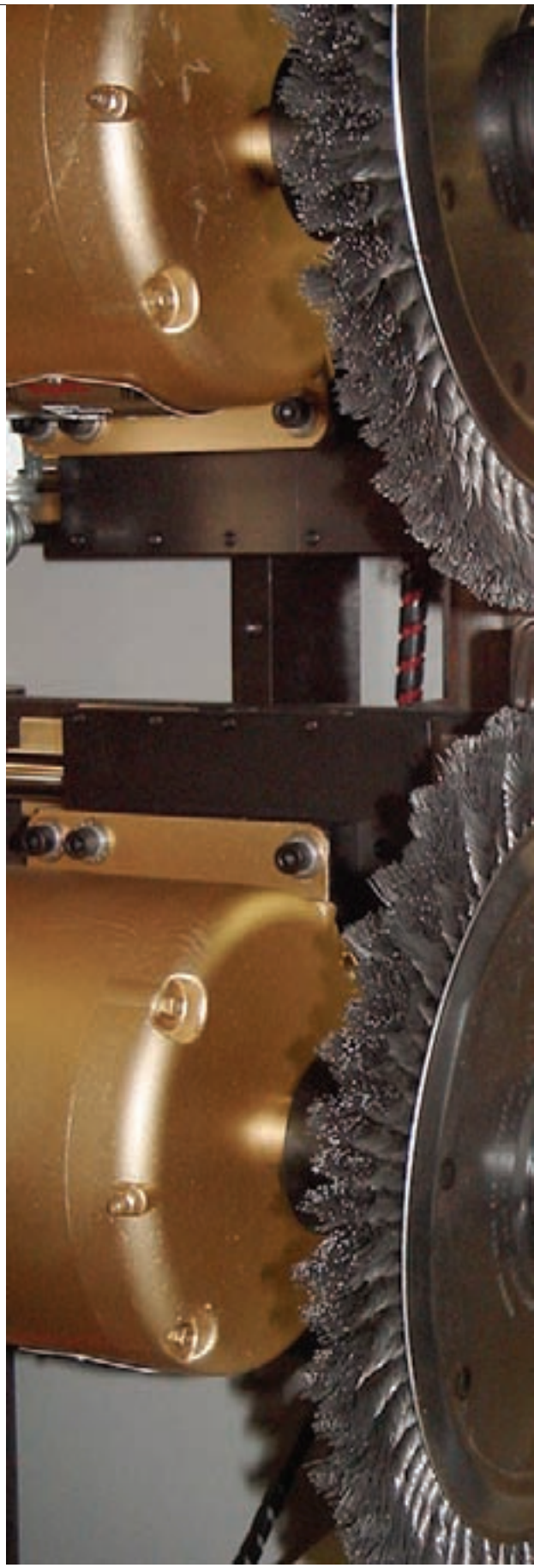
OLS Zero-Setup Gear Deburring System

BOOSTS MINING AND CONSTRUCTION SUPPLIER'S BOTTOM LINE



The need to deburr gears after the teeth are finished is a problem that almost every gear manufacturer faces. As we all know, burrs created by gear cutting methods can cause functionality issues, safety concerns and issues with heat treatment and grinding.

Deburring, by definition, is simply removing a protruding, ragged edge raised on the surface of metal during hobbing, shaping, gashing or grinding. It is a necessary step for the aforementioned reasons.

Such was the case when On-Line Services of Cleveland, OH, was approached by a major worldwide supplier of mining and construction equipment with a need to reduce cost and labor as well as increase quality. As we also know, there is a definite need for consistency, efficiency and quality in today's manufacturing world.

What led the customer to OLS was its frustration with the hand deburring method. OLS says that the primary problem was that the process was labor-intensive. Despite extensive training, finish and consistency varied from operator to operator. Making matters worse, production would literally be stopped or greatly slowed down if someone called in sick. While the quality was acceptable, it was never predictable and occasionally parts were rejected because of bad deburring.

