

COMPANY PROFILE ///

SURFACE COMBUSTION

A LEADER IN INDUSTRIAL HEAT-TREAT EQUIPMENT



For 110 years, Surface Combustion has provided thermal systems and equipment to enhance the physical properties and surface characteristics of the materials used in gearing and more and improve the performance and competitiveness of customers' products.

BY KENNETH CARTER, THERMAL PROCESSING EDITOR

A company doesn't just make a ripple in the industrial sector after more than a century in business — it makes a splash.

Surface Combustion celebrated its 110th year in 2025, and it's come a long way from its humble beginnings of a couple of scientists working on a joint patent.

Now, the company is a fully integrated supplier of furnaces and services that aid many industries, including the gear-manufacturing industry, where Surface Combustion can assist in many different steps in that process, according to Ben Bernard, vice president for global sales and marketing with Surface Combustion.

VITAL STEP IN GEAR PRODUCTION

"In the gear-blanking start of production, once you have a forged form of a gear, we can help normalize those gear blanks to get them ready for the gear-cutting process," he said. "Depending on the volume of production, we would then have a continuous normalizing furnace. It could be an isothermal annealing function, just to make sure that you have the quality of the gear ready for gear cutting, to extending gear cutting life, whether it be hobbing, broaching, or rolling — whatever the processes might be — all the way through to the shaving."

In the middle of the value stream offered by Surface Combustion is the traditional heat treatment that most people think about — for example, neutral hardening or carburizing, according to Bernard.

"Surface combustion has a full line of batch and continuous furnaces, as well as atmosphere generator equipment, that enables the heat treatment of the gears to the final specifications after hardening, and then the final tempered requirements for the hardness," he said. "And then from heat treating, you would go to final grinding, and then you'd have a finished gear."

FULL LINE OF FURNACES

Surface Combustion has a full line of thermal processing furnaces and atmosphere furnaces, according to Bernard, and those furnaces can be continuous batch atmosphere heat treatment or be built for vacuum heat treatment.

"We have a full line of vacuum hardening and vacuum carburizing furnaces as well," he said.

Although Surface Combustion doesn't make gears outright, Bernard said the equipment designed and built by the company is an integral part in the successful creation of essential gearing.

"We are an equipment supplier and equipment OEM where we actually manufacture the heat-treat thermal processing equipment that would sit on a gear manufacturer's floor — or forge shop's floor if it's the gear blanks — they would blank the gears and then they would heat treat them before they ship them off to the gear-cutting

manufacturing facility, whether that's aerospace, mining gears, or automotive," he said. "They would have a heat-treat area with Surface Combustion equipment in it. That would become a step in the process where you would either have the gears batch loaded or in bins going to the furnace, and from there, to final form shaping."

INTEGRITY, TRADITION, AND TECHNOLOGY

Over its 110-year history, Surface Combustion has — and continues to — take pride in its family-owned roots, according to Bernard.

"We value integrity, tradition, and technology," he said. "We stand by our customers, and we do everything in our power to make sure the customer has what they need to have a successful project. We're with you every step of the way with our full staff of support, aftermarket parts, and services. We are a leader in this industry with over 650 process patents, and we also have some of the most notable registered trademarks in the industry, whether it be AllCase[®] for batch inertial quench furnaces or RX[®] endothermic gas generators, which is the baseline carbon potential inside of carburizing furnaces. We have a strong tradition here in a large market share, so we have a large installed base and capabilities through our references."

That tradition paves the way for Surface Combustion to be a leading contender when it comes to technology, according to Bernard.

"We're always looking at the newest technologies — taking feedback from our customers and looking for the next opportunity to evolve what we have into a larger format," he said. "For example, wind gears — you have to take a traditional pit size furnace and make it larger to fit the form of the product that they're trying to cut in a gear industry. Or, you have smaller components, like fasteners. We have to figure out how to get small parts through the same furnace, so we always use our technology to adapt to what the customers present to us."

CYCLICAL SECTOR

When it comes to how the company has kept pace with an ever-evolving industry, Bernard points out that an advantage to that has been the cyclical nature of the sector.

"We have technologies that were developed in the '70s that could be coming out again as fresh themes — electrification of furnaces is one," he said. "We had to have electric heating capabilities developed back in the '70s when there was an energy crunch, so we have some of those same technologies today that we can apply to the ever-evolving green technology push. We have those challenges as well, and we have solutions for those."

Cleaner working environments are also a challenge that Surface Combustion has been tackling, according to Bernard.

