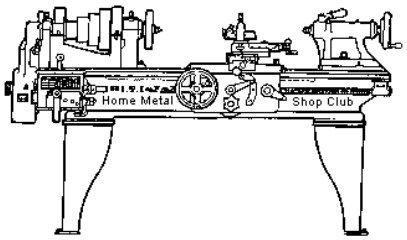
Home Metal Shop Club

August 2011
Newsletter

Volume 16 - Number 8



http://www.homemetalshopclub.org/

Since its founding by John Korman in 1996, The Home Metal Shop Club has brought together metal workers from all over the Southeast Texas area.

Our members' interests include Model Engineering, Casting, Blacksmithing, Gunsmithing, Sheet Metal Fabrication, Robotics, CNC, Welding, Metal Art, and others. Members always like to talk about their craft and shops. Shops range from full machine shops to those limited to a bench vise and hacksaw.

If you like to make things, run metal working machines, or just talk about tools, this is your place. Meetings generally consist of a presentation with Q&A, followed by ***show and tell*** where the members can share their work and experiences.

President	Vice President	Secretary	Treasurer	Librarian
Vance Burns	*John Hoff*	*Martin Kennedy*	*Emmett Carstens*	*Dan Harper*
Webmaster/Editor	Photographer	CNC SIG	Casting SIG	Novice SIG
Dick Kostelnicek	*Jan Rowland*	*Dennis Cranston*	*Tom Moore*	*Rich Pichler*

About the Upcoming September 10 Meeting

General meetings are usually held on the second Saturday of each month at 12:00 noon in the meeting rooms of the Parker Williams County Library, 10851 Scarsdale Boulevard, Houston, TX 77089. This month's meeting will be held on September 10th. Visit our website for up-to-the-minute details.

Randy Slane will speak on *Abrasives in the Shop*.

Recap of the August 13 General Meeting

By Martin Kennedy, with photos by Jan Rowland and Martin Kennedy

Twenty-two current and two new members - Kevin Kirmse and Stan Reves - attended the 12:00 noon meeting at the Parker Williams County Library. Vice President *John Hoff* led the meeting.

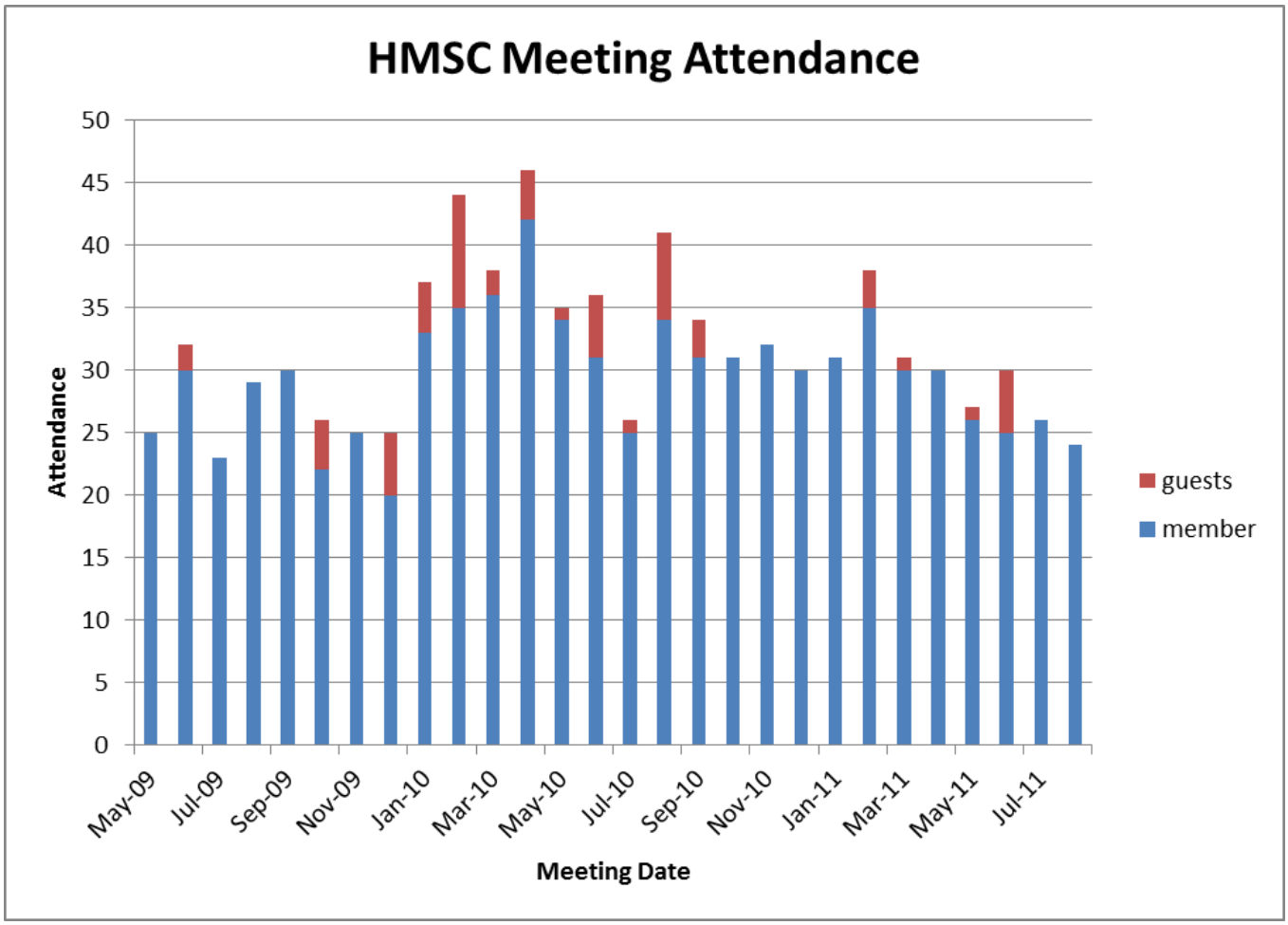
Ideas for programs at our monthly meeting are always welcome. If you have an idea for a meeting topic, or if you know someone who could make a presentation, please contact John Hoff.

