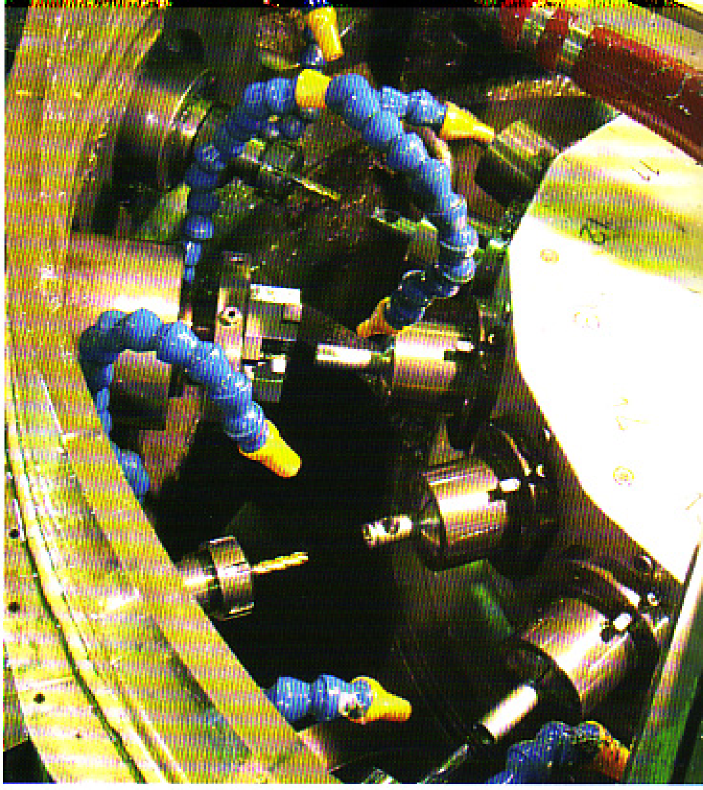
By Robin Bergstrom
RYB Communications

# A Diet Of High Volumes, Long Runs



**Suggest a strategy of high volumes and very long runs, and many screw machine houses grow anxious. Add that the high volumes are for automotive customers, and the anxious soon become squeamish—except in the case of this supplier. It thrives on the volumes and chases the long runs.**

In 1905, Frank O. Curtis founded Curtis Screw Co., Inc. in Buffalo, New York, and began turning out machined parts. Mr. Curtis, who served as president until 1917, held one of the earliest U.S. patents for a multi-spindle machine.

Curtis Screw, now approaching its 100th anniversary, is a $75 million company, occupying more than 325,000 square feet under roof in four locations (two plants in Buffalo, and one each in Cornelius, North Carolina, and Prospect, Connecticut). The company runs more than 200 primary metalcutting machines, including rotary transfer machines, multi-spindles, single-spindles and Swiss-style machines from a variety of manufacturers. Today, Curtis Screw is a supplier to the global automotive industry.

## Shifting Gears

For many years Curtis Screw was a $10 -$20 million company, running an expanding battery of Davenport and Acme-Gridley multi-spindles as well as a stable of single-spindle machines. The company built a substantial capacity to perform a wide range of secondary operations—boring, broaching, centerless grinding, chucking, deburring, drilling, gun drilling, honing, milling, turning and so on—to add value and to completely finish often highly complex parts requiring multiple operations on multiple machines. This strategy provided a certain degree of self-sufficiency: By being highly integrated, Curtis did not have to rely on another shop's schedule to complete a necessary secondary operation. Indeed, the only processes not performed in-house were, and are yet today, heat-treating and plating.

Then, in the early 1980s an opportunity arose that would amend the screw machine paradigm at Curtis Screw. The opportunity was a high-volume order with incredibly long runs. The part was an automotive fuel injector. The customer was General Motors.

"This presented us with a serious dilemma," says Ed LeClair, vice president, operations. "We had to make a decision. Did we want to make the kind of commitment required to go after jobs with millions of parts per year and contracts that might extend into multiple years? What would we sacrifice—shorter runs, smaller lots, a greater diversity of jobs and customers; the comfort zone that we'd built over the course of 80 successful years? This required a rethinking of how we did business and with whom we did business. The decision, obviously, was not an easy one."

## The Flexible Solution

The high volumes and long run contracts certainly had an appeal at Curtis Screw. However, the decision to pursue this new market bore with it a hefty—and immediate—requirement for investment in capital equipment.

"We knew we could make these parts a number of ways—multi-spindle machines, chuckers, rotary transfer machines," says Mr. LeClair, "and we knew we'd have to invest in a substantial number of machines to meet the volumes involved. We also knew we needed an entirely efficient and absolutely reliable process. When you're making millions of one part a year, you've got to have confidence that your process is not going to fail."

