Home Metal Shop Club

July 2010
Newsletter

Volume 15 - Number 7

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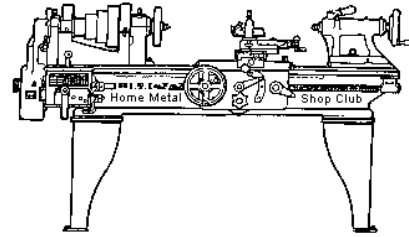
Since its founding by John Korman in 1996, The Home Metal Shop Club has brought together metal workers from all over the Southeast Texas area.

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 August 14 Meeting

The August general meeting will be held on the second Saturday of the month at 1:00 p.m. in the Parker Williams County Library, 10851 Scarsdale Boulevard, Houston, TX 77089. Visit this web link for up-to-the-minute details.

Bubba Vaughn, manufacturing engineer with FMC Corp, will speak on Advanced Milling.

Recap of the July 10 Regular Meeting

Twenty-five members and one visitor, *Byron Rosston,* attended the 1:00 p.m. meeting at the Parker Williams County Library. President Vance Burns presided.

Presentation

HMSC Member *Bruce Lunde*, talked about "From Drafting to G-Code", describing the process of using software for Computer Aided Design and Computer Aided Manufacturing (CAD-CAM).

Bruce became interested in CAD-CAM after purchasing a manual desktop mini-mill from Harbor Freight. He wanted to be able to make circles and irregular shapes, but found that impossible with only hand control. For practice in building a CNC machine, he made a wooden CNC router, which was shown to the HMSC in January 2009. He has recently completed a conversion of his mini-mill to CNC.

The software Bruce is using includes Alibre Design Professional for CAD, Cut2D for CAM, and Mach3 for CNC control. Bruce selected these programs because they met his needs at a relatively low price. For those interested in trying the software, demonstration versions of all three programs are available for download.

The basic process he uses to make a part is to design it in Alibre, export a DXF file and load the file into Cut2D to produce G-Code, and then send the G-Code to Mach3 for CNC control of the mill. First, Bruce made a brief demonstration on how to build a simple 3D model in Alibre. He then loaded the model into Cut2D and showed how to create a toolpath. After selecting the appropriate post-processor in Cut2D, G-code specific to Mach3 was produced.

Some of the features of Mach3 were demonstrated. The code created in the demonstration was loaded and execution was simulated. Bruce found that Mach3 incorporates many wizards that allow basic CNC operations such as drilling hole patterns and engraving text, without needing the use of CAD-CAM software.

Bruce talked about his current project to generate backlit Lexan panels for electrical switches on a RV, and showed some brief videos of the CNC machining operations.

Slides from Bruce's presentation can be viewed at this web link

Show & Tell

Dennis Cranston is in the process of building a 3D scanner that will allow direct input into 3D CAD. The low-cost scanner incorporated a web camera, a laser line generator, and a rotary table driven with a stepper motor. The hardware is mostly complete and is controlled using an Arduino open source electronics prototyping platform. Dennis is writing Visual Basic Net code to control the scan and output a point cloud that can be loaded into 3D CAD.

Dennis passed around a few copies of Make Magazine. There was a organizational meeting for Make:Hou in May. Another meeting may be held soon. Monitor the Forum/community tab on the Make website and our Tinkering group on Yahoo if you are interested in becoming involved.
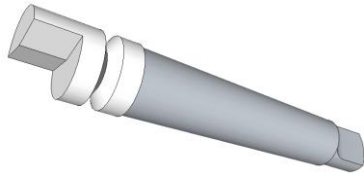
Dick Kostelnicek showed a threading tool height and alignment positioner that he made from a stock drill arbor for his lathe's tailstock (left photo).

He also passed around a homemade single point fly-cutter that he used to produce an 18-tooth module 0.5 gear (right photo). This gear was needed to repair the drive position sensor on an x-ray machine at St. Luke's Hospital and had been requested in an email received by HMSC officers. Dick produced the gear from two photographs of the gear taken next to a machinist's scale, without having the original gear! In answer to a question, he described how to determine the pressure angle of gears using modeling clay by rolling the gear through the clay, carefully cutting across the gear pattern with a razor, and comparing the impressed gear's tooth or rack angle to paper cut to the standard pressure angles. Dick also suffers from having money burning a hole in his pocket; he passed around an interesting ratcheting tap holder that he couldn't resist from Harbor Freight.

