Old World Expertise

Dear Editor,

I am writing this in response to some articles appearing in your journal, but I want to take the opportunity, also, to express my thanks for all the good work your publication is doing. I always look forward to your next issue being in my mail slot. I know I will find timely technical articles relevant to our manufacturing situation here at Amarillo Gear Co., as well as thought provoking commentary on events and trends affecting our business. The Publisher's Page is always worth the reading.

I would like to comment about remarks made in your January/February and July/August issues by Mr. Joseph L. Arvin, President, Arrow Gear Company. Mr. Arvin is right on the mark concerning the loss of what he calls "old world machining expertise" in the gear industry.

I began working for my father in his automotive repair business when I was 8 years old. My first job was to keep the shop clean and make sure all the tools were accounted for and in the proper place. When I mastered that, I was allowed to clean parts for reassembly. Later, I was taught to disassemble, paying close attention to how the mechanism was put together. After that came hands-on reassembly. Finally, I began to learn about diagnosing problems and executing the repair.

Each new level of training was built on a necessary foundation of previously mastered skill and knowledge. First, I learned what the tools looked like, how they worked, how to pick the best tool for the job, and how to keep my work area clean and organized so I could get the job done. Then I learned what the parts looked like, what their names were, where they fit in the mechanism, how they contributed to its function, and what malfunction could be traced to a particular part. Only after all this was learned could I begin to understand how my father knew what was wrong with a vehicle and how to repair it.

I was 24 when I started my career here at Amarillo Gear Company, and the learning process is the same. "This is a spiral bevel gear, and this is how it differs from the hypoid gears you saw in your dad's shop. This is the convex side of the tooth and that is the concave side. This is called profile, and this is called bias. This is how lapping works, and this is why we lap gears in sets. This is called a tooth contact analysis. Can you see from this how the motion of the gear tooth in relation to the pinion tooth transfers the power? This is a face mill cutter. The machine moves the cutter in the same path the mating gear tooth will make as it passes through the tooth gap, thus generating the tooth gap as it cuts. These are proportional changes that you can use to adjust bias and profile to improve the bearing pattern. Now that you've mastered fixed setting method, we bought a new machine that does duplex cutting. We will finish both sides of the pinion at one cutting." Now comes face hobbing, CNC generators, power cutting, dry cutting, and who knows what else.

So what is "old world machining expertise" and where does it fit in today's world? I believe that old world expertise is a profound understanding of the manufactured part, and how it is physically (not just electronically) made. When you get right down to it, gears are still made by removing material from the gear blank to form the tooth gap. We use electronics now to put the blank where we want it and to put the cutter where we want it, and to move them both the way we want them to move. The successful gear technician on the plant floor is the one who knows why.

That level of expertise is a function of attitude(AT), aptitude(AP), opportunity(O), knowledge(KN), and time(T). If we were to look at it mathematically, it might look something like this:

$$((AT+AP+KN) \times O)/T = \text{expertise}$$

as time(T) goes from Day 1 to retirement.

We bring with us mechanical aptitude (not everyone is born with this), an attitude of continuous improvement (if you don't have it, get it), and we add knowledge (mine, yours, theirs, wherever we can get it). We apply that to every hands-on activity involved in gear manufacturing (opportunity), and over time (required!) we produce old world expertise within ourselves.

It becomes incumbent, then, that we as individuals share the expertise we have acquired with the next generation, that we as managers provide the opportunity for the acquisition of meaningful experience for employees, and that our companies nurture and retain expertise in the work force.

That sounds good, and no one would disagree that it is a noble goal, but it is not going to happen by itself. It will require a commitment from employee and manager alike to invest the time and energy to make it work. The dividends are well worth it. The future of gear manufacturing in this country depends on it.

Sincerely,
Bob Gerhardt
Gear Department Manager
Amarillo Gear Co.

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If you would like to respond to this or any other article in this edition of *Gear Technology*, please fax your response to the attention of Randy Stott, managing editor at 847-437-6618 or send e-mail messages to *people@geartechnology.com.*