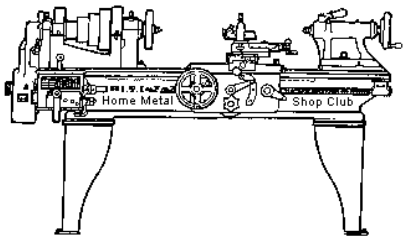
Home Metal Shop Club

March 2012
Newsletter

Volume 17 - Number 3



http://www.homemetalshopclub.org/

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

Our members' interests include Model Engineering, Casting, Blacksmithing, Gunsmithing, Sheet Metal Fabrication, Robotics, CNC, Welding, Metal Art, and others. Members enjoy getting together and talking 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 April 14 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. The meeting location and time has been confirmed through April of this year. The next meeting will be held on April 14th.

Visit our website for up-to-the-minute details and for the meeting's topic.

Recap of the March 10 General Meeting

By *Martin Kennedy*, with photos by *Jan Rowland* and *Dick Kostelnicek*


Vance Burns

Twenty-nine members and four guests - Jared McMillan, Jacob McMillan, Douglas Bolger and George Edwards (an original club member) - attended the 12:00 noon meeting at the Parker Williams County Library. President *Vance Burns* led the meeting.

We need more articles for the monthly newsletter! If you would like to write an article, or would like to discuss writing an article, please contact the Webmaster Dick Kostelnicek.

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.

Presentation

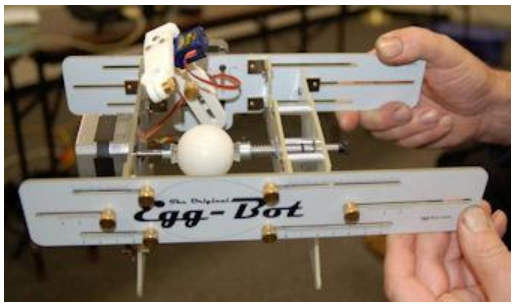

George Carlson

George Carlson spoke on several topics, but primarily about his MakerBot Thing-O-Matic 3D printer. George has had a long involvement with the Home Metal Shop Club, and served as its second president.

After WWII, in the late 1940s and into 1950s and 1960s, many people built things themselves. They included woodworking and metal working as part of their hobbies. Magazines during those times reflected this interest and there were many articles showing how to build things. Several magazines catered to **Do It Yourself** or **DIY** topics. However, the interest in DIY waned, and during recent times, not many people build things - they just bought them.

The Do It Yourself industry has seen a recent resurgence. DIY again appeals to people – many of them younger than 35. Hobbies today encompass both old and new technologies, and several encompass woodworking and metal working. The practitioners use the word **MAKE** instead of DIY. Examples are "maker group" to describe clubs and "maker space" to describe facilities. A popular magazine is Make Magazine, which promoted the 2008 Maker Faire in Austin. A special issue of Make Magazine showed 175 kits that are now available.

George showed one of his kit projects – a clock that uses an Atmel AVR processor to show time on micro ammeters. George bought the electronics and built the wood case that houses black ammeter covers to be evocative of old electrical equipment.

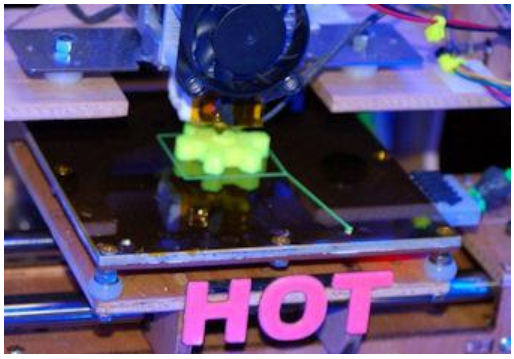


Another of George's kit projects was built by his daughter. She wanted a robotic dog, but George thought it would be better to start with a simpler project. They selected the EggBot, an art robot that can draw on spherical or egg-shaped objects from the size of a ping pong ball to that of a small grapefruit. The frame of the robot is made with circuit boards, which can be easily manufactured and are dimensionally very precise. One of the most popular things that George makes with this robot is golf balls with the president's picture.

