Home Metal Shop Club

September 2010

Newsletter

Volume 15 - Number 9

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

About the Upcoming October 9 Meeting

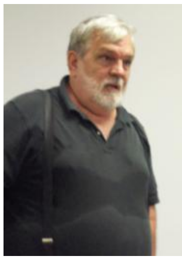
The September general meeting will be held on the second Saturday of the month at 1:00 p.m. in the Parker Williams County Library, 10851 Scarsdale Boulevard, Houston, TX 77089. Visit the web link http://www.homemetalshopclub.org/events.html for up-to-the-minute details.

October: *Lee Morin* will speak on *Heat Treating*.
November: *Mike Hancock* will speak on *Vacuum Techniques and Applications*.

Recap of the September 11 Regular Meeting

Thirty members, our newest member *Eddie Powell*, and three visitors, *Joe Ross, Tony Gaylord, and CJ Janecke,* attended the 1:00 p.m. meeting at the Parker Williams County Library. President *Vance Burns* led the meeting. A motion was made and carried to move the meeting time up to 12:00 Noon, pending room availability, to allow time for the Novice and other Special Interest Groups at the end of the meeting. Dues were collected for the upcoming year, and we currently have 38 paid members.

Presentation



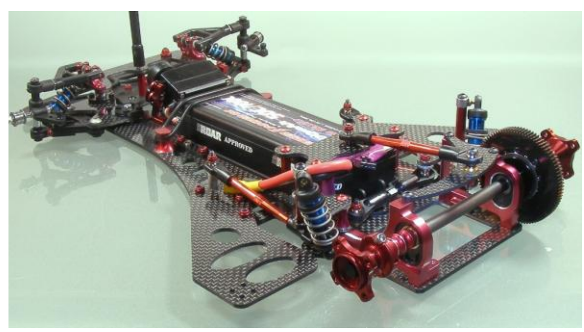
John Stranahan spoke on a variety of topics – Radio Controlled Cars, Lathe Alignment, Gunsmithing, and Making an Intake Header for his car. John operates a business selling parts of his own design for Radio Controlled Cars

Radio Controlled Cars

John became interested in radio controlled cars about 12-15 years ago. He races his cars on a track located in Porter, Texas. This track is 275-ft. long and 75-ft. wide, and was recently host to the World Championship, where 210 Nitro fueled 4WD cars raced for a 10-day period. The Nitro 4WD cars have a top speed of 60 MPH. This class of cars was developed about 10 years ago, and was designed to be easy to drive. Ten to twelve cars are run at a time on the track.

The larger cars that John brought were 1/10 scale, and have a 1 HP motor driven by lithium polymer batteries. The smaller cars were 1/12 scale, and have a 0.1 HP motor. The larger cars cost about $1,000 with quality components, and the smaller cars cost about $300. The batteries last about 6 minutes @ 47A, and can deliver up to 200A for brief periods! Charging can be dangerous, and is done inside a Nomex flameproof bag.

John runs electric 2WD cars, which have a top speed of 65 MPH. He became interested in building his own chassis for the cars to combat some problems he observed with current designs. One of the major problems was that the cars tended to fly when they went over 50 MPH due to aerodynamic lift. John builds and markets a frame for the car built out of 0.1” thick woven graphite carbon fiber. This material is fairly expensive, and costs about $60 for an 8 x 10-inch sheet. The car bodies are made out of molded 0.030-inch thick Lexan.



The original cars that John obtained used 3 shock absorber located on the top of a hinged rear end assembly. John noted that this design was not one seen on real cars, and he thought that there might be room for improvement. He wanted to make a new design that would address the need for more speed without making the car fly. He based his suspension design on a late model Mustang, with a rear end that goes up and down instead of pivoting. He found that his design added 4 MPH to the speed, and gave him a competitive advantage in races.