Joe Scott (left photo) showed some tools from his shop: a Myford tool that he uses to adjust the lathe tool height, a stepped lathe test bar that he highly recommended, a square that he had cut to fit into the slots in his mill, and lathe centering buttons used to check the tailstock alignment.

Joe Williams demonstrated optical parallels that are used to check the faces of a micrometer anvil and spindle to determine how flat and parallel they are to each other. Visible interference lines are formed by the light waves reflecting between the surfaces of the micrometer anvil or spindle. The parallels are in a set of four that checks the parallel condition at 90-egree intervals of rotation of the spindle.

John Hoff described how he had made his own phosphating, or Parkerizing solution using a jigger of phosphoric acid, a jigger of magnesium dioxide, plus a biscuit of degreased steel wool. There was much interest and discussion on Parkerizing, and it was identified as a presentation topic for a future meeting. It was mentioned that shoe paste wax could be used after Parkerizing to get a really dark finish.

John passed around HSS two lathe bits (left photo) that he ground in order to allow him to make internal and external Acme threads. The process he used was to cut the external thread to depth, then move the bit slightly to widen the groove in successive passes until the groove and thread were the same width. This allows him to cut multiple Acme thread sizes using a single tool. He then machined the internal thread in a similar manner, using the external thread he had made to check for fit.

Martin Kennedy passed around a rectangular piece he made on his lathe from an irregularly shaped piece of metal, as a teaser to encourage reading his article below in this newsletter.

Problems and Solutions

Byron Rosston was having trouble removing the axle from a gear drive from a drive mechanism on an amusement park train (left photo). It was suggested to remove the worm first before the worm wheel and its shaft could be extracted.

Cliff Johnston was trying to modify a lathe tailpiece fixture for use with a slitting saw and got an acceptable recommendation.

Martin Kennedy recounted that he was having trouble with a coolant shield on his lathe cracking at the mounting screws. It was recommended that he use polycarbonate (Lexan) to replace the shield instead of using plexiglass.

Novice SIG Activities

SIG coordinator *Rich Pichler* instructed several interested HMSC members on how to thread on a lathe. They successfully threaded a plastic rod after completing a bonus instruction on how to fix the lead screw on the lathe!

Articles

Turning a Cube
By *Martin Kennedy*

I seem to always need a piece of steel that's a different size than any of my stock. I also seem to always have irregular pieces of scrap. Before I can fabricate a part, I usually need to take an irregular piece and make it thinner and square. The best way to do that is machine it in the lathe. I could also use a fly cutter in my mill, but I can remove metal faster (and more quietly) with the lathe.

For this article, I've selected a very irregular piece. It was cut out of a piece of heavy wall 8" pipe. No two sides are parallel, and two of the sides are rounded. I cut a chunk out of the larger piece shown in the photo. Ordinarily, I'd use the band saw to somewhat square it up, but for this example, I'll leave the stock as it is.

First, I put it in a four-jaw independent chuck. It's not important to get the piece perfectly centered. Just get it close. Depending on the size of your piece, you may be able to set the base of the piece against either the face or the jaws of the chuck. My piece didn't fit in a way to make that possible, so I use parallels to get it aligned. In this example, I've put them straight

across the jaws, because the stock is large enough that they fit. You may have to put them in diagonally for smaller stock.

Two warnings about using parallels: 1) **Don't bend them** when you tighten one of the jaws, and 2) **Don't leave them in the chuck** when you turn the lathe on! They'll fly out and possibly damage something (like you!).

The next step is to face the stock. I'm taking off about 0.020 per pass. I like to use a HSS cutting tool for this instead of one with an insert. Cuts that impact the tool as the stock rotates tend to chip the inserts.
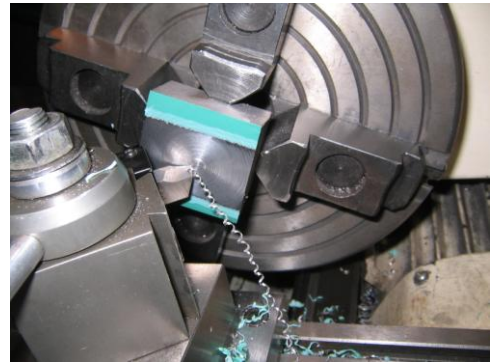
After the first side of the stock is faced, the next step is to turn it over and face the opposite side. Once again, I use the parallels to get the first faced side parallel with the chuck. Here I'm using a rubber mallet to tap the piece right up against the parallels as I slowly tighten all four jaws. Remember to remove the parallels before turning on the lathe!