George became interested in hobbyist 3D printers. Development of these home built 3D printers started in 2005 at the University of Bath, UK, with the RepRap project (Replicating Rapid Prototyper), an initiative to make a 3D printer that replicated itself. The prototype Darwin printer was completed in 2008. Improvements resulted in the 2nd generation Mendel printer in 2009 and the smaller Huxley printer in 2010. These printers use a frame made primarily of threaded rod, connected with plastic fixtures made on the printer.

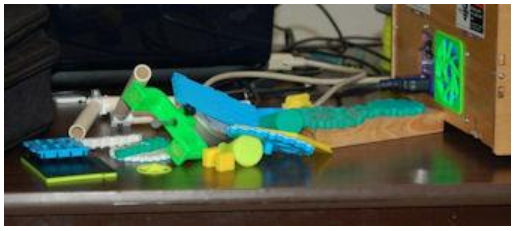
In 2009, another group in New York, with ties to RepRap, began developing their version of a 3D printer under the name MakerBot. Unlike the RepRap project, the goal of MakerBot was to develop a kit printer, not to develop a self-replicating machine. Their first machine was called the Cupcake. It was sold as a complete kit. About 2,500 of them were sold. It was open source and based on many user suggestions. The second generation, Thing-O-Matic 3D printer, was developed in 2010. The kit sells for about $1,100 and takes about 2 days to build. The most recent product is the Replicator, a slightly larger printer with dual print heads. It is sold completely assembled for about $1,800. The consumable

plastic filament for the printer costs $50 for 2 lbs. Most small parts use a small amount of filament, and the production cost is about 25 cents per part.

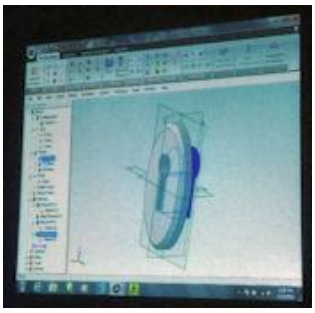


George showed the Thing-O-Matic 3D printer that he built. The printer has an extruder head on top, which moves up and down and is driven by a Z-axis stepper motor. The extruder head uses either ABS or PLA plastic filament. PLA is more transparent but not as sturdy. The extruder nozzle is 0.016" diameter. The feed mechanism is very precise, since feed rate and X-Y speed must be dead on to extrude enough but not too much material as the part is made.

At the bottom of the printer is a heated platform, driven on the X and Y axis. The printer can make parts up to 4 ¾-inches square x 4-inches tall. The part's accuracy on outside surfaces is about 0.001-inch, while inside hole accuracy is about 0.008-inch.



George showed examples of several parts that he made with the printer. Diring the meeting, he demonstrated how to make a part from scratch. He designed a keyhole escutcheon (ornamental plate, shown below-left) using the Alibre CAD program, and saved it as an STL (stereolithography) computer file. The file was loaded into ReplicatorG, an open source CAM software designed for 3D printing. The ReplicatorG output is G-code. Before printing, George viewed a simulation of the G-code execution in netFabb Studio Basic. He then saved the G-code to a SD flash drive, which he plugged into the printer. Although the printer can be driven directly from a computer, George found that using a SD flash drive was more reliable. It only took about 3 minutes to plot the part.



Show and Tell

Three members of TX/RX Labs attended the meeting. They invited us to visit their facility near Minute Maid Park between 7:00 pm and 11:00 pm on Friday (free meal!) or between 11:00 am and 3:00 pm Sunday (free bacon!). TXRX offers classes on many subjects, including machining. They have mills, lathes, and 3D printers available for use by their membership.

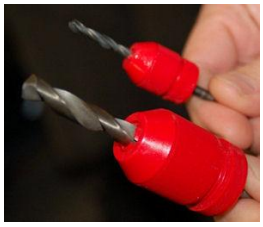
Mike Hancock challenged the membership to figure out how a smooth shaft could be used as a linear actuator. He passed around a rolling ring linear actuator that employs such a mechanism.

Mike Hancock

Joe Williams passed around an A-F set of B&S Adaptors to hold different size end mills. These adaptors were the precursor to collets, and are no longer used. They are similar to drill bushings.

