets needed to significantly improve combustion.

Engines referred to as "small engines" typically are gasoline fueled and capable of generating shaft power of 25 horsepower or less. Small engines generally are used in low-cost, low-profit consumer and commercial products such as chain saws, lawn mowers, portable electric generators and small utility vehicles. Carburetors are 20 to 30 times less expensive than electronic fuel injection (EFI) systems, so the air/fuel mixture in small engines usually is generated using a carburetor for cost savings and to provide ease of manufacturing. However, EFI systems are much more efficient and significantly reduce emissions. An improved carburetor design that addresses the limitations of fuel economy and high emissions is needed.

## The Invention

UW–Madison researchers have developed an improved system for engine carburetion utilizing an emulsion tube. A porous wall surrounds an inner passage, where air travels around one side of the wall and fuel travels around the opposite side. Air is supplied through the pores of the tube to aerate the fuel, and the aerated fuel is expelled into a venturi while engine intake air further mixes with the fuel. The emulsion tube provides a high degree of fuel/air mixing across the entire range of intake airstream flow rates. The tube may have one or more holes drilled through its outer surface to the inner passage to assist in custom tailoring the fuel/air mix for the engine to provide the desired fuel/air ratio across the engine's operation range of intake air flow rates.

The pore sizes and densities may vary at different locations along the length of the tubular body to further customize fuel/air ratio and flow rates. However, variable-porosity tubes can be difficult and expensive to construct. The improved carburetion design provides an alternative arrangement with an emulsion tube formed of a tubular body with three axially aligned sections that each have different average pore sizes and densities to vary porosity discretely over the length of the tubular body.

The porous emulsion tube generates a foamy "bubbly flow" across the entire operating range of air intake flow rates of common

carburetors, with a well-mixed emulsion at the tube's exit far superior to that produced with conventional emulsion tubes. With appropriate tailoring of the porosity of the emulsion tube, a linear relationship between fuel flow and air intake flow may be provided, resulting in improved efficiency and reduced emissions.

## Applications

- Small engines meeting air quality and emissions regulations and standards

## Key Benefits

- Generates a foam-like mixture of fuel and air
- Enables fuel to be broken into a distribution of small droplets
- Decreases cycle-to-cycle variation
- Improves combustion efficiency
- Reduces emissions

**Tech Fields**

- Engineering : Electric machines

For current licensing status, please contact Emily Bauer at emily@warf.org or 608-960-9842