The customer had to debur the edges of the teeth on both sides of a family of parallel axis gears in order to achieve a required chamfer/radius of approximately 0.0300". In considering the solution, OLS was mindful of the customer's desire for the machine and, more importantly, the processes to be repeatable. Ultimately, the process accountability the

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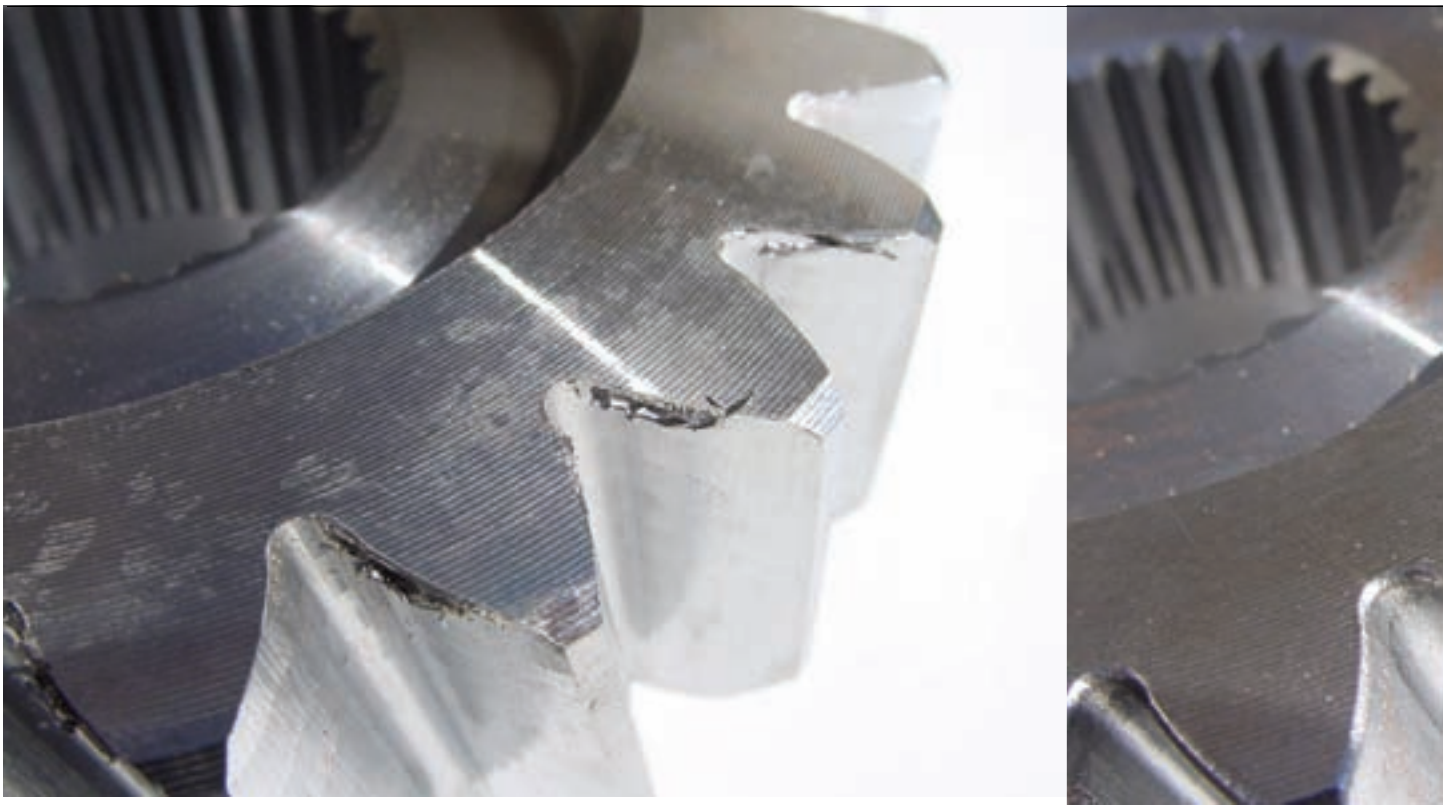

customer sought was a more specific quantification for a good part. This family of parts needed to be processed in an automated cell with minimal operator involvement. A manual setup method was not acceptable due to the large variety of sizes, number of teeth and batch quantities that these parts are processed in.

The solution involved using a total of four wire brushes simultaneously configured to remove burrs and create a consistent edge-break around the entire gear tooth profile.

Why Brushes?

With all the different options available for deburring media, why choose brushes? Following is a list of pros vs. cons that OLS discussed with the customer.