Martin Kennedy showed a video on casting, machining and dimensionally checking handbells

Dick Kostelnicek brought two non-marking plastic drill stop collets (right photo). They're a more reliable alternative to using masking tape on drill bits to set the depth. They are available from woodworking suppliers.



Jared McMillan showed a very professional looking track cutting torch that he made primarily from old printer motors and gears (left photo). Some of the frame parts were cast in aluminum.

John McMillan needed to make a ½-inch left hand Acme threaded part for the cross thread feed on his 7-inch Atlas shaper. He made and hardened his own custom tap from tool steel.

Norm Burls

Norm Burls uses a somewhat unpopular FN 5.7-mm x 28-mm cartridge with his carbine. The ammo is expensive and hard to find, so Norm wanted to reload his own ammo. As part of the reloading process, he needed to trim cases to the correct length. He obtained a Lyman Trimmer Plus Case Conditioning Kit, which is essentially a primitive metal lathe. It didn't work on small cases because the chuck was too deep. To remedy this, he made a new set of jaws for the chuck.

Joe Scott brought some small Genesee hollow mills. He showed how he had made a Garand type 1 lockbar using a collet and one of the mills.

Joe also brought in several original 1941 Johnson LMG blueprints that he obtained from the estate of the manufacturer. The blueprints had been damaged in a flood. He described how he repaired them using archival repair tape. They were then photographed with a high resolution camera.

Gary Toll showed his gun screwdriver set.

Dan Harper reminded us to ask for shop tours when visiting a new facility. He described a dual headstock lathe that he saw during a tour of an Oceaneering facility.

Problems and Solutions

A member had three broken test indicators, two Starrett Last Word, and a Gem. He had a quote of $70 to repair each one, and wanted to know if anyone knew how to disassemble the indicators. Someone suggested Instrument Repair & Calibration Inc on Wayside Drive, and Texas Nautical Repair on Montrose Street. Another said that he had seen a 20 page book on how to repair. The club is trying to get a speaker from Texas Indicator, and perhaps he could provide some information. Another suggestion was to choose one of the indicators and do an autopsy on it.

A member wanted to know how to make a checkered surface. A die and a hydraulic press were suggested, but others said it was hard to make the sharp edges needed on the die. Another way would be to use a broach.

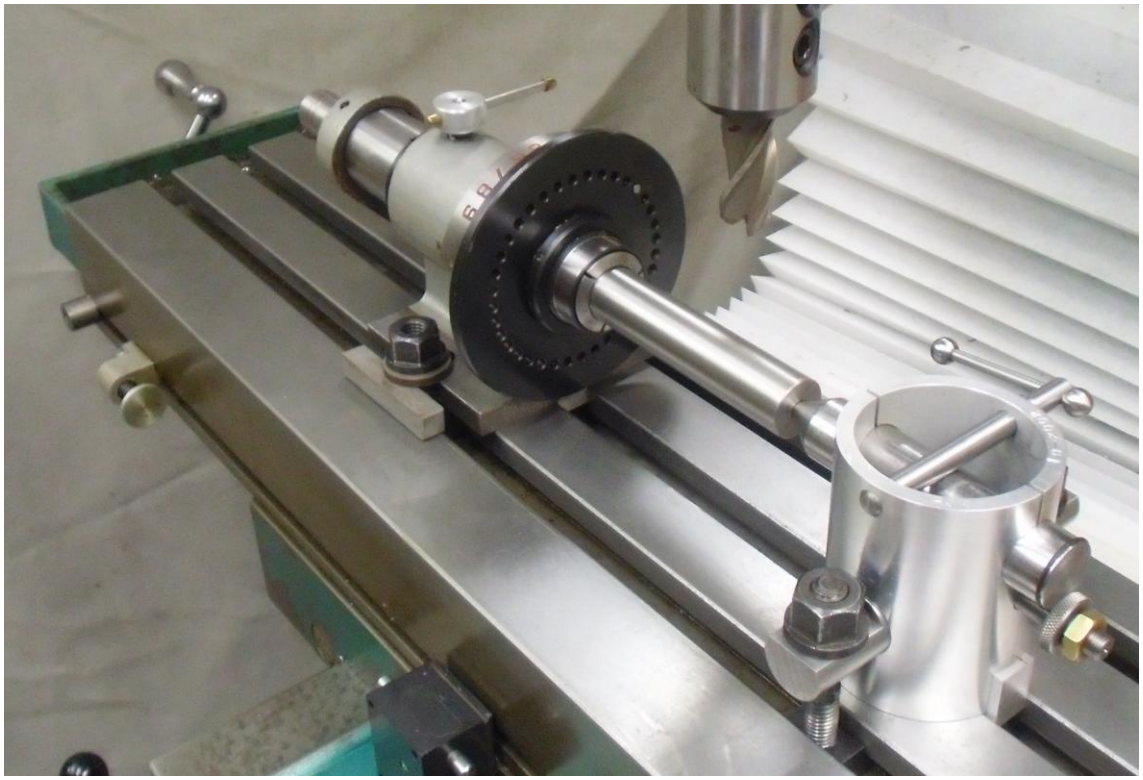
A member wanted to know how to finely adjust the angle of the Morse taper he had made. Prussian Blue and a file were suggested.