Tom Moore brought in a box of HSS lathe bits and scrap brass to give away. *Jan Rowland,* once again, had miscellaneous hardware to give away, and *Dennis Cranston* had milling saws to sell.

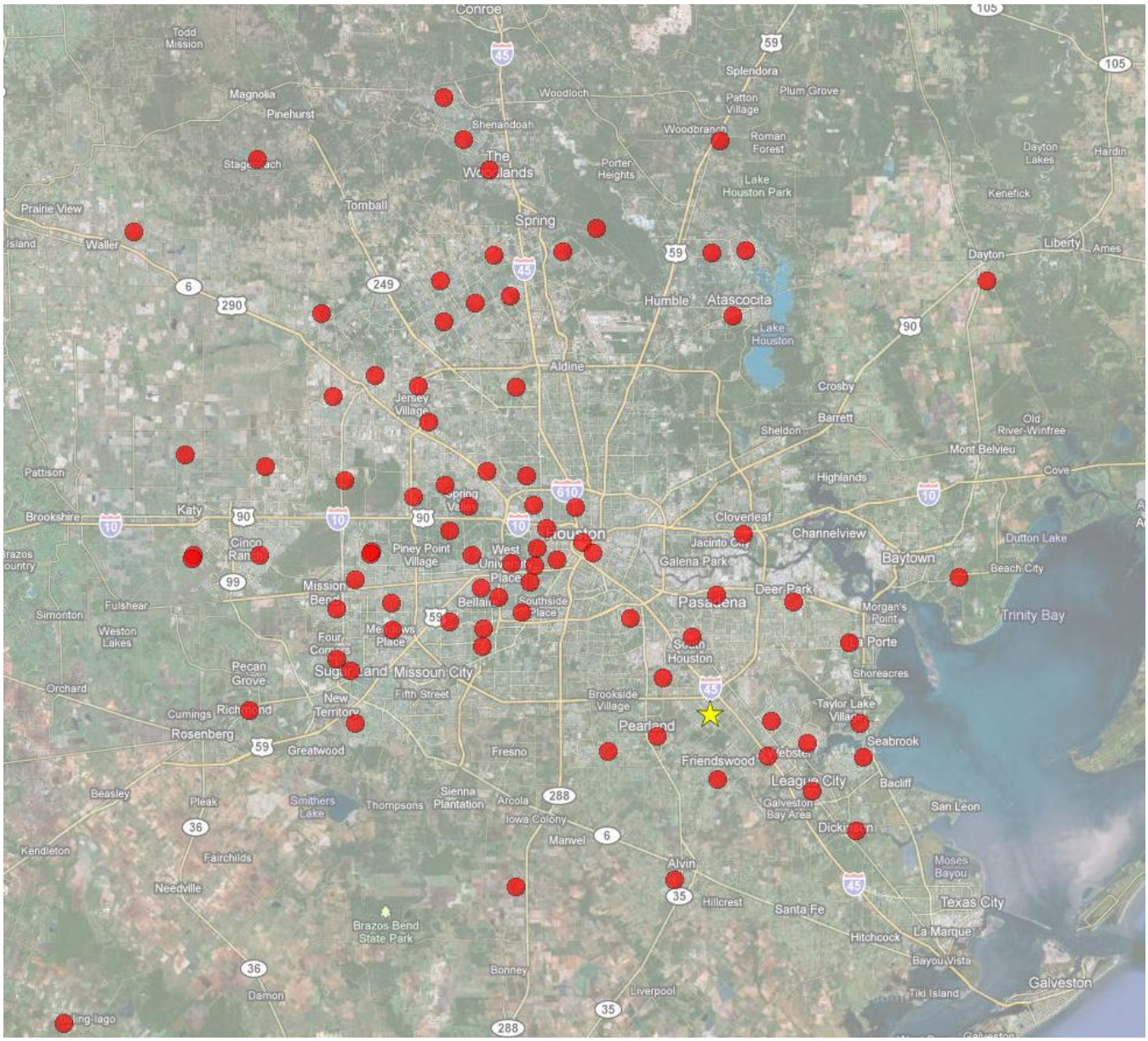
Membership

Compiled by Martin Kennedy

It's that time of the year again! Annual club membership dues of $15 should be paid to the club secretary Emmett Carstens at the September meeting. How would you like to receive a free club membership next year? All you need to do is to make the main presentation at one of our next twelve meetings. Sign up now!



This graph shows our meeting attendance by date over the last 2 ½ years. We have been experiencing a decline in meeting attendance since reaching a peak in early 2010. Please bring your ideas to the next meeting on how we can reach more metal working enthusiasts to increase our membership!



This is a graphic representation of over 200 current and former member locations in Houston, TX metropolitan area. The locations are identified by member's zip code. Some dots represent multiple matches. The yellow star shows our current meeting location. There are a handful of members outside of this area who do not show on the map.

Presentation

The main presentation on metallurgy was delayed until a future meeting due to illness. Three extended Show & Tell presentations were given instead.

Show & Tell

Joe Finelli became involved in the HMSC when he started building model trains. His day job is flying 737s for United. He promised a future presentation on this topic.

Joe showed several O gauge train models that he built. His favorite type of model trains and cars are from Lionel and 2-7/8 gauge, preferably made before or slightly after WWII. He was attracted to this era because those trains were made sturdily and were designed to be repaired if they broke. He makes model trains for his extensive personal collection of reproductions and originals, and to sell on eBay.

The trains are generally made with cast iron frames and sheet metal. The sheet metal is hand cut and punched for small runs and cut using a laser cutter for larger runs. Many of the trains include motors.

Mike Hancock spoke on induction heating. He bought an induction heater at a scrap yard. The equipment was originally used for brazing carbide chips onto machining tools. It consists of a radio frequency generator and a water cooled coil. Induction is a way of inducing currents in conductive materials. It uses radio frequency waves to transfer the energy. Mike's induction heater runs at a frequency of 45 khz. The frequency can be tuned for various materials. Mike's unit is 2.5 kW at 220V.

The heater is used by placing the material to be heated within the induction coil. The power is varied depending on the material. High resistance material heats very quickly, while lower resistance materials heat more slowly.