"Vacuum hardening is another instance where we've done that,



Surface Combustion has a full line of thermal processing furnaces and atmosphere furnaces. (Courtesy: Surface Combustion)



Over its 110-year history, Surface Combustion has – and continues to – take pride in its family-owned roots. (Courtesy: Surface Combustion)

and also for vacuum ion nitriding where we have created alternative ways to nitride without the use of ammonia in order to make it a little bit more approachable,” he said. “We have so many different markets that we support, whether it be mining or primary steel production down to medical and aerospace. We have to be able to adapt and understand the specific requirements for each industry and adapt our furnaces to their specifications.”

CUSTOMER RESOURCE

And that means being a resource its customers can draw upon — a resource with extensive knowledge and history and references harnessed by a full engineering staff, according to Bernard.

“When a customer comes to us, we really want to understand the work description and the process needed,” he said. “We ask them questions like: What is the cycle timing? If they don’t know that, then we ask what kind of material grade are they using? What are the final heat treatment specs that they’re doing? That’s the kind of information we need to understand. We want to know the total avail-

able operating hours per year, and whether it’s going to be a continuous process. If it’s a batch process, we need to know what works for their own company process flow.”

Another aspect of satisfying a customer is not just the equipment and what it can do, but how it will be integrated into the customer’s work space, according to Bernard.

“We’re talking form, fit, and function: Where’s it going to fit? What’s the available space? Is it replacing something? Is it going into a greenfield?” he said. “And also, from the materials and process standpoint, we want to understand what kind of operating

temperature range is needed, what types of different pieces of equipment are required, in addition to very specific things to the equipment: What type of heat source are they looking for — electric or gas heated, direct fired, indirect heat in the case of an atmosphere furnace. This also includes what types of controls and systems they need in place in order to maintain the quality in their furnaces.”

110 YEARS

Surface Combustion began in 1915 when scientists Dr. William Arthur Bone of London and Charles Edward Luck of New York collaborated on a joint patent. The scientists were experimenting with fuel gas, and they determined that, by mixing air prior to combustion with just enough air to support that combustion, it resulted in a much hotter and efficient flameless combustion, according to Bernard.

“At that time, it was the surface combustion,” he said. “They had a joint patent together, and then they got together with industrialist Henry Doherty, and they formed the company Surface Combustion



Although Surface Combustion doesn't make gears out right, the equipment designed and built by the company is an integral part in the successful creation of essential gearing. (Courtesy: Surface Combustion)

in 1915." Through those decades, Surface Combustion has been involved with many achievements that have pushed the industry forward, but one that sticks out for Bernard is when the company created and supplied roller hearth furnaces used to destroy chemical weapons.

"We supplied four of them to demilitarize chemical weapons in Russia," he said. "That was a bipartisan project through the UK MOD, Canadian DFAIT, and the U.S. government where we supplied four large 60 x 60 base tray roller hearths to get rid of millions in the stockpile of projectiles in the early 2000s. We supplied that, and all those stockpiles are gone."

As a testament to the longevity of the equipment Surface Combustion manufactures, Bernard pointed out the company has produced continuous stainless-steel strip lines used for annealing that are still running.

"We also have brass continuous strip lines, and we have aluminum continuous strip lines that are floaters that we have patents for," he said. "Floaters mean the aluminum in the heating section never comes in contact with any moving member or mechanical damage. That is a critical process in making an airplane fuselage. And just celebrating 110 years is a great milestone. It's gone by really fast. To be a family-owned company and be able to say that we're USA-owned and primarily getting all our vendors and supply base for the USA as well, we're really proud of that fact, too."

LOOKING TO THE FUTURE

Bernard expects Surface Combustion's importance in the industry



Surface Combustion is an equipment supplier and equipment OEM that manufactures the heat-treat thermal processing equipment that would sit on a gear manufacturer's floor. (Courtesy: Surface Combustion)

to continue to grow as he sees the growth of nearshoring in the U.S.

"As some of the industrial base comes back to the U.S., new challenges might come up, so we're always adapting to new industries that might have some need, whether it be from energy to aerospace and even to outer space," he said. "There are people who are looking for projects in order to heat treat components that are used in those areas, and we're able to adapt into those marketplaces with our references."

Since we have a broad market presence, we can continue to be a resource to the industry in the next 10 years, sharing our knowledge and our experience through our references. We see that as a resource to industry. We ask customers to start with Surface Combustion, and then we can assist them as a family-owned, made-in-the-USA company with a strong presence and support." ♪



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