Novice SIG Activities

Rich Pichler and the Novice Group discussed various lathe operations.

Tailstock for Spin Indexer

By *Dick Kostelnicek*



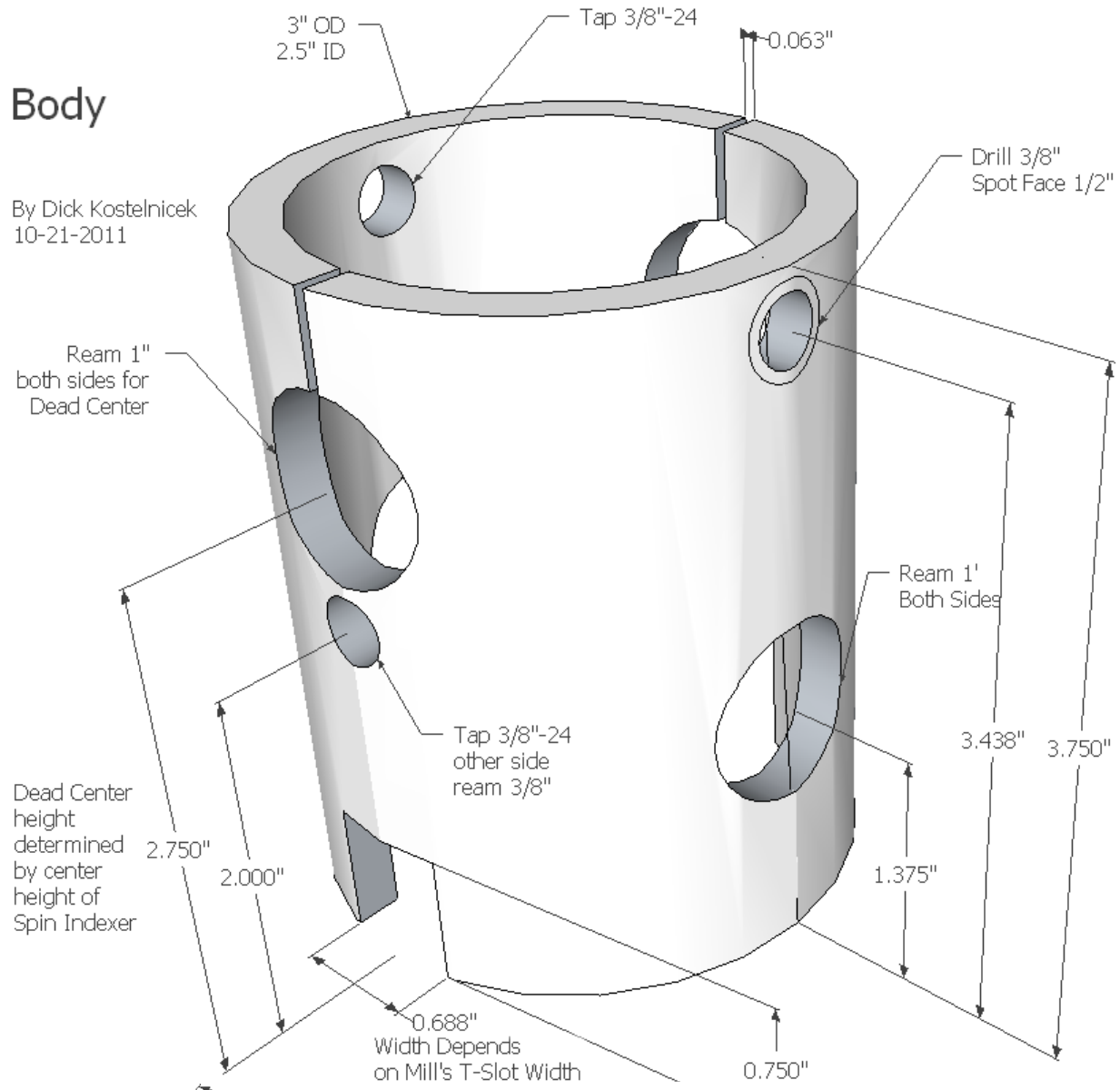
A spin indexer holds work in a 5C collet and can align its rotation by one degree increments. You can't overhang work too far from the collet's mouth or it will flex and chatter when milled. I've built an unconventional tailstock that supports extended bar stock (see photo above). Both the spin indexer and tailstock bases are keyed so they align along a T-Slot in the mill's table.