Rotary transfer machine technology had caught the company's eye a few years earlier. In 1980, Curtis Screw bought its first 12-station machines from a relatively new company, Hydromat of St. Louis. According to Mr. LeClair, the company ventured into rotary machines (the initial order was for two machines) because the concept promised significant reductions in downtime, work-in-process (WIP) inventory, scrap and operator involvement.

"One of the things that's proven a definite advantage of rotary transfer technology over screw machine technology is the former's modularity," Mr. LeClair says. "If a unit suddenly goes bad, you can pretty easily pull it out and replace it, without incurring significant downtime. You then repair the unit off-line while the machine continues to produce parts. With most screw machines, if a spindle goes bad, the whole machine goes down, and you're not going to make parts until you're able to fix or replace whatever is broken—which might take days or weeks."

Other rotary transfer advantages were seen in the machine's durability, repeatability (to 0.0002 inch) and flexibility. "The rotary transfer machine fit very nicely into our machining strategy," Mr. LeClair says. "Basically, we like to be able to provide our customers with one-stop shopping. For example, we process a broad range of materials, from brass and aluminum to free-machining steel, stainless, 303, 430, 11L40, 5120 and 8620 gear blank material. And in terms of machining processes, we offer Swiss machines for very close-tolerance, high-precision parts, single-spindles and multi-spindles for more conventional parts and components, and the rotary transfer machines for very complex parts that would normally require secondary operations if run on a screw machine. Any time you can finish a part complete in a single machine, that becomes a competitive advantage in that it eliminates additional setups and part handling, both of which introduce the potential for error in process control."

When the final decision was made to go after this new market, the technology deemed best suited to help the company make the transition was rotary transfer technology.

"We examined alternative processes—conventional screw machines and other manufacturers of rotary machines—but the experience with our first Hydromats drove the decision," says Mr. LeClair. We needed a machine—a process—that would be 100 percent reliable, that would run its heart out and that would require very little care and attention. Our sense of it was that Hydromat could fill this need."

Accordingly, the company placed an order for twelve 16-station machines.

The fuel injector part, which initially represented a serious dilemma, would become a $25 million-a-year program.

## Creative Scheduling

Mr. LeClair points out that the order for a dozen rotary transfer machines, while more than just a substantial investment, also drove some fundamental operational changes.

The Hydromats, now numbering 15, are run 24 hours a day, 7 days a week. The actual schedule

Among Curtis Screw's 200 machine tools are 15 rotary transfer machines. These are run 24/7 to crank out the company's bread and butter high volume, long run jobs.

consists of four 12-hour shifts. Operators work 12 hours a days for 4 days; then they're off for 4 days. This results in a rolling 8-day shift schedule, which is replicated on the night shifts.

"The issue here was to create a schedule that would permit continuous operation and maximum machine utilization," Mr. LeClair says. "You have to consider that these machines are relatively expensive—about $600,000 per machine when we bought them and perhaps as much as $900,000 today—and with that kind of investment, you've got to fully exploit it. You need to be able to tool the machine up and run a part that's going to stay on that machine for a very long time."

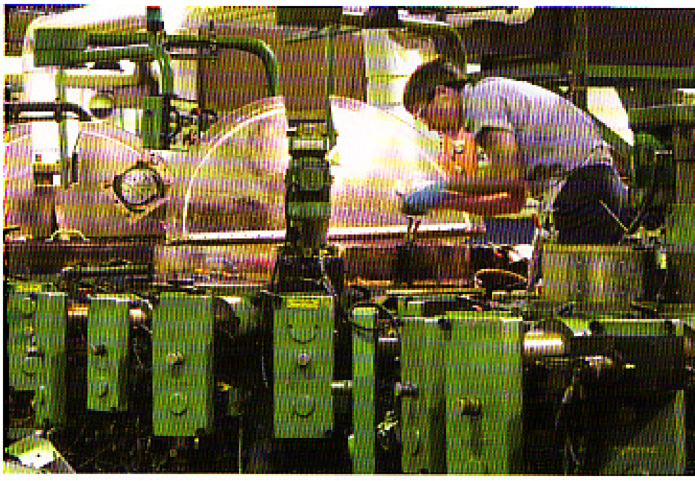
He points out as well that this scheduling approach not only permitted full utilization of the machines, but it also proved invaluable in holding down capital investment. "Without this work scheme," he says, "we'd probably have needed 18 machines to keep up with the volumes. So, we were able to avoid purchasing an additional six machines, at a cost of some $3,600,000, plus tooling, floor space, operators, and so on. The key here was to buy process equipment that would prove rugged enough to run 24 hours a day, 7 days a week, year after year, and then schedule the work so that we could do just that."

## Controlling The Process

According to Mr. LeClair, critical to any successful machining strategy, whether it applies to rotary machines, multi-spindle or single-spindle machines, is a rigorous attention to maintaining consistent process parameters. The process, after all, drives everything else: inventory and scrap reduction, productivity, part quality and ultimately customer satisfaction.