John went through the construction techniques he uses to build a prototype for a new design. He starts by making a new design in AutoCAD. The design is printed out at 1:1 scale, and John cuts out the pattern. The pattern is glued to a carbon fiber sheet. The first construction step is to drill mounting holes. It can be difficult to drill the holes in the carbon fiber where desired, because the drill bit tends to wander. John found that the best method for drilling holes was using a 15,000 RPM Dremel mounted on a drill press. Another method that worked was drilling a very small pilot hole with a conventional drill, and then drilling the final full diameter hole.

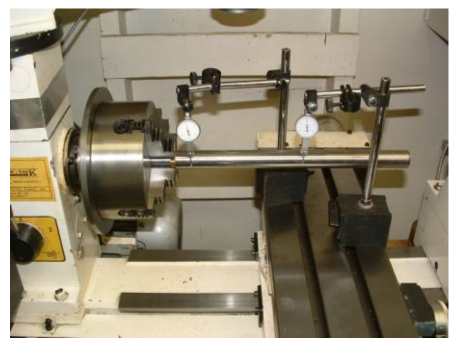
The next step is to cut out the outline on the glued pattern. John starts by cutting the straight lines with a Dremel 4000 and a cutoff wheel. He then uses a drum sander on the Dremel to cut the contours and clean up the final shape.

Once John works through several prototypes of a part and is satisfied with the design, he has a commercial manufacturer make production runs using a router.

<u>Inlet Manifold</u>

John wanted to replace the single throttle body on his Ford Focus with four throttle bodies, one for each cylinder, to improve the performance. He started with the throttle bodies from a Suzuki 750, and made a new header plate from ABS plastic to adapt the spacing of the new throttles. A video was shown of the machining process for the ABS. Coolant was required for the machining – not for lubrication, but to keep the ABS from getting hot.

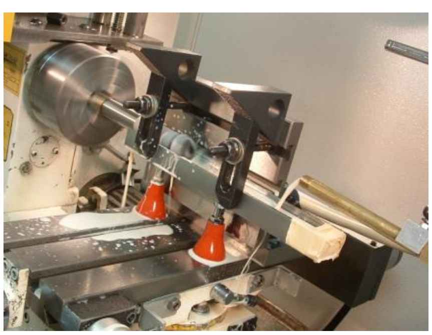
<u>Mill - Lathe Modification and Alignment</u>



John uses a manual ShopTask Mill - Lathe combo for his work. For his gunsmithing work, he wanted the mill - lathe to be very accurate. To increase the rigidity of the mill - lathe, he built a new base table from structural tubing. He felt that the milling head was not adequately supported, and built a bridge adaptor to support the head from both sides.

John went through the many steps required for alignment of the lathe, including leveling, checking the ways, aligning the head and aligning the tailstock. He has published a CD on the technique and many other Home Shop topics.

<u>Gunsmithing</u>



John talked about how he used his mill - lathe to build target rifle stocks employing stainless steel bedding blocks. The custom parts make for a very tight fit and increase rifle accuracy. Next, he showed how he modified the barrel. It takes special fixtures to remove the receiver from the rifle barrel prior to machining work. John showed the many steps required to make a precision receiver, bolt, and barrel from less accurate components. He does all the work on his mill - lathe combo. Many operations employed specialized fixtures that he made. He showed some before and after targets that demonstrated how much closer shot groupings could be obtained after the machining.

Show & Tell

Vance Burns showed a video of a water jet propelled jet pack that he wants to build someday.

Lee Morin gave away T-slot rakes that he made with his CNC plasma torch to all meeting attendees. Thanks, Lee!

Joe Williams passed around a massive 1 ¼" – 5 Acme tandem tap from his collection.

Martin Kennedy described a vertical shear bit that he made based on an article from GadgetBuilder, and has a video of it in use posted in the club's video page.

Rich Pilcher acquired a routing attachment that can be used to make spirals and flutes, and passed around the owner's manual.

Joe Scott showed an adaptor that he made to hold a custom cutter with a mill saw holder. The cutter was used for a machining operation on a gun scope holder.

