

# An Automated State of Mind



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**Au-to-ma-tion** (ô'tə-mā'shən) n. 1. Automatic operation of equipment, a process, or a system. 2. The techniques and equipment used to achieve automation. 3. The state of being automatically operated.

As global competition continues to increase, North American die casters are facing growing challenges on a daily basis. Not only are our die casters being asked to provide higher quality castings at lower prices, they are finding it difficult to find workers to fill the positions needed in an effort to meet this demand. In order to persevere in this aggressive world economy, the need for automating die casting processes is proving critical to the industry's competitiveness according to many of today's successful die casters.

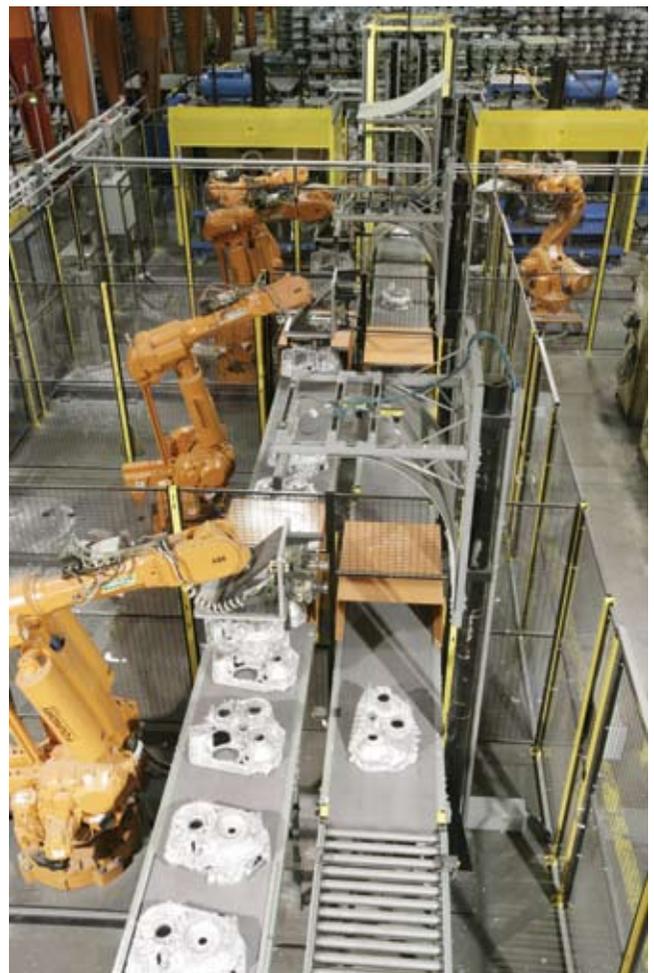
Automation in die casting is the next logical step in the industry's evolution from its primitive beginnings, which started in 1849 when Sturges patented a process for casting printer's type with a machine known as a "Lead Kettle." In 1868, die casting as we know it today was born when Charles Babbage, an English inventor, developed a pressure die casting process to make components for a calculating machine that was a precursor to modern computers. By 1892, phonographic parts were being die cast for Thomas Edison's then revolutionary phonograph and the new cash register. It wasn't until nearly 60 years after Sturges's patented process that die casting began to evolve and the mass production of commercial parts commenced.

Despite its meager beginnings, die casting has advanced from the original low pressure injection method to techniques including high pressure casting at forces exceeding 4,500 pounds per square inch, squeeze casting and semi-solid die casting. A process that was once limited to simple lead type alloys, has now progressed forward so that modern die casters are producing castings in a variety of sizes, shapes and wall thicknesses that are strong, durable and dimensionally precise.

Modern die casters use a number of sophisticated methods to automate the die casting process and provide continuous quality control. Automated systems can be used to lubricate dies, ladle metal into cold chamber machines and integrate other functions, such as quenching and trimming castings. Microprocessors can now obtain metal velocity, shot rod position, hydraulic pressure and other data used to adjust the die casting machine process, assuring consistent castings shot after shot. These process control systems also collect machine performance data for statistical analysis in quality control. Die casting has come a very long way over the past century, and will likely continue to progress due to the added capabilities and increased quality that automation provides modern die casters.

