

Cookin' with gas: Professor earns patent for flameless industrial oven

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Prototype of the flameless impingement oven built by Pawel Olszewski in the engineering and engineering technology department at UW Oshkosh. Olszewski recently was granted a U.S. patent for the oven, which mixes air and flammable gas in such a way that it creates heat without visible flame. Credit: UW Oshkosh

Pawel Olszewski, a University of Wisconsin Oshkosh associate mechanical engineering technology professor, recently was granted a U.S. patent for his flameless impingement oven, designed and built in

the Teaching and Energy Research Industrial Lab (TERIL) on the Oshkosh campus.

Olszewski began the patent process back in 2019 with WiSys, the Wisconsin-based nonprofit dedicated to helping inventors protect their [intellectual property](#), and received the news of approval in February.

Titled "flameless impingement [oven](#)," the invention is patent number US 11,585,601 B2, granted on Feb. 21.

Industrial ovens—like the ones this creation improves upon—are used for a variety of purposes, including heat treating and melting materials like steel or aluminum. The benefits of the flameless impingement setup, Olszewski said, include faster heating to increase productivity; fewer emitted pollutants because the thorough heating reduces [nitrogen oxides](#); and a reduction in [fuel consumption](#) with [gases](#) exhausted at lower temperatures.

The new oven arranges [natural gas](#) and air jets to directly affect the object being heated, substantially transferring heat by impingement transfer rather than by conventional radiation and thermally induced convection.

Because the air and gas are swirling at such speeds inside the oven—"like a huge tornado," Olszewski explained—the chemical reaction to produce [extreme heat](#) is occurring everywhere all the time.



The flameless impingement oven prototype features 25 air nozzles and 16 natural gas nozzles. Once ignited, the oven produces temperatures beyond 1,000 degrees Celsius. Credit: University of Wisconsin Oshkosh

The chamber, which is a foot tall, a foot wide and a foot deep, reaches temperatures beyond 1,800 degrees Fahrenheit.

"Everything mixes and the gas is always meeting the oxidizer," he said. "So when you look inside the furnace during the normal flameless operation, there are no flames. You have combustion but no flames. Natural gas oxidizes, it reacts with the oxygen, generates heat, but there is no flame."

The prototype was built in the TERIL on the third floor of the Halsey Science Center. The oven is the fourth unique industrial system built there and requires the other three to run: chilling, pumping and

compressed air.

The idea can be traced back to when Olszewski was a post-doctorate fellow at the University of Michigan. While there, he worked with simpler flameless ovens. The ideas continued to swirl around in his mind and when he came to UW Oshkosh in 2014 he and his students began to create all of the industrial systems that allowed for the oven to exist.

"There is no single piece of the equipment that was purchased in the state it's in. Everything was purchased as a component," he said. "We cut whatever the frames, we organized our own control cabinets, everything here including the software that controls all of the systems."

What Olszewski is hoping for next is a local company to express interest so the idea can grow beyond the single prototype. He said any company that melts aluminum, cast iron, steel or even glass could make use of the technology. It can translate to more or less any size and ovens already in use could be retrofitted.

"I'm hoping it will catch somewhere," he said.

More information: Patent number US 11,585,601 B2: [image-ppubs.uspto.gov/dirsearc ... downloadPdf/11585601](https://ppubs.uspto.gov/dirsearc...downloadPdf/11585601)

Provided by University of Wisconsin Oshkosh

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