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Fuel-saving ignition breakthrough

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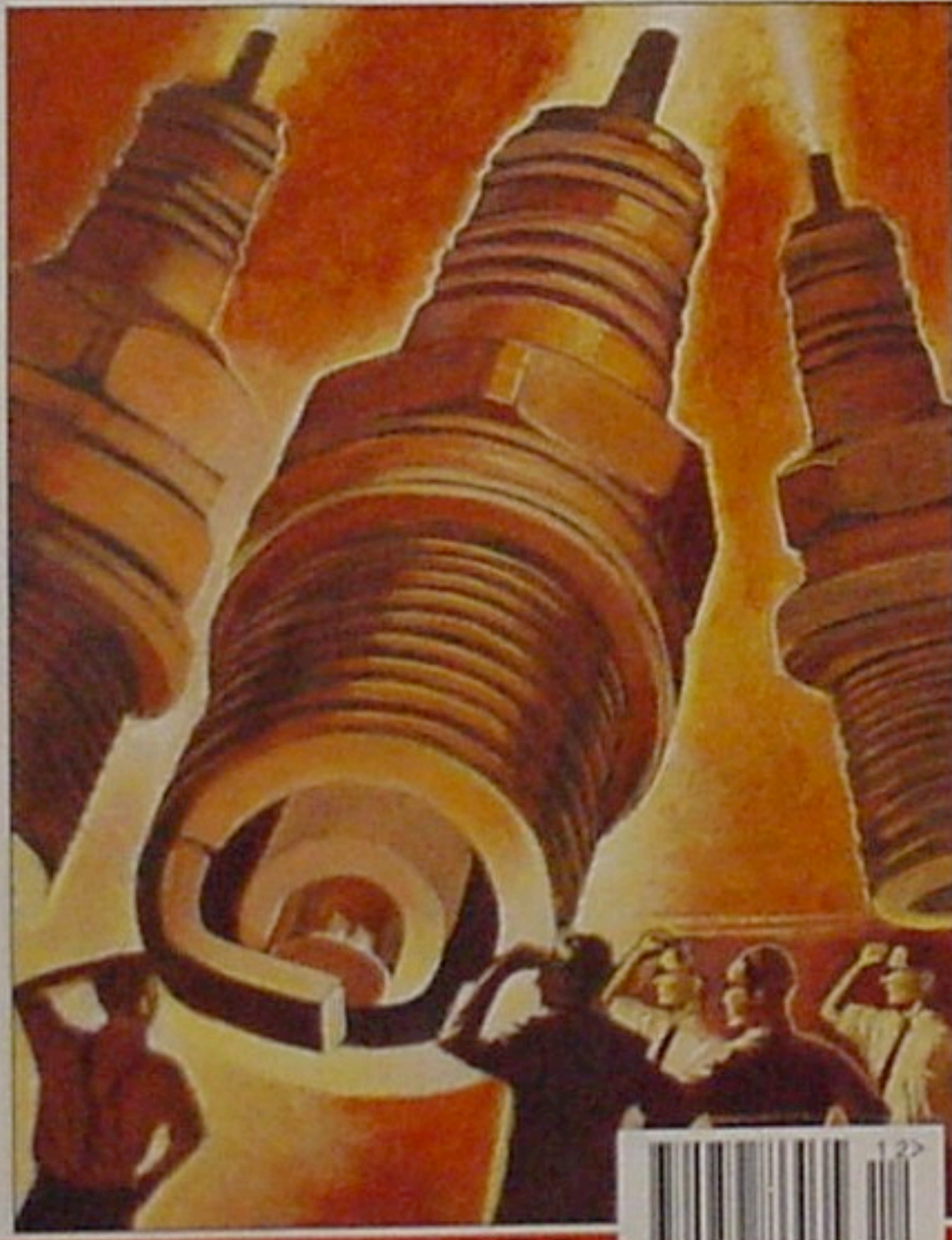
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Arlington, MA-based Combustion Electromagnetics Inc. revolutionizes ignition spark with its Hybrid Inductive Ignition (HBI).

EXCLUSIVE REPORT:

REBIRTH lean-burn technology

Flow-enhanced spark breathes new life into an old technology, improving performance and fuel economy

John Lewis, Northeast Technical Editor

4 benefits of flow-enhanced spark

- A higher peak voltage of 38 to 42 kV allows larger spark plug electrode gaps that improve ignition and reduce electrode erosion.
- Faster rise times, higher discharge energy, and higher circuit efficiency give greater resistance to spark-plug fouling.
- Faster coil-charge time (V_{coil} that of 50) eliminates computerized dwell and makes HBI (the new system) universal. Retrofitting is easy on many different types of powerplants such as racing and performance, stationary natural gas, production vehicle, and other engines.
- Rapid coil-charge time and a low-loss snubber substantially reduce switching losses and dissipation, despite HBI's higher energy and peak currents.

Without cupping your hands around it, a match in a hurricane quickly blows out. Today's ignition systems present engineers with a similar challenge. Piston motion, even at moderate engine speeds, induces flow velocities that easily quench the spark before the fuel mixture ignites. That's why engine designers typically locate spark-plug electrodes in a crevice protected from the combustion chamber's flow field.

Michael Ward, president of Arlington, MA-based Combustion Electromagnetics Inc. (CEI), has a different take on things. He says flow should actually be an asset when lighting the lean-fuel mixtures that provide the engine efficiencies and low NO_x emissions that automotive engineers desire.

Now, Ward has a patent for flow-coupled spark discharge which one Chrysler engineer says could be the enabling technology for the next generation of lean-burn engines, once the Holy Grail for those seeking to improve fuel economy. Test results at GM, Mazda, Lucas Industries, and Chrysler highlight the advantages of

Ward's high-energy, flow-resistant spark. With average U.S. fuel economy at its lowest level since 1985, according to *The New York Times*, and car companies entering the penalty phase for missing CAFE (Corporate Average Fuel Efficiency) requirements, lean burn and Ward's high-flow spark may offer a panacea.

Key to the patented technology: a low-cost ignition system that, he says, delivers three to five times more spark energy, higher ignition efficiency, more spark power, and greater flow resistance.

The spark actually thrives in the engine's flow field, Ward asserts. Components enabling the high-powered spark:

- A power converter that steps up battery voltage to 42V from the standard 12V.
- Higher switching currents from standard 600V IGBTs (insulated gate bipolar transistors).
- A proprietary false-firing arrester.
- A low-loss snubber that reduces switching losses and sends coil leakage energy back to the battery.

Taken together, these components produce a spark with current in the range of 300 mA to 500 mA and with a triangular