"With the future looking like more variations of products with smaller lot sizes, it makes logical sense to utilize the automation technologies that are available today," proclaims President of Ryobi Die Casting Tom Johnson. Ryobi, located in Shelbyville Indiana, is one of the largest independent die casters in the world with 2004 sales totaling \$161 million. With 42 die casting machines ranging from 500 tons up to 3500 tons, the company supplies various parts, including cylinder blocks and transmission cases to the automobile industry.

Ryobi has been witness to the evolving industry over the past 20 years. What started as a small subsidiary of Japanese die caster Ryobi Ltd. with 50 employees, has grown to become one of North America's top producing



*ABB model IRB-6600 robots load and unload the trim presses. The castings are then moved along a conveyor belt where ABB IRB-6400 robots identify and deflash the castings.*



*The robots work in conjunction to maximize efficiency, accuracy, safety and consistency in this finishing cell that is automated with two twin presses, six robots, a large conveyor and shotblast.*

die cast plants and employs 600 workers. With a workforce this large some might wonder if automation might one day drastically reduce the plant's workforce.

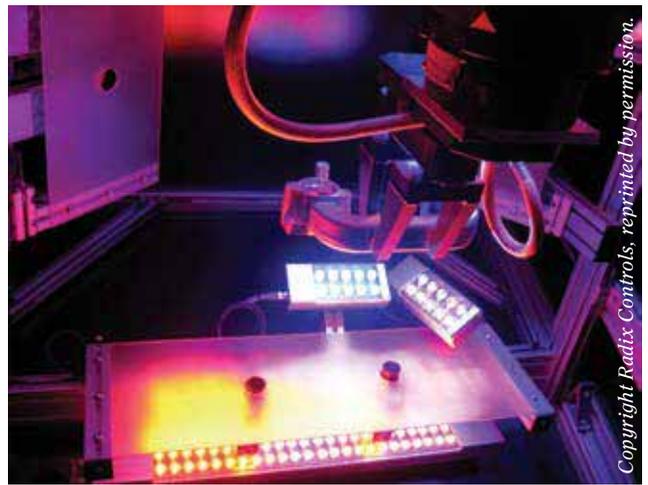
"A common misconception is that automation is putting people out of work," Johnson remarks. "Automating our processes allows us to be more competitive so that our business continues to thrive and grow. As business expands, we need more people with the skills automation calls for, and rely on our equipment to take the safety risks and get the job done efficiently and accurately."

In fact, automating their cells with ABB robots has done just that for Ryobi. Several years ago, company officials had the foresight to see the return on investment for automating a cell to finish gearboxes. According to Ryan Willhelm, Director of Finance, of Ryobi's die cast plant, the savings were tremendous. "Automating the cell has reduced annual costs associated with production by \$400,000 simply from moving away from hand filing to robotic finishing," Willhelm stated.

However, it's not simply about cost. This cell has increased productivity, quality and consistency, and has even reduced the number of shifts it takes to meet their quota. By running only two shifts, five days per week, the cell produces 2,000 parts per day. It has also eliminated the need for four of the cell's fixtures, reducing the number from the six that were initially required down to two. "The consistency of this cell has achieved a level of quality that has increased more than 50 percent," noted Willhelm.

The outcome of this increased quality has resulted in an end customer who is very pleased, and will most likely turn to Ryobi for future die casting needs thereby potentially expanding their business. Robots have opened the door to automating finishing applications for both simple and complex shaped castings. They can mimic human motions, and although they lack the senses of sight and touch, robots provide consistency and repeatability making them ideal for processes like finishing.

This is but one example of the success that Ryobi has seen with automation. Earlier this year, the plant installed another finishing cell to deflash gearboxes and transmission cases. Two robots begin by loading and unloading castings into two trim presses. The castings are presented to the robots on belt conveyors, and each robot uses a vision



*Robot vision systems are giving "sight" to robots and flexibility to production lines. Over the past decade, not only have vision systems become affordable, but they've become more intelligent with today's technology.*

