Pickett from a Manufacturing Perspective

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I have been collecting Pickett slide rules actively for a few years now. Pickett made their slide rule line for about 30 years, and during those years, released quite a number of different models and variations. Being a machinist as well as an engineer, I have developed some theories on how Pickett made their slide rules, and how they brought improvements into the line.

Pickett had a very interesting method of producing slide rules. It appears they coated the rules with a base coat of either paint or plastic (I am not certain on this), and then printed the scales onto the base coat. They followed this with a clear matte finish plastic coating, on the order of a few thousandths of an inch thick. This served as a barrier against dirt and minor scratches, and held the printing in place.

Pickett originally produced magnesium rules that were 5/32nds of an inch thick. They put grooves on the outside edges to center the indicator over the scales, thus eliminating the possibility of scratching the scale surfaces. The top groove is wide and flat bottomed, to accommodate the indicator spring, and the bottom groove is shaped in a "V" to center the bottom of the indicator. Great idea, except that the indicator did not move as smoothly as a K&E. This would later be corrected when Pickett moved to the nylon indicator bars, but I am getting ahead of myself.

Along came the corrosion problem. Magnesium has a nasty habit of corroding in a most unpleasant fashion. It turns a dull, dark grey and loses whatever shine it may have had. The corrosion can lock sliding surfaces together if it gets bad enough. It also reacts to any holes in its covering material, no matter how minute the holes turn out to be. Microscopic holes in the plastic coating of the Pickett rules allowed moisture to react with the magnesium, causing the bubbled finish seen on many of these slide rules. Once bubbled, the finish cannot be repaired. This set of problems completely ruined any hopes of a rugged lifetime design for the Pickett line. Something had to be done.

The answer to this problem lay in a change in the metal used to produce the slide rules. They had a number of choices. Brass would be very easy to machine, but would also tarnish, making it an unattractive alternative. Steel rusts, but is workable from the machining point of view. Stainless steel does not rust, but it is expensive, and very hard on the tooling, which makes it expensive to machine.

Aluminum alloys can be machined easily, and hold their tolerances well. They do react to temperature by shrinking and expanding, but this is not significant when it comes to a slide rule. A ten-inch rule will grow a few thousandths of an inch due to a moderate increase in temperature. Fortunately, it will grow uniformly, and the amount of growth is insignificant relative to the gauge marks on the rule.

So, Pickett said, "Switch to aluminum". Simple, right? Wrong. I believe the switch caused many problems in the manufacturing. I am not sure where Pickett obtained the aluminum, but it had to be at least 3/16ths of an inch thick to allow for manufacturing. This allows 31 1/4-thousandths of an inch of extra material to be removed to produce a smooth surface. All minor scratches from shipping and handling can be cleaned up in this first machining step. The smooth surface is important to the production of the slide rule. This means that 15-thousandths of an inch was removed from each side of the slide rule blank.

I just looked through my standard reference for anything needed in manufacturing, commonly known as the MSC Industrial Supply catalog. (It is available free from www.mscdirect.com, or 1-800-645-7270. You will need to establish an account with them. You will not regret it.) I found that 6061 aircraft grade aluminum bar stock is available in 3/16ths and in 1/8th inch thicknesses. I do not have the late 1940s price sheet available, but using todays prices, the 3/16″ by 1″ by 6′ bar costs $5.70. The 1/8″ by 1″ by 6′ bar costs $3.90. Switching from 3/16ths to 1/8th produced an equivalent cost savings of $1.80 per bar, plus the cost of machining. Each bar would produce five ten-inch rule parts. Changing to the thinner bar stock would result in a much lower cost to manufacture. The 1/8th-inch bar allowed 12-thousandths of an inch per side to be removed to clean up the surface.

Now, I learned as a machinist that it takes a long time to make changes to tooling when working in a production environment. To combat the corrosion problem, Pickett first changed to producing the aluminum in 5/32nds thickness. There were no changes to tooling, with the exception of some cutters, and changes in speeds and feeds. Then they tried to use the same indicator groove technology with the less expensive 1/10th-inch-thick aluminum. A number of fixtures had to be modified to accommodate the change in thickness. It worked, but it did not solve the smoothness problem.