Dick Kostelnicek showed a Ipevo Point 2 View video camera that will auto focus down to about 1-inch.

Dean Henning showed a two-lobe camshaft that he built for a small engine, and described how it was made.

Problems and Solutions

Dan Harper asked if anyone had experience with the Glaceon milling vice.

A question was raised on the best way to make small Aluminum parts for radio controlled models with hand tools. It was suggested that using a collection of files, cleaned with a file card and chalked before use, worked well. Another suggestion was similar to the recommendation in the main presentation: cut close using a pattern glued to the stock and use a belt sander, a file, or sandpaper on a granite block to finish. It was mentioned that the side of a cut-off blade worked well as a scraper, especially if mounted in a handle.

Joe Scott asked about having links to local auctions on the website. It was mentioned that signing up with some of the auction houses like Lyons or Lemons would result in regular emails of upcoming auctions. Joe also mentioned that he'd like to see a presentation in the future on horizontal milling machines.

Novice SIG Activities

SIG coordinator *Rich Pichler* continued last month's demonstration on how to set up the feed for threading on an Atlas lathe. Single point threading was performed in several passes on a 3/4" plastic rod after cutting start and stop areas to the base of the thread.

Next time we will make a trial fit to the thread with a nut, and look at other lathe operations. Thanks to Dennis Cranston for providing the lathe!

SIG coordinator *Dennis Cranston* gave an introduction and tutorial on casting.

Carbide Tools for the Lathe and Milling Machine

By *J.R. Williams*

The typical lathe tool that a hobby machinist uses will have a carbide chip brazed onto the tool shank. The common grades are C2 and C6. Grades run from C1 to C8. C2 grade is designed for use on cast iron and non-ferrous materials and has a tough high binder that cements fine grain tungsten carbide and cobalt together. C6 grade is balanced for wear, shock resistance, and toughness with larger grain sizes and a medium binder content.

The carbide inserts are made by blending finely ground carbide grains with a binder material, usually cobalt, and then pressed in dies to shape the finished product. The pressed inserts are made oversize and are then fired at very high temperature to sinter the finished chips. The sintered chip is about half the size of the original pressed part. Manufacturers have the process down to where the finished sintered product is at the desired size and does not require additional grinding. However, some chips are ground to shape and then coated.

The average hobby machinist probably will be satisfied with either grade. The main requirement for good carbide service is to operate the machine at high speeds while taking a good heavy cut, providing the machine can handle the high speeds and feeds. The heat produced from the cut is passed on to the chip and not the work. Most small lathes do not have sufficient power to warrant carbide tooling. The chips produced are designed to break-up and fall away from the work. Long stringy chips usually mean that you should increase the feed and or speed.

The brazed-on carbide tooling is the lowest cost approach. I find myself using a mixture of tooling. For tools that require special shapes, high-speed steel tooling is a good choice. For rough cutting I use a brazed-on insert and follow up with a carbine insert tool, a Kennametal “top notch” insert of the NP series having a small radius tip. It has a sharp positive cutting edge with a chip breaker relief. This insert works fine for me with alloy steel, stainless, aluminum and copper and brass. A typical carbide insert has a specific *cutting window* of feed verses speed. Work in the window and it cuts well, but it will not provide a good finish for very shallow depth of cuts. This is largely due to the factory honed cutting edge on the insert. The honing removes the very sharp edge and improves insert life. Typically, the tool needs a depth of cut of about 0.015 inch to provide a satisfactory finish. Larger depths shorten the life of the insert. I prefer the positive top rake cutting tools with negative rake top edges. They’ll produce excellent results.

