



# Use of Multiple Injections of Increasing Pressure to Reduce Diesel Engine Emissions

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**WARF: PO1108US**

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**The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a technique for simultaneously reducing both nitrogen oxide and particulate emissions from diesel engines.**

## OVERVIEW

Nitrogen oxides and particulates (soot) are two common pollutants that result from the burning of fuel in diesel engines. Cooler engine conditions tend to reduce nitrogen oxide emissions; however, these same conditions increase the emission of particulates, which do not fully oxidize at lower temperatures. Similarly, high engine temperatures oxidize more soot, but generate greater amounts of nitrogen oxides. Due to this “nitrogen oxide-soot tradeoff,” reducing both types of emissions at once has proven difficult.

## THE INVENTION

UW-Madison researchers have developed a multiple fuel injection scheme that should simultaneously reduce both nitrogen oxide and particulate emissions from diesel engines. Instead of injecting a single fuel charge during a combustion cycle, several charges are injected. Each charge carries an amount of fuel that when added together equals the single charge and is injected at a higher pressure than the last. Spacing fuel injections into several charges of increasing pressure enlarges the surface area of the soot clouds that are exposed to oxidation. It also maintains more uniform combustion temperatures, leading to cooler engine conditions and lower nitrogen oxide emissions. This technique provides higher combustion chamber mixing and greater soot oxidation rates even during the power stroke when mixing rates are reduced due to piston expansion.

## APPLICATIONS

- Diesel engines

## KEY BENEFITS

- Results in lower particulate and nitrogen oxide emissions than single injection

## THE WARF ADVANTAGE

Since its founding in 1925 as the patenting and licensing organization for the University of Wisconsin-Madison, WARF has been working with business and industry to transform university research into products that benefit society. WARF intellectual property managers and licensing staff members are leaders in the field of university-based technology transfer. They are familiar with the intricacies of patenting, have worked with researchers in relevant disciplines, understand industries and markets, and have negotiated innovative licensing strategies to meet the individual needs of business clients.



- schemes using similar timing and fuel volume
- Provides an innovative way for the diesel engine industry to meet new, tougher emission standards
  - Achieves particulate control within the combustion chamber using a straightforward modification of existing hardware
  - Eliminates need for cumbersome and expensive particulate traps
  - May be used with exhaust gas re-circulation (EGR) to further reduce nitrogen oxide emissions
  - May result in better fuel economy

## ADDITIONAL INFORMATION

### Related Portfolios

**[Reactivity Controlled Compression Ignition Technology Portfolio](#)**

### Tech Fields

Engines & Power Electronics - Automotive

Clean Technology - Transportation

## CONTACT INFORMATION

For current licensing status, please contact Emily Bauer at [emily@warf.org](mailto:emily@warf.org) or 608-960-9842.