"At each machine we have a detailed control plan that tells the operator exactly what to do," says Mr. LeClair. "We spell out tool change frequencies—when tools need to be changed *before* they begin to wear. The plan tells the operator what features need to be checked, how frequently they need to be checked, what gages should be used and which of the features are SPC characteristics. The gages are computerized, and all the data are fed into a centralized SPC system."

Control plans differ from process to process and machine to machine, depending on the characteristics of the parts being run. Common to all plans,



An advantage of rotary transfer is accessibility to the tooling and work zone. Modularity is another benefit that Curtis likes. If a tooling component goes down, it can be quickly swapped out with little impact on production.

however, is that they do not provide the latitude for the operator to make on-the-fly or arbitrary individual process decisions or changes, thus deviating from the established process plan. However, operators are crucially involved in the establishment of process parameters and controls but thereafter strictly adhere to the control plan. They understand that deviations from the plan predictably result in an aberration of the process, potential bad parts and tainted SPC data—and increased cost.

"On the Hydromat machines," Mr. LeClair says, "the control plans are more detailed than on other machines because the parts run on them are more complex and involve more operations." A part that runs on an Acme-Gridley might have 30 features or dimensions. A rotary transfer part, however, might have twice that many. Consequently, control plans on the Hydromats are considerably more detailed.

## Determining Process Selection

Factors involved in giving shape to a machining strategy include tolerances, the number of features to be machined and the number operations required. According to Mr. LeClair, with a rotary machine the tolerance you end up with is a function of the number of times you address a given feature. If you address a feature three or four times, you progressively achieve tighter tolerances. On a 12-station machine you could theoretically address a single feature 11 times—not that this would be a particularly efficient use of the machine, but if for some reason you wanted to do this, you could. The point is that the more times you address a feature the tighter the finished-part tolerances.

Mr. LeClair points out that there are some cautionary notes regarding rotary transfer machines.

For example, some parts are just not strong process candidates for rotary machines—parts with very tight end-to-end, ID-to-ID concentricity, or parts with many, many OD features and not much clamping area.

An especially important issue to consider is technology use. Mr. LeClair notes that investment strategies differ from operation to operation and from country to country. In Europe, for example, it's not uncommon to depreciate a new piece of equipment over 5 years and then sell it in the sixth—and then start the whole process over again. In the United States, the tax laws are structured in such a fashion that there's no real advantage to periodically roll over equipment. In fact, the depreciation guidelines in the United States, which haven't been changed since 1986 or improved since 1981, actually serve as a disincentive for investment in new technology.

"Our approach," Mr. LeClair says, "has been to buy the best technology available and then run it forever—quite literally. We're still running a lot of the Acme-Gridleys that were purchased in the 1960s and 1970s. We've got an outstanding repair/rebuild department. So, we run our machines very, very hard. We repair them when they break down and then run them very hard again. In my 18 years with the company I don't think we've retired more than three or four machines."

This run full-open philosophy is particularly true on the rotary transfer machines. Mr. LeClair says that about 50 percent of all the parts run at Curtis could be processed on a Hydromat, but the company has found that dedicating them to high-volume, long-run jobs is where they best support the overall strategy.

"When it comes to volumes," Mr. LeClair says, "we are at the very high end compared to virtually any other screw machine operation. The low end of our business would be about 500,000 pieces per year. In the middle of the spectrum would be jobs that run 1 to 2 million pieces. The high end is 10 to 12 million pieces."

Further, he suggests that the jobs that Curtis goes after typically have very long running lives. "Some operations would love to have a job that runs 6 months," Mr. LeClair says, "but we shy away from these. We shy away from jobs that last 1 to 2 years. We go after jobs that run 3 to 5 and up. And to land and keep this type of business requires a process that's completely reliable and dependable. And that's where the Hydromat fits in. We load them up with these types of jobs and let them run. Run and run and run."

## Essential Support

Mr. LeClair notes that despite the company's self-sufficiency; vertical integration; and strong ability to repair, rebuild and maintain its battery of machine tools; the issue of service and support is nonetheless very important.

"With uptime being an absolute priority, we try to carry a pretty deep supply of spare parts, especially for the high-volume machines, the Hydromats," Mr. LeClair says. "However, we can't possibly carry everything, nor can we anticipate what may fail and when. It's at those moments when the true strength of a supplier shows through."

Another related issue has to do with the ease with which a company can interact with its suppliers on technical or engineering matters. Does the supplier, well after the sale of the product, continue to offer advice, counsel and technical and engineering support? Is the supplier proactive in assisting with tooling and process issues? Mr. LeClair suggests that this, too, is one of Hydromat's strengths.

*For more information about rotary transfer technology from Hydromat, call (314) 432-4644 or visit their website at www.hydromat.com*

**At the end of the day, it's about getting good parts out the door. Curtis has built its business over almost 100 years by delivering good parts on time to the global automotive market.**