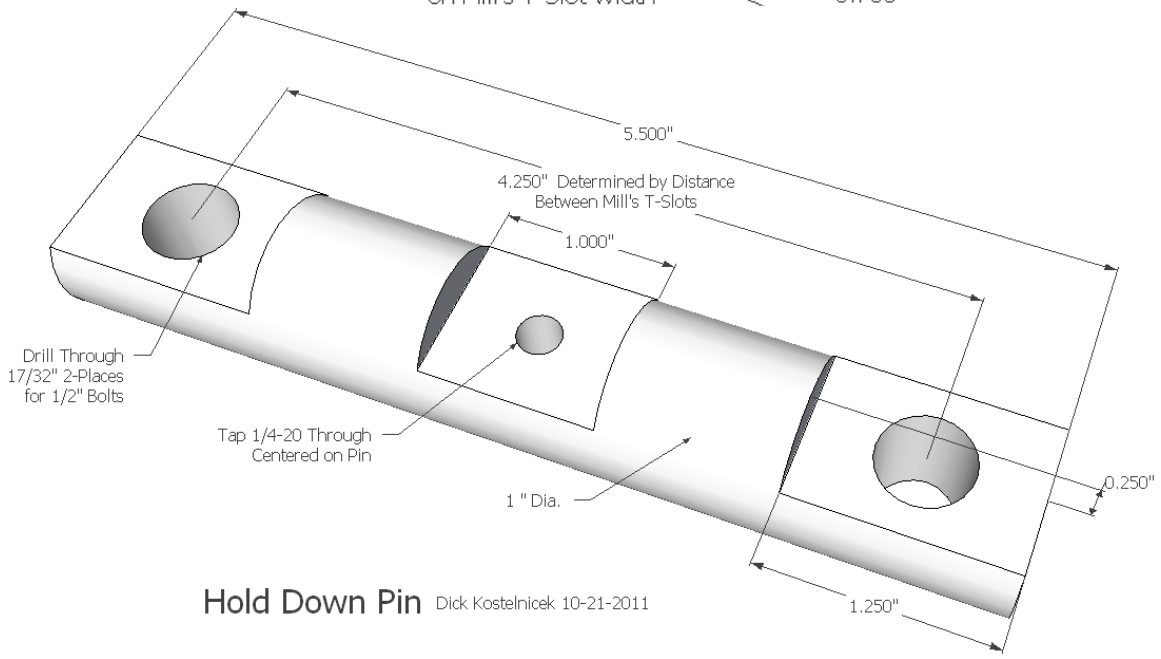
Carefully measure your collet's height above the indexer's base and locate the hole for the **Dead Center** at the same position on the tailstock's **Body** (see drawings below). My collet's axis is 2.75 inches above the base, but this may vary among various spin Indexer manufacturers.