Mike made crucibles from carbon rods by using a ball mill to make the cavity. When placed in the coil, carbon gets white hot (right photo). He has melted brass in these crucibles. Mike passed around two stainless steel bars that had been silver soldered together by pushing them together and placing the joint within the induction heater. Other uses for the induction heater are annealing welds, brazing and vacuum brazing.

Mike also showed some powdered silver solder in flux paste. Paste is much preferable to silver solder rod, as it's easier to heat both the material and silver solder together. The paste has a six month shelf life and costs about $50 for

a tube. Refrigerating the paste can extend its shelf life. Using the induction heater takes about 20 seconds to make a joint. The paste can be obtained over the internet or locally at a jewelers' supply house.

Martin Kennedy is building a Sterling Engine, and wanted to learn how to use the rotary fourth axis he added to his CNC mill (right photo). He designed a three dimensional part using a CAD program, then built 4-axis G code with a CAM program. The 3D part was machined from aluminum on his mill, as can be seen in this video.

Martin also described how to set the tension on a band saw blade. A detailed article, drawings, and a spreadsheet for tension calculations are included in an article in this newsletter.

Mike Winkler showed a well made finger/treadle engine that he built from plans. It was made of polished aluminum. The flywheel has brass inlays.

Problems and Solutions

A member requested advice on how to drill radial ½-inch diameter holes to make a satellite dish around the circumference of a 16-inch diameter x 1-inch thick aluminum disk. It was suggested to make up a guide bushing and drill with a drill press.

Novice SIG Activities

Dick Kostelnicek demonstrated how to disassemble, clean, and reassemble a Jacobs drill chuck and a three jaw lathe chuck.

Articles

Quantifying a Leak

By *Dick Kostelnicek*

I thought I had a leak in the underground fresh water distribution system in my back yard. The system consists of ¾-inch buried polyethylene (black plastic) tubing connected to four copper pipe risers that are topped with garden hose bib faucets (left photo). All subsurface tubing connections were made with polyethylene burs and double stainless steel hose clamps. The system is connected to the house's cold water supply that's nominally pressurized at 45 psi. After a long dry spell in the weather, I noticed one area of the lawn that was greener than the rest. The questions were: does my underground water distribution system leak, and if so, by how much?

First, I conducted a *leak-down* test by attaching a Bourdon tube pressure gage to one of the garden faucets (left photo). The water supply to the house was closed and I noted the time it took the underground distribution system's pressure to leak down to around 2/3 its initial value.

Next, I removed the pressure gage and did an *excess-capacity* test. The system was recharged to house pressure and the house supply was again shut off. I measured the excess amount of water stored in the pressurized underground line by opening a faucet and capturing all excess water that discharged until the pressure fell to zero (right photo).

From these two simple tests, *leak-down* and the *excess-capacity*, the leak rate in gallons per day was determined from the following measurements and calculation.

Initial Pressure: P_I = 44 psi

Final Pressure: P_F = 29 psi

Leak-Down Time: T = 110 minutes = .076 days

Excess-Capacity: V_X = 8 oz = 0.0625 gallons

Leak-Rate $R = \frac{V_X}{T} \bullet \ln\left(\frac{P_I}{P_F}\right)$ = 0.34 gallons per day

Where **ln()** is the natural logarithm function.

A 0.34 gpd leak is less than one gallon per day. This small leak is acceptable and no repairs were sought.

Note: I based the above *leak-rate* formula on exponential leakage with time due to linear volumetric expansion of the underground tubing with pressure.