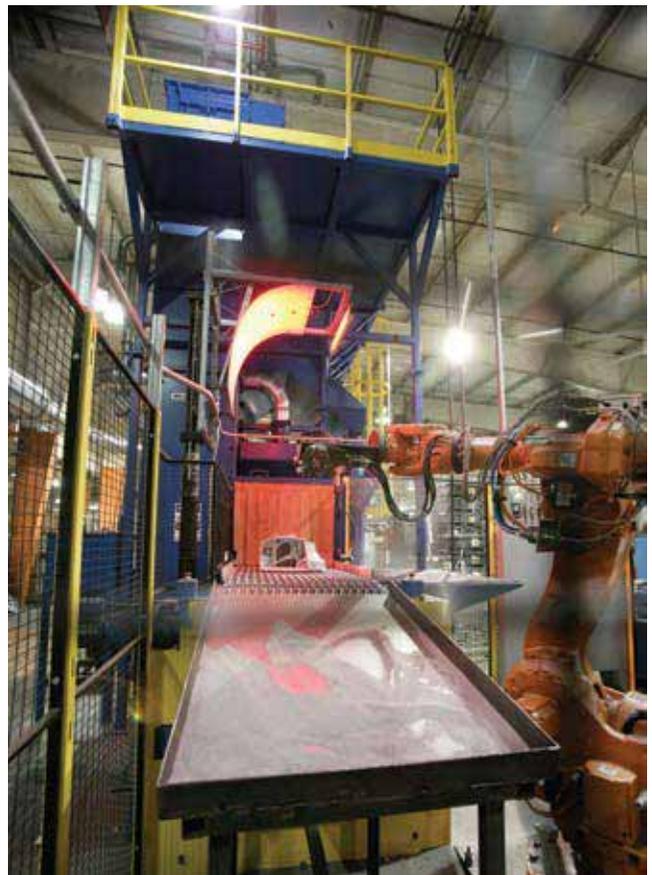
system to locate the parts prior to placing them in the trim presses. The castings are then placed on a conveyor that moves them to one of three finishing robots – each having a dual end of arm tool. It is here that the robots equipped with two cameras each again utilize vision technology to identify and locate the castings, determine the die number that produced the castings, and then move the castings to the finishing tool. This state-of-the-art vision system allows the same automated cell to finish two different casting types each with up to nine different die numbers. Once the

castings are deflashed, they are placed on the conveyor and moved to a shotblast that is then unloaded by the final robot, which dumps the shot and places the castings on an exit conveyor. This robot is also equipped with vision so that it can locate and identify the part. The parts are then moved to a leak test station where Ryobi staff members check for any leakage.

Until recently, tasks such as this were beyond robotic automation capabilities. Without the vision capabilities of this cell, this could not be possible unless designers included fixtures to orient parts or sorters to separate different models. Today, robotic vision systems are giving “sight” to robots and flexibility to production lines. Where fixtured tools once reigned supreme, vision-guided robots are making their presence known in the die casting industry.

In the last decade, two dimensional (2-D) and three dimensional (3-D) vision systems have not only become affordable, they have become more intelligent with today’s technology. There are many benefits that vision can provide customers, including money saving solutions and reduced errors in castings, all of which Ryobi has realized. Vision systems allow the robot to both locate and identify a casting, thereby reducing production time. In addition, they are fully capable of identifying a casting and then inspecting the casting for a variety of things, such as the presence or absence of a particular feature.

Automation solutions are constantly changing and emerging into the forefront of cutting-edge industrial



*An ABB IRB-6600 robot uses vision to locate the part on the conveyor and identify the part type.*

technology. Just ask Ryobi’s Maintenance Supervisor, Dave Bentley, “It’s fascinating to watch the technology change and evolve. I’ve been here 11 years, and every time I think I’ve learned something, something new comes along – like the vision.”

Automation is a series of phases or building blocks that, once fully realized, provides multiple benefits including flexibility. Flexible automated equipment is the key for many die casting plants. Robotic automation is flexible automation rather than the fixed automation of the past. Fixed automation only makes sense when producing the same product “forever.” However, the days of producing the same product over an extended period of time have passed. Today, product life cycles are typically very short. Even within a one year period, there can be minor modifications that are needed very quickly to maintain a market share. In Ryobi’s case, “The key to providing effective solutions is to create, design and integrate flexible automation technologies that our customers can easily apply to improve their production processes,” said Tom DeJong, CEO of Rimrock Corporation in Columbus, Ohio.