Here, I've completed two faces. I now have some flat sides to work off of. And I'm a third of the way finished!
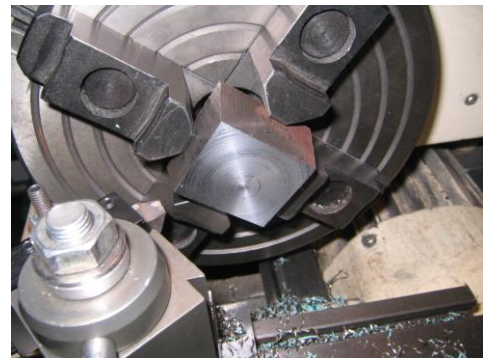
The next step is to turn the stock 90 degrees, and clamp into the chuck. To get the piece roughly square, first loosely tighten all four jaws. Then firmly tighten the two jaws that are on the faced sides. This will assure that the side you're about to face is square with the two faced side. On this piece of stock, the other two unfaced sides that are in the chuck aren't parallel with each other, so I can't get them very square with the faced sides. You can use the parallels to help you with rough alignment of the side that you're about to face, but it's not necessary.

Face this edge, then, flip the piece over. Use the parallels again to make sure these next two sides are parallel with each other. Again, favor the tightening of the jaws that clamp the faced sides. Remove the parallels before turning on the lathe. You're now two thirds complete!
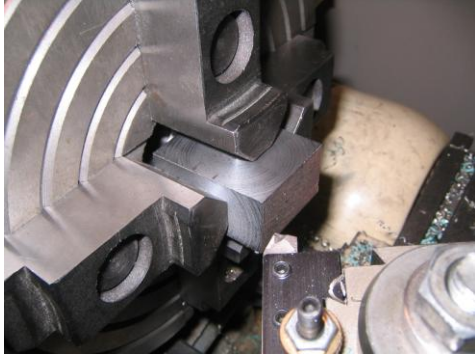
Now, on to the last two sides. This time, I do not use the parallels since I have four flat square sides to work with. I've left a gap between the bottom of the stock and the face of the chuck, as I'm counting on the jaws of the chuck to hold the stock in perfect alignment. Once you've faced this side, flip the piece over and repeat. All done!

Here's the completed piece. I checked to see how square it was, and found that the maximum thickness variation was about 5 thousandths. Using a square to check the angles showed that the piece is nearly square. If I had been a little more diligent about making sure that the stock was bumped up against the parallels, I probably could have gotten it even closer. Another thing that would have helped with accuracy would be to have a better chuck!

Indexable Insert ANSI Identifiers
By *Dick Kostelnicek*

If you're like me, you may have put off learning how to determine the identifier for sintered-carbide, single-point, indexable inserts. Their alphameric ANSI Identifiers, like TPMT32.51, may seem mysterious but they're really quite straightforward. Now, you may be faced with ordering inserts for a tool holder that you purchased from a catalogue that is long gone. The holder came with several replacement inserts, but they've been all used and you didn't write down the insert's identifier noted in that catalogue. OK, you're clueless. But don't fret. Here's a quick course on insert identification.

The ANSI, American National Standards Institute, identifier specifies the dimensional features of an insert and contains 10 alphameric positions. Only the first 7 are commonly used. For 95% of the tooling that you'll encounter, it's just 4 letters followed by 3 numbers, like CCMT32.52. Whole numbers have a single digit, e.g. **3** or **2**. Fractions are written as two digits separated by a decimal point, e.g. **2.5**. The 4-th letter is often dropped when it is **N**, as in SPG434.

Position	Alphameric	Feature	Notes
1	letter	**SHAPE**	
2	letter	**CLEARANCE**	
3	letter	**TOLERANCE**	
4	letter	**TYPE**	Dropped if no center hole and chip breaker
5	number	**SIZE**	May contain a decimal point, e.g. 2.5
6	number	**THICKNESS**	May contain a decimal point, e.g. 1.5
7	number	**CUTTING POINT**	May contain a decimal point, e.g. 0.2

An ANSI Insert ID table, detailing these 7 features, is reproduced at the end of this article.

Now, here's how I determine the seven parts on an insert's ANSI identifier.

SHAPE   This is easy, **S** = Square, **T** = Triangular, etc. For other shapes, see column 1 in the ID table below.

CLEARANCE   Hold the insert's edge in contact with a swing arm protractor and measure its clearance angle, often called the front relief. Column 2 in the ID table gives the clearance letter. For example **P** = 11 degrees. Measure this angle perpendicular to the inserts side and not near a point.