Setting Tension in a Band Saw Blade

By *Martin Kennedy*

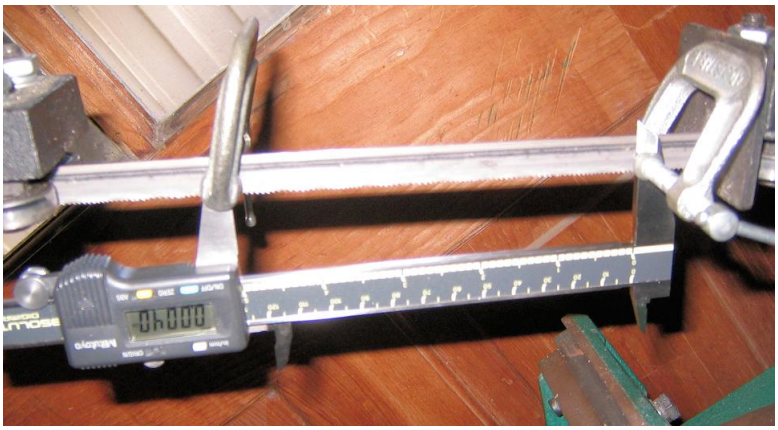
After breaking my last band saw blade, I started thinking that I may have been breaking blades too often due to having the blade under too much tension. My procedure for tensioning the blade was to crank it as tight as I thought I should. This is not a repeatable process. I started looking for some way to measure the blade tension more accurately.
There are two ways to set the tension in a band saw:

1) Measure the tension directly. Dick Kostelnicek wrote an article on how he built a load cell to measure the pounds of force on the saw wheel.
2) Measure the amount the blade stretches when applying force. Metal stretches linearly with load (until it plastically deforms near yield). Knowing the amount of stretch allows calculation of the load.

The design of my band saw did not lend itself to building a gauge like Dick's to measure the tension directly. Instead, I thought that I would build a tool to measure the tension. I went as far as making the drawings for the tool before I stumbled on an easier way; using equipment that I already had.

Tension can be measured using a dial or electronic caliper. The procedure is very easy:

1) Start with a slack blade with all the tension removed.
2) Open the caliper a known distance. 5" seems to work fine for my saw. We're trying to measure movement of only a few thousandths. If you use a very small distance, like 1", you'll be trying to accurately measure a few ten thousandths. I don't recommend this!
3) Temporarily clamp the caliper jaws to the saw blade using c-clamps or other clamps.
4) Set the caliper to zero, or note the reading.
5) Apply tension to the blade until the desired stretch is obtained.



I found several places that described this procedure. Most of them gave a few thousandths of stretch as the desired amount, but none explained how to calculate this amount. I dusted off one of my old Strength of Materials texts, and re-taught myself the calculation using Hooke's Law, d=(FxL)/(A*E). Where d is the deflection in inches when applying a force of F lbs. along a length of L inches divided by the product of the cross sectional area A square inches times Young's Modulus. Young's Modulus E is 29-30,000 psi for most steels.

Here's a typical calculation for a ½-inch bi-metal blade from this spreadsheet. The items highlighted in yellow are the input parameters. The gauge multiplier is equal to 1 if you're

using a caliper. If you build a gauge like the drawing below, it's 1.5, since for every unit the blade moves, the gauge shows 1.5 units.