My mill has 5/8-inch T-slots that fit 11/16-inch wide keys. Alter the drawings below for both the **Key** and the key's **Body** slot to be compatible with your mill's T-slot width. The center-to-center separation between every other T-slot will determine the separation between the large bolt holes in the tailstock's **Hold Down Pin**. On my mill, this measures 4.25 inches. Also, my mill's T-nuts use 1/2-inch diameter bolts.

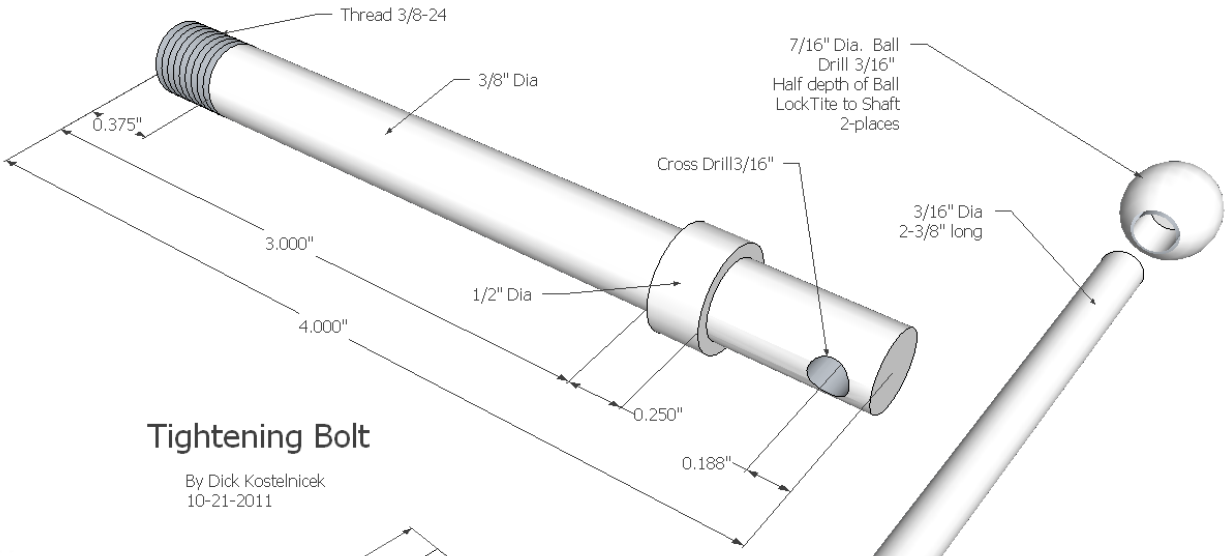
I've installed an O-Ring that protrudes slightly above the **Dead Center's** round surface near the flat end**.** This prevents the **Center** from inadvertently falling out of the tailstock **Body** while being handled. A ball handled **Tightening Bolt** locks the **Dead Center** into the tailstock by cinching its tubular **Body**.

A round knurled thumb nut on the horizontal **Stop Bolt** adjusts the in-out position of the **Dead Center**. This knurled thumb nut is backed by a brass hex jam nut. An O-Ring is sandwiched between the two nuts and provides sufficient rotation drag on the nuts to prevent them from loosening. Hence, the back position of the **Dead Center** is maintained while allowing it to freely slide forward. *Bon machining!*