TOLERANCE   You can't determine tolerance by just looking at an insert. In the home shop, this is only important for tool holders having multiple inserts, like some milling cutters. Then, just make sure you replace all of them with the smallest, like tolerance inserts that you can afford. Otherwise, each insert may cut at a slightly different depth. See column 3 in the ID table.

TYPE   Look at the top and bottom of the insert along its edge and determine the shape of the chip breaker's groove. Then, note the shape of the countersink in its mounting hole. Match the cross section of your insert with a picture in column 4 of the ID table and obtain its letter identifier. This letter is often dropped if it is **N**, indicating there's neither chip breaker nor mounting hole. For example: see SPG434 pictured below.

SIZE   Hold the insert up to the light and against a drill hole gauge. Find the hole that just touches all sides of the insert. The insert's numerical size designation is the number of 1/8-inches in the drill gauge's hole. For example: 3/16-inches = **1.5** while 3/8-inches = **3**. This is called the I.C. or Inscribed Circle.

THICKNESS   Measure the inserts thickness with a caliper. Its numerical designation is given in 1/16-inches. For example, a thickness of 7/32-inches = **3.5**.

CUTTING POINT   Use a radius gauge, drill gauge if you don't have one, to determine the radius of the insert's point. The numerical designation is the number of 1/64-inches. For example, a radius of 1/32-inches = **2**.

Three inserts, having different shapes, along with their tool holders are shown below.

CCMT32.52   TPMT32.51   SPG434

Boring Bar - CCMT32.52

Right Hand Lathe Tool
TPMT32.51

3-Cutter Face Mill with R8 Shank - **SPG434**

Tools for measuring the dimensional features of carbide inserts are shown in the photo below.

ID position	Feature	Measuring tool
2	**CLEARANCE**	swing arm protractor
5	**SIZE** (IC)	drill hole gage
6	**THICKNESS**	caliper
7	**CUTTING POINT**	radius gage
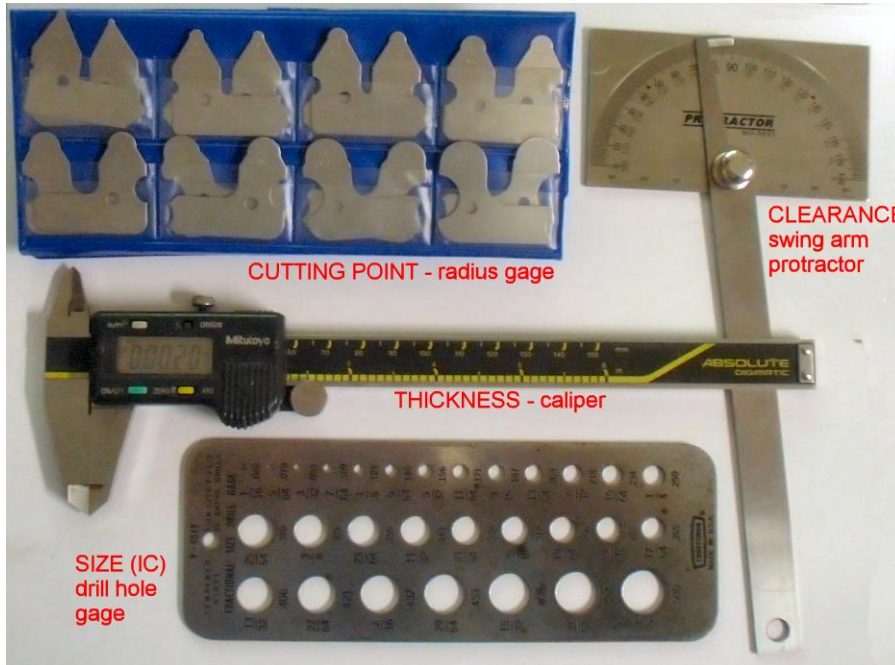
CUTTING POINT - radius gage

THICKNESS - caliper

CLEARANCE swing arm protractor

SIZE (IC) drill hole gage

The grade of a carbide insert, e.g. C2 or C5, and the coating type, e.g. Titanium Nitride or Uncoated, should also be specified when ordering inserts, but both are not part of the ANSI Identifier. Grade and coating will not be discussed here.

Tip: Use an engraver to write the ANSI Identifier on a non-mounting surface of your tool holder prior to first use. You'll thank yourself for having done so when you reorder its inserts.

The following table is excerpted from the ANSI B212.4-2002 specification.

The entire document is available from this web link .