Example Calculation of Saw Blade Tension and Resultant Gauge Reading

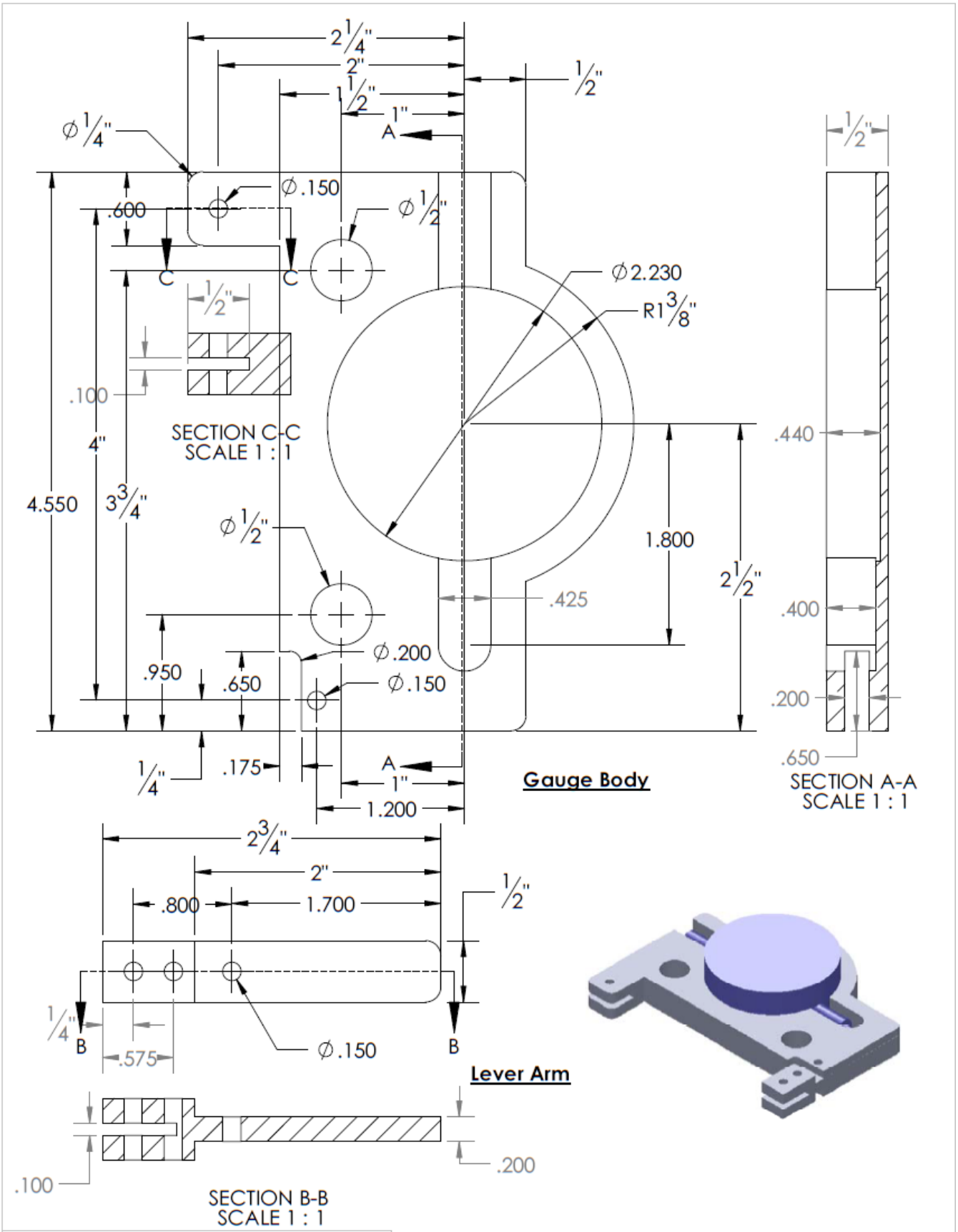
INPUT				
Recommended Tension		25,000	psi	
Blade width (root of teeth)		0.5	in	
Blade thickness		0.025	in	
Gauge length	l	5	in	
Gauge Multiplier		1		lever arm
CALCULATED				
Young's Modulus	E	3.00E+07	psi	most steels
Blade Area	A	0.0125	in^2	
Recommended Force	F	312.50	lb	
Elongation - Hooke's Law	d	0.0042	in	d=(FxL)/(A*E)
Gauge Reading		**0.0042**	**in**	

The blade manufacturer should recommend a tension. Here are typical recommendations:

Recommended Tension	min	max	
Carbon flex back	15,000	20,000	psi
Carbon hard back	20,000	25,000	psi
Bi-Metal under 1 1/4"	25,000	30,000	psi
Bi-Metal over 1 1/4"	30,000	35,000	psi

If you're interested in a commercial gauge, good but expensive ones can be obtained from Starrett or Lenox. If you want to build a gauge, I've included my unbuilt plans at the end of this article. You'll have to modify it slightly for the specific dial indicator that you use. I designed it to fit a Mitutoyo 2780S 0.150-inch gauge, which is slightly smaller and thinner than a standard 2 ½-inch dial gauge. This gauge is obsolete, but there are similar Mitutoyo Series 2 gauges available. You don't even have to build the gauge in metal. I stumbled across a web link that shows a gauge built of wood!

Oh, from the introduction to this article, what I found about the tension breaking blades is that I don't think that was my problem. I was getting stress cracks starting opposite the teeth that were cracking towards the teeth. This site has good information about saw blades, and my problem was clearly excessive blade force into the work piece coupled with a long spacing between the blade guides.



SIZE A | FILE NAME Tension Gauge | REV. B
SCALE 1:1 | Band Saw Tools | SHEET 1 OF 1