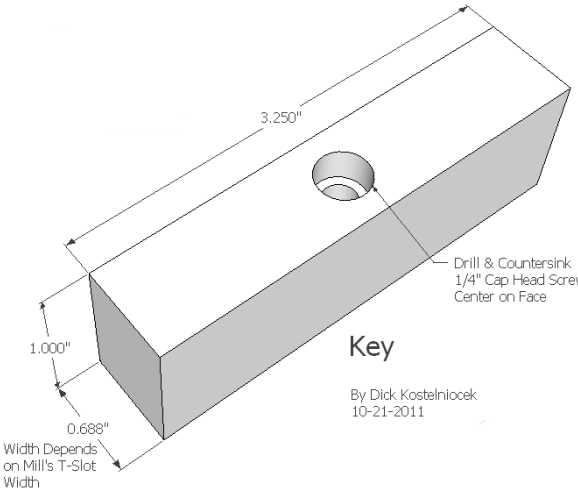


Hold Down Pin Dick Kostelnicek 10-21-2011



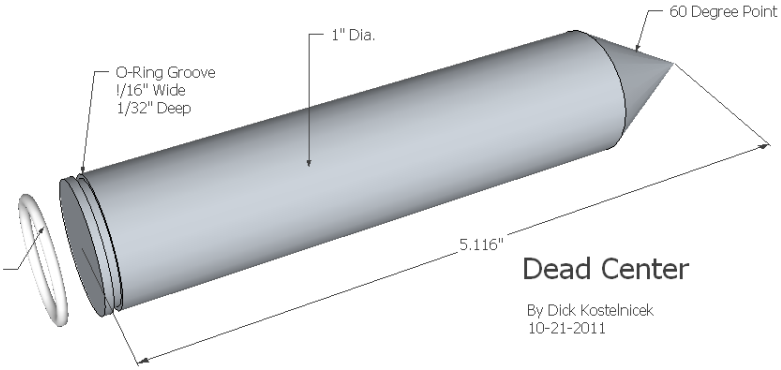
Tightening Bolt

By Dick Kostelnicek
10-21-2011



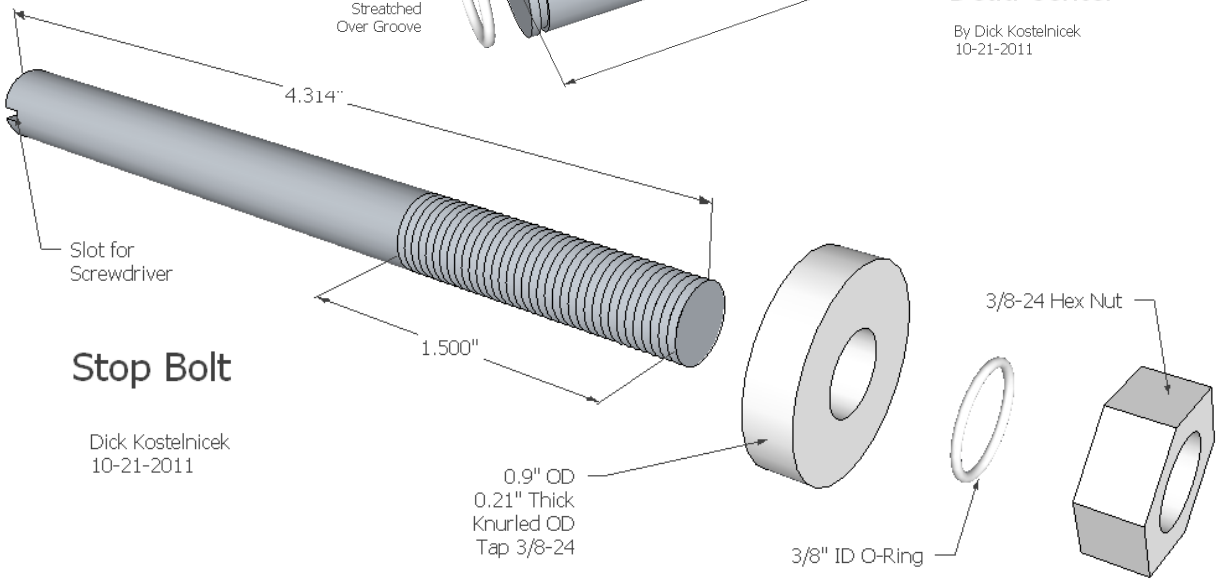
Key

By Dick Kostelniocek
10-21-2011



Dead Center

By Dick Kostelnicek
10-21-2011



Stop Bolt

Dick Kostelnicek
10-21-2011

A Blacksmith's Legacy

By Shannon DeWolfe

What does a blacksmith shop, a 1922 Sterns-Knight automobile, and a brewery have in common with electronically controlled constantly variable transmissions (ECVT), now numbering in the millions? Hub van Doorne.

Hubert Jozef van Doorne, "Hub" to his friends and family, was born to Martin and Petronella (Vervoort) van Doorne in the village of America, Province of Limburg, NL, January 1, 1900. He passed away May 23, 1979, at home in Deurne, Noord-Brabant, NL. Hub was one of the most prolific inventors and successful businessmen of the twentieth century. Yet few have heard of him in the USA. Not so in Holland! He is recognized as one the great industrialists of the twentieth century.