Table: ANSI B212.4-2002 insert identification system (S N C N 4 3 2 — positions 1 through 7)

1 SHAPE	2 CLEARANCE	3 TOLERANCE CLASS	4 TYPE	5 SIZE (I.C.)	6 THICKNESS	7 CUTTING POINT
A Parallelogram 85°	N 0°		A			
B Parallelogram 82°	A 3°		B 70°/90°			
C Diamond 80°	B 5°		C 70°/90°			
D Diamond 55°	C 7°		F			
E Diamond 75°	P 11°		G			
H Hexagon 120°	D 15°		H 70°/90°			
K Parallelogram 55°	E 20°		J 70°/90°			
L Rectangle 90°	F 25°		M			
M Diamond 86°	G 30°		N			
O Octagon 135°	O Ω°		Q 40°/60°			
P Pentagon 180°			R			
R Round 360°			T 40°/60°			
S Square 90°			U 40°/60°			
T Triangle 60°			W 40°/60°			
V Diamond 35°			X With Dimensions			
W Trigon 80°						

Position 4 — SIZE (I.C.): For equal sided inserts this indicates the inscribed circle (I.C.) in 1/8 of an inch. Examples: 1/8" = 1; 5/32" = 1.2; 3/16" = 1.5; 7/32" = 1.8; 1/4" = 2; 5/16" = 2.5; 3/8" = 3; 1/2" = 4; 5/8" = 5; 3/4" = 6; 7/8" = 7; 1" = 8; 1-1/4" = 10. For rectangles and parallelograms two digits are necessary. 1st digit = number of 1/8" in width. 2nd digit = number of 1/4" in length.

Position 3 — THICKNESS: This indicates the insert thickness in 1/16 of an inch. Measured From: Cutting edge to opposite pad on insert types F, G, J, & U. Cutting edge to bottom on types H, M, R, & T. Top to bottom on types A, B, C, N, O, & W. Examples: 1/16" = 1; 5/64" = 1.2; 3/32" = 1.5; 1/8" = 2; 5/32" = 2.5; 3/16" = 3; 7/32" = 3.5; 1/4" = 4; 5/16" = 5; 3/8" = 6; 7/16" = 7; 1/2" = 8; 9/16" = 9; 5/8" = 10.

Position 2 — CUTTING POINT: This indicates the form on the cutting point in 1/64 of an inch for those with a radius. Examples: 0.002" = 0; 0.004" = 0.2; 0.008" = 0.5; 1/64" = 1; 1/32" = 2; 3/64" = 3; 1/16" = 4; 5/64" = 5; 3/32" = 6; 7/64" = 7; 1/8" = 8; 5/32" = 10; 3/16" = 12; 7/32" = 14; 1/4" = 16; any other = x.

TOLERANCE CLASS — Tolerance on Dimensions (± from nominal), Dimension

Tolerance Letter	B	A	T
A	0.0002	0.0010	0.001
B	0.0002	0.0010	0.005
C	0.0005	0.0010	0.001
D	0.0005	0.0010	0.005
E	0.0010	0.0005	0.001
F	0.0002	0.0010	0.001
G	0.0010	0.0005	0.005
H	0.0005		0.001
J	0.0005	******	0.001
K	0.0002		0.001
L			0.001
M	0.0010		0.005
U	***		0.005
N			0.001

* see charts below

VALID FOR SHAPES: C, E, H, M, O, P, S, T, R, W

I.C.	A Class J, K, L, M, N	U	B Class M, N	U
3/16	0.002	0.003	0.003	0.005
7/32	0.002	0.003	0.003	0.005
1/4	0.002	0.003	0.003	0.005
5/16	0.002	0.003	0.003	0.005
3/8	0.002	0.005	0.005	0.008
1/2	0.004	0.007	0.006	0.011
5/8	0.004	0.007	0.006	0.011
3/4	0.005	0.010	0.007	0.015
1-1/4	0.006	0.010	0.008	0.015

VALID FOR SHAPE D ONLY

I.C.	A Class J, K, L, M, N	B Class M, N
7/32	0.002	0.004
1/4	0.002	0.004
5/16	0.002	0.004
3/8	0.003	0.006
1/2	0.004	0.007
5/8	0.004	0.007

VALID FOR SHAPE V ONLY

I.C.	A Class J, K, L, M, N	B Class M, N
7/32	0.002	0.004
1/4	0.002	0.004
5/16	0.002	0.004
3/8	0.003	0.006
1/2	0.004	0.007
5/8	0.004	0.007
3/4	0.004	0.007