Rimrock is a leading supplier of automated capital equipment for the die cast industry. As a strategic partner of ABB, the company supplies total automation solutions ranging from robotic part finishing and material handling to robotic spray and ladling. “We understand that modern die casters face unique challenges on a daily basis. Due to the competitive nature of the industry today, automation solutions need to be easily modified and decidedly

flexible to allow our customers to customize the equipment on a case by case basis," DeJong added.

In order to remain competitive, manufacturers need capital equipment that can be quickly reprogrammed to meet their customer's demands. Robots can, in fact, be easily interchanged and adjusted, or after a project has concluded the equipment can be reprogrammed and reconfigured for the next big job. For instance, if Ryobi would be forced to finish different parts, the plant would simply have to change the end of arm tooling and reprogram the cell. This ultimately will increase the plant's payback, and the return on investment will begin to build exponentially.

Finishing isn't the only area that can easily become integrated with today's automated technology. Spray and extraction robots are also becoming a necessity for today's die casters. With these tools in place, cycle times are decreased and the cooling time is consistent, resulting in less scrap. This style of automation is giving North American die casters a viable edge over the competition. In fact, a major advantage can be found among small casting manufacturers. Many small die casting companies do not yet have automation technologies in place, however those that have moved toward automating their processes have a seen a definitive advantage over the competition.

When considering automation, die casters also have to determine what producing quality products is worth to their customers. By utilizing automation to increase the quality, die casters are essentially reducing the amount of scrap castings, and are providing better quality products. It can be a real adjustment for some companies. Getting good parts has proven itself worth one percent of the selling price. For instance, a car manufacturer for which Ryobi produces castings is a \$9,000,000 per year customer. With the quality of the castings worth one percent in cost reduction, this particular customer is realizing an annual savings of \$90,000 through the reduction or even elimination of the number of bad castings that have been machined. This is certainly a good argument for repeated business with Ryobi.

While overall quality, consistency, accuracy and reduced labor costs are good arguments for automation in and of themselves, there is one added benefit that may be the most significant advantage of all – safety. Quality and cost may be the most visible elements driving automation today, but safety is the key issue. Due to the advancements in automated technology, companies who purchase automation equipment have significantly reduced workers compensation claims. In Ryobi's case, this is largely due to the fact that they do very little hand filing now. In fact, hand filing at the Shelbyville plant has been reduced by approximately 85 to 90 percent. It's clear that automation is allowing die casters to capitalize upon their work staff, and redistribute the dollars that have been historically spent on expensive worker's claims costs.

Die casters like Ryobi aren't the only ones realizing that automated capital equipment is the way of the future. According to the Robotics Industry Association (RIA), North American robotics suppliers saw orders lead 36 percent in the first half of 2005. A total of 10,712 robots



*Due to the precise and efficient nature of robotic finishing, Ryobi Die Casting has reduced hand filing by 85 to 90 percent in recent years.*

valued at \$638.9 million were ordered by North American companies through June, putting the robot industry on pace for a record year. The RIA estimates that more than 150,000 robots are now at work in factories in the United States, placing the U.S. second only to Japan in terms of robots use.

"We've been tracking the industry on a quarterly basis since 1983 and can report that there were more robots ordered in the second quarter of 2005 than in any previous quarter," said Donald A. Vincent, Executive Vice President of RIA. The first half surge was led by demand for robots that perform applications such as material handling and arc welding. Orders in the automotive and metalworking industries were especially strong, according to recent RIA data. "Experienced users such as the automotive manufacturers are now finding expanded uses for robots as they strive to reduce costs, improve productivity, and speed time to market with their new products. New users are turning to robots to help them become globally competitive and to keep manufacturing jobs at home," Vincent asserted.

It seems apparent that robotic capital automation is not simply a passing trend, but a manufacturing necessity that is here to stay. More and more manufacturers, especially within the die cast industry, are realizing benefits from consistency and quality to safety and reduced costs. In an era when competition is rising and as technological achievements continue to advance, many die casters are looking towards the future of die casting and wondering if robotic automation is right for them. In such a competitive global economy, only time will tell the impact that automation ultimately will have on North American die casters.



Mark Riekert, Applications Engineering Manager for Rimrock Corp. will be a featured speaker at NADCA's Plant Management Conference. His presentation on automated deburring is scheduled for Thursday, September 22, 2005.