I know of no other way to put this: nylon is a horror to machine. Try holding it in a vise, without distorting it, while it is being cut. Use the wrong speeds and feeds, and/or the wrong style of cutter, and the part comes right out of the vise. About the only thing worse is Teflon. The saving grace for nylon, as far as Pickett was concerned, was that it would solve the sticky indicator problem. Nylon slides "real nice" on aluminum.

Nylon can be molded, but that is an entirely different manufacturing technology. It takes a different type of machinist's skills to produce molds. The mold design had to allow for the shrinking of the molded part as it cooled. Molding machines are expensive, too. I would venture to guess that it took Pickett a while to figure this all out, and then to bite the bullet and contract out the molds and the molding of the indicator bars. While they were at it, they went whole hog and had the three-hole indicator windows made at the same time. Molding optically clear plastic is yet another sub-specialty in the art of machining. The molds for these had to be expensive propositions, and had to be covered by volume.

Once the new indicators were in production, Pickett could take the step of eliminating the grooves on the outside edges of the rules, thus saving some manufacturing steps and, of course, money.

Next came the cast aluminum braces, which were a total failure. Pickett tried them out, but found they did not hold the stators well, and were very prone to stripped threads when the screws were tightened. Since these cast braces covered the ends of the stators, it was possible to eliminate the step of cutting the rounded corners. To eliminate the problems associated with the cast aluminum braces, Pickett had a real stroke of brilliance. They went to the stamped brace. Further, they contracted with a screw machine shop to make the captive nuts and precision screws in aluminum (to prevent dissimilar metal corrosion, and rust). Again, the stamping process requires yet another type of machining technology.

At some point in their production, they implemented a tensioning spring system in the top stator. Two leaf spring recesses were machined into the face of the top stator groove, under the braces, and two leaf springs were installed to apply uniform pressure to the slide as it was moved. This simple device kept the need for tension adjustments to a minimum.

Pickett needed time to complete each change in each line in their slide rule offering. I would assume they had a very small staff in their tool and die shop, where all the jigs and production tooling were made. I would also venture to guess that Pickett needed time to be able to fund any outside contracting expenditures. Considering the size of their line, I would assume the changes took several years to accomplish throughout the entire product line.

Finally, they had the whole problem solved. The screws and nuts were easy to make, store, sell, stock, and replace. The stamped braces were very cheap to make. The aluminum solved the magnesium corrosion problem. The aluminum was available in a standard size, and easy to work with. Many magnesium-related manufacturing steps were eliminated, saving costs. The nylon indicator bars and plastic indicator windows smoothed the indicator movement.

They contracted out to at least one leather company to get their cases. The original plastic/rubber style cases held moisture, which exacerbated the magnesium corrosion problem. Pickett tried the felt cases, which would breathe well, but didn't offer much other protection.

Next was the leather sheath with a fold-over snap flap. The snaps caused a bit of a problem, though. Closing the snap caused the finish to be removed on that spot on the slide rule, and sometimes caused the indicator window to break. This led to the use of the flap and slot, which held the slide rule reasonably secure, and did not mark the rules. The plastic insert made it very easy to slide the rule in and out without binding, protected the slide rule from damage, and gave the case a uniform shape.

Throughout all this, Pickett went through changes in the scales, evidenced by the 271-style numbers on the right ends of the slides. They also changed their part numbers by adding "N", "-T", "-ES", "-G", and "-GP". All this means that there are more than 100 models and variations in just the production models in the Pickett line. This does not count the numerous special-order slide rules they made for various companies.

The complete lifetime of the company ran from 1945 to the mid-1970s. This gives the collector a very good opportunity to gather relatively modern slide rules in an abundance of variations, all from one source. This is the kind of thing that makes collecting fun and challenging at the same time. I have over 100 Pickett slide rules now, and still have only a fraction of the entire line. I look forward to many more years of learning the Pickett line and its variations.