Cons

- Brushes are not capable of creating a “dimensional” chamfer—for example, a straight 45-degree angle cut to a specific depth. This, however, is usually a disadvantage any way, as it creates two new edges that would act as sharp edges or stress points. The radius that a brush creates actually relieves the stress points.
- Slight visual surface effect on the face of the part. This also is not typically a concern, as it generally does not harm the actual surface finish.
- Wire breakage. Throughout the life cycle of the brushes, the wire tends to fracture and break off, leaving small wire particles at the floor of the machine.

Pros

- Flexibility allows for ease of setup.
- Cost-effective compared to other methods.
- Environmentally friendly—does not produce hazardous waste compared to other methods.
- Equipment is smaller and less expensive than other methods.
- Process accountability and repeatability.

Adam Mutschler, applications engineer at OLS, says one big reason they chose wire brushes was the brushes’ ability to take advantage of the *Zero SetUp* feature of OLS’ machines. He says that *Zero SetUp* is a program that’s written into the software and includes a series of software screens where the operator can find pre-stored part profiles. Users set the parameters and save them as a "recipe" (profile). After that, the machine can be commanded to set the brushes for that recipe with the touch of a few buttons.

The *Zero SetUp* system allows the software to set up the brushes to properly contact the parts and set the brush engagement and wear compensation.

OLS’ Auto Amp Compensation was another selling point. Auto Amp Comp is a proprietary system used to control brush pressure, says Mutschler. It is an automatic adjustment system that maintains constant brush pressure. As brushes wear, the system measures brush pressures against the pre-set value and brushes accordingly.

Auto Amp Comp is also capable of alerting the operator when a brush head is at fault for whatever reason, thus preventing unprocessed parts.

This feature is also used to achieve the desired brush engagement amount for each part being processed. Upon the initial setup of a new part number, all brush heads are retracted to allow the maximum-size part to enter. The specific part number is then called up on the recipe screen of the operator interface, and the start button is pressed. The part shuttles into the machine and begins to rotate. As the front door is closed, all brush heads are activated, and they begin to feed toward their desired location until the proper load is met. Upon each brush reaching its desired load parameters, that brush is de-activated until the remaining brushes have reached their desired load setting. Once this "auto-set" process is completed, all brushes are activated and execute a complete cycle, producing a good part, even for the setup process. The machine is now set up to process the batch of this part number.

So, by using the Auto Amp Compensation and the *Zero SetUp* menu system features on the machine, the parts are easily set up, and each part exits the machine as a good, finished part, eliminating setup scrap, Mutschler says.

For proper positioning of the brush, the machine axes must be moved for each gear to be deburred. Two methods can be used:

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Gear data is used to position the five axes of the machine properly. The operator enters the part outside diameter and the bore diameter. This is required for clearance issues and provides positioning for the brushes to engage at the sweet spot. Once entered, the axes move into position and the part is deburred. The positions can be optimized if needed by the operator. OLS marketing manager Tony Festa sums it up as "You select a recipe and the software just does it." The second option is for the operator to manually adjust each axis to accommodate the settings needed.

In either case, the data of all variables include brush axis position, brush engagement amount, part speed, direction, etc.—all variables that make up the specific part's recipe. These recipes are stored alphanumerically, and each is labeled with a number or letter designation. Once the gear has completed the primary shaping process, the operator refers to the software to find the correct recipe and transfers the data to the central processor. A number of machines are designed to interface with an auto-load system. The auto-load system has the capability of communicating to the machine which part is loaded and, automatically can re-set the software on its own.

The standard OLS Model 5000 *Zero SetUp* Gear Deburring System is capable of handling parts up to 350 pounds. For the top side only, specifications include 2–16" in outside diameter, and up to 16" faces (height). When considering both sides simultaneously, compatible measurements are 3–16" in outside diameter, and up to 16" faces (height).

The Model 5000 is available with standard, manual setup and in several other sizes to accommodate the needs of larger parts.

And what did the manufacturer of mining and construction equipment say about the end result? "Our customer was pleased with the results of the machine, as the control of the edge radius, the machine repeatability and the ease of operator involvement allowed this unit to become a robust part of two important cells," Mutschler says. "The cell is a complex balance of all machines communicating and performing as needed, and when one goes down, they all stop. Operator involvement is reduced to brush changes approximately once per week and normal housekeeping. The part quality is excellent and the brushed radius corners have also reduced chipping that can be caused by other forms of chamfering. They have been able to operate hands-off, allowing all communications to function and setups to be predictable and dependable." ■

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