The low cost brazed-on cutting tools typically will require a minor touch up of the cutting edge with a good diamond stone or wheel. I have equipped in my shop with diamond abrasive wheels that I use on carbide tooling. The initial cost of a diamond wheel is high but the life is excellent. My oldest wheel is about 30 years old. The “Green” wheels used on carbide do not produce a sharp edge as their abrasive grains fracture the cutting edge of the carbide. I grind the steel of the tool’s base with a standard aluminum oxide wheel and move over to the diamond wheel to finish the brazed-on carbide chip. The chips are be ground back enough to provide a new surface as they dull extending their life considerably.

I have tooling set up for use of triangular threading inserts for both external and internal threads. The inserts save time and provide the correct thread form. My large boring tool is made from a ¾-inch bar with a carbide insert and can be reground on the diamond wheel to extend its life and, for some materials, provide a better finish. The small bar will fit into a 5/16” hole. The threading tools must be handled with care, as they are very fragile and easily chipped. For small bores I have used a high speed tap ground down to provide a one-tooth cutter.

During milling, carbide comes into play as a single insert on a fly-cutter I use them for copper aluminum and steel. In all cases, the tool will be reground to provide a high positive rake and run with the use of a mist coolant system that is air operated. I use sufficient air pressure to provide a fine spray and don't get into the true mist or fog mode. The coolant is a soluble oil and water solution. It provides lubrication, while the air blast removes the chips to prevent them being recut. Recutting leaves scratches on the finish.

I use standard high-speed end mills for most work and carbide end mills for hard to cut materials.

Carbide Insert Coatings: The higher quality inserts will have coatings of hard compounds of aluminum oxide, nitrided materials, or diamond. Common ones are: TiN (titanium nitride), TiC (titanium carbide), TiCN (titanium carbonitride), TiCON (titanium oxycarbonitride), Thin film Diamond, PCD (Polycrystalline diamond), PCBN (polycrystalline Cubic Boron nitride). All the coatings greatly increase tool life along with the insert's cost. The coatings reduce friction between the cut chip and the insert and greatly increasing the life of the tool. Lower power machines will not benefit from the increased tooling cost of carbide insert. A recent presentation at a Home Metal Shop Club meeting showed machines with 50 HP motors driving the spindle while the average hobby machine might have no more than 2 HP available at the spindle.

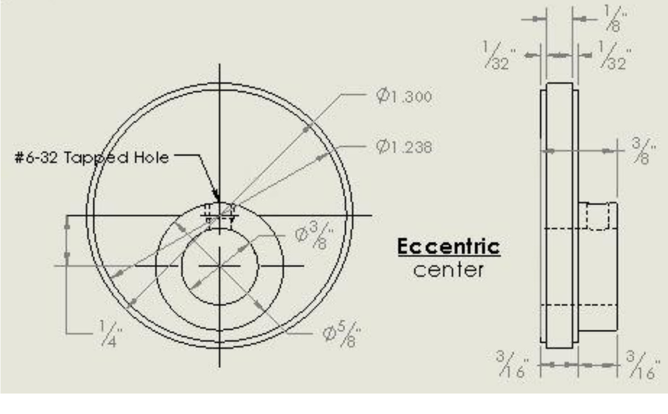
I have used a Ceremet insert, a ceramic and metal mixture, to clean up an existing part that only required the removal of a few thousandths inch. The cut was on a work hardened Inconel overlay in a short bore. The Ceremet inserts approach the cutting capability of diamond and CBN (Carbon Boron Nitride) chips in hard-to-cut work.

Why It Takes So Long To Machine a Part

By *Martin Kennedy*

I don't know about you, but it seems to take me forever to get a project finished in my machine shop. When starting a project, I generally think it'll only take about two hours. But past history shows that I'm a terrible estimator of the amount of time required. Here's an example of why…

OVERALL OBJECTIVE – The objective was to make the centerpiece for a steam engine eccentric. I knew that I could make an eccentric on the CNC mill or on the lathe. Each has its pros and cons. The lathe is faster, but it's harder to get the offset in the eccentric in exactly the right spot. The mill is slower to take off steel and requires me to generate several pieces of G-code for the various operations, but it's accurate and automatic so I don't have to turn knobs and check dimensions the whole time I'm machining. Last time I made an eccentric, I made it on the lathe. So this time, I decided to make it on the mill. First, I needed a piece of stock that was thicker than any plate I had in inventory, and larger in diameter than any bar stock that I have. I had some scrap heavy wall 8" diameter pipe that was thick enough. But it was very irregularly shaped and needed to be



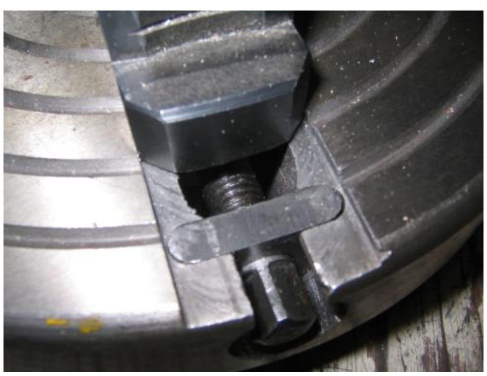
made into a block first. That led to…

PROJECT ONE – I used a fly cutter (and some earplugs) to take the piece of scrap pipe and make it into a block on the mill. This went off without a hitch, although it took longer than I thought it would. I'm now ready to make the eccentric, which will now be…

PROJECT TWO – I ran the G-code and made the front side of the eccentric. One of the last operations was to drill the offset hole for the shaft, and I had a brief lapse in judgment and made the 3/8" hole with a 3/8" drill, instead of using a slightly undersize drill bit and reaming to final size. When I put a temporary shaft in the eccentric to clean it up on the lathe, I could see that there was too much slop in the hole. I had to scrap the part. Which resulted in….

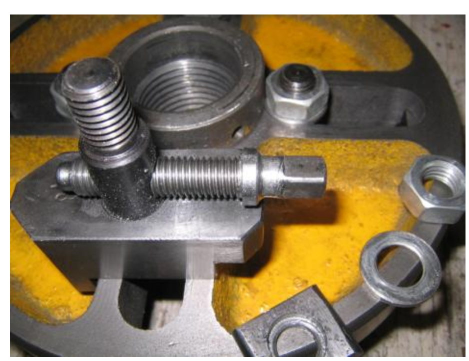
PROJECT THREE – To make another eccentric, I needed another steel block. This time, instead of using the mill (and the earplugs), I decided to use the lathe. I wrote an article about that project, so I won't go into any detail here. Another project completed without a hitch! I'm really good at making blocks! On to…

PROJECT FOUR – Since I was removing a lot of metal, and I had the CNC code set to remove only 0.015" per pass, the mill took a long time to make the first eccentric. For the next try, I decided to use the lathe to save time. I mounted the part in my four-jaw chuck. Although it had worked fine for making the block, I was now having trouble tightening one of the jaws – it wouldn't get completely tight. I looked closely and saw that the adjustment screw had pushed through the cast iron of the chuck body, and sheared off a small semi-circular piece of iron. This happened once in the past on another adjustment screw, and I fixed it by machining the chuck body to accept a steel insert. I decided to fix this problem once and for all. I made three more steel inserts and machined the chuck body to accept them. After reassembling the chuck I was ready to get back to the original project of making an eccentric. I put the block back into the chuck and tightened three of the jaws, feeling really proud I had made such a neat fix. But the fourth jaw would not tighten? Now what? I took the mechanism apart and saw that one of the adjustment screws had stripped out. Arrgh! Now I have to do…



PROJECT FIVE – The stripped screw was not one that I could get at the hardware store. I put a three-jaw chuck on the lathe and made a replacement screw. I installed it in the chuck. OK, now I'm really ready to make the eccentric. Feeling like I had finally conquered all the problems, I jumped into….

PROJECT SIX – I mounted the block in the four-jaw chuck. I knew that to make the eccentric, I'd need to cut the OD of the eccentric, then to use two of the chuck jaws and a dial indicator to slide it over the appropriate distance for the offset, and then cut the hub and drill the hole for the offset. I wanted to make sure this plan would work before I started, so I tried to use the jaws to offset the block. The jaws bottomed out before moving the block over far enough. I looked at the chuck, and saw that some big washers holding the jaws on the chuck were hitting where the chuck mounted to the lathe. Maybe some smaller washers would work



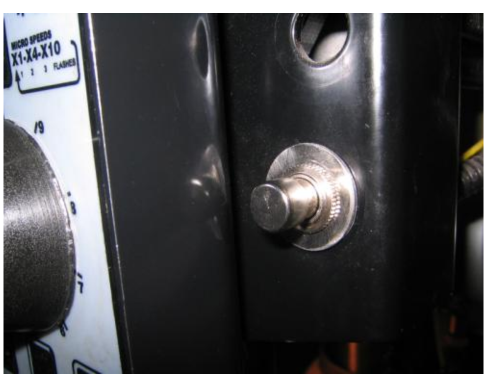
better? I looked around, but could not find any small enough. No worries, I'll just cut down the OD of the washers I already have in…

PROJECT SEVEN – I clamped the four washers together on a threaded shaft, and cut them to the same diameter as the points on the nuts. The picture, above right, shows the cut down washers. Easy as pie. How come all the repair projects go smoothly while all the actual projects go so poorly? I'm ready to go back to the original project, which is now….

PROJECT EIGHT – The smaller washers work a lot better, but unfortunately, I still can't clamp down enough to offset the piece enough. I tried reversing some of the jaws, but I can't seem to get a combination that will hold the part in both the regular and offset positions. I think about using a thick shim between the block and the one of the jaws, but I'm worried that it might fly out of the chuck during machining. *I have since found out that this can be done safely.* You know what I really need? A better four-jaw chuck! I'll just buy one, and quit using this cruddy one that I keep fixing. A new chuck is now…

PROJECT NINE – I look at chucks in a variety of places. To be able to clamp the largest piece possible, I need to buy the largest chuck I can for my 9" x 20" lathe. The one I have is a 7" chuck, which I find out is a very odd size. I can get a 6" or maybe an 8". I do some research to see if an 8" will even fit. My measurements show me it's really close. I find out that some people have done it, but it's really too big. The jaws hit the lathe ways when cranked out all the way, and there's some talk about the effect of the weight and inertia on the bearings and motor. So an 8" is out, unless I want to get a bigger lathe. A bigger lathe? Hmmmm. No! Stop that! No bigger lathe for you! There's no more room in the garage, anyway. Since I don't want to get a chuck that's smaller than the one I have, I ultimately decide to abandon this project. Forget using the lathe. Back to making the part on the CNC mill in….

PROJECT TEN – The on/off switch on my mill is unfortunately right next to the spot where the pendant controller hangs when not used. Because of the design of the switch, I have accidentally hit it several times during milling operations, which turns off the mill and makes me lose all my zero positions. I've been thinking about replacing it for some time, and since I'll be in the right part of town when I'm out for lunch, I decide to pick up a replacement switch. The place I go, EPO, has about a hundred different switches, but I have a lot of trouble in finding a 120V lighted push on/push off switch that's stiff enough not to be accidentally flipped. I finally find a nice one with a guard around the button. I install it on the mill, and find out it's really a momentary contact switch. Darn! Back to the store for…



PROJECT ELEVEN – I swap out the switch for an unlighted heavy-duty push on/off button. This one works fine, except that the hole for the old switch is much larger than the neck of the new switch. No problem, I'll just make adapter pieces on the lathe, which I do. Switch ready. Block ready. G-code ready. Time to start…

PROJECT TWELVE – I make the eccentric on the CNC mill. This time, I use an undersize drill and then ream the 3/8" hole. I put the part on the lathe for final clean up and sanding. Done! And it only took two weekends and about 20 man-hours!