At the ripe old age of ten, Hub went to work for his father in the blacksmith shop. This was not unusual for the times. To apprentice a trade at an early age was the best option for many youngsters at the turn of the twentieth century. Hub was very lucky to work with his father. His first job was polishing horse hooves after shoeing.

When Hub was twelve, his father died quite suddenly. His mother, Petronella, did not take the untimely death of her husband well. A few days after Martin died, she was sent to an asylum where she spent the next seven years in the care of the nurses. Hub, his elder sisters, and his younger brother were left alone to fend for themselves. As the eldest son, Hub took the responsibility of providing for the family very seriously. His desire to operate the family's blacksmith shop as his own was overruled by his older sisters. They reasoned, rightfully, that Hub was as yet not strong enough to handle a blacksmith's daily work. Instead, he quit school and went to work full-time for a penny a week apprenticed to another smith in his father's blacksmith shop, now rented out for much needed income by the family. Two years later he sought and found employment at the Mandigers Machine Factory in Eindhoven. His salary is not recorded. Hopefully, he was making more than a penny a week.

During the War to End All Wars, Mandigers Machine was converted to armament work. Hub continued there, now inducted into the Dutch Army, as a machinist. After the war, he again returned to the employ of the tenant blacksmith in his father's shop in Deurne. He was not there long, moving next to a company in Helmond that made machines for the textile industry. That company went bankrupt in 1921 forcing Hub to find employment elsewhere. It was at this time that he and his younger brother Wilhelmus (called "Wim" by all) started their first company, the "Hub van Doorne coarse, fine, and stove foundry and repair facility for bicycles and engines." WHEW! What a name for a blacksmith and mechanic shop! The shop did not do well. To supplement his income during this period he also worked as the chauffeur and personal mechanic of a certain Dr. Wiegersma in Deurne. Dr. Wiegersma was a well known and respected man in Deurne. Hub became well known in his own right, as the doctor's chauffeur.

After four years of struggling to make a living, Hub decided to return to Mandigers Machine, this time as shop manager. While in his employ, Mr. Mandigers introduced Hub to Mr. Huenges, director of the Coolen Brewery and Ice Factory in Eindehoven. This proved to be a most fortuitous introduction for Hub. Mr. Huenges had complained to his friend Mr. Mandigers that he could not find a competent mechanic to fix a knocking noise in his Stearns-Knight automobile engine. The Knight engine is an unconventional design with sleeve valves replacing the ubiquitous poppet valves. The design was different enough that most mechanics of the day would not touch it. Those mechanics that did attempt to repair it failed. Mr. Mandigers suggested that Mr. Huenges let Hub try his hand. By this time Hub was a master mechanic and was able to repair and maintain almost anything. He had built two delivery vans from scratch and a pedal car large enough for four children that looked every bit a proper automobile. Hub was able to find and silence the knock in short order.

Mr. Huenges was mightily impressed with Hub's mechanical ability. He encouraged Hub to go into business for himself, even going so far as to supply seed money of 10,000 Kroners and shop space at the brewery in Eindhoven! From those humble beginnings the van Doorne's Aanhangwagenfabriek (trailer factory) was born. Teaming again with his brother Wim, the company grew rapidly from the start. Within a year they had 32 employees. Within a decade, 1000 employees. In 1932 Hub designed a heavy haul trailer which was one-third lighter than anything else on the road. A lighter trailer meant more goods could be hauled within legal *Gross Vehicle Weight* or GVW limits. The freight companies of Europe beat a path to his office door. To say the "Lightweight" was a boon to the company is a huge understatement. The Lightweight trailer kept the doors open at DAF through the Great Depression. Today DAF is the fastest growing large truck manufacturer in the world.

The history of DAF during the depression, WWII, and into modern times is very interesting. Unfortunately, I do not have the space to chronicle those years here. Luck, an inventive mind, able management, and government contracts after WWII ensured the survival of DAF. But there is so much more. I urge the reader to follow the links provided at the end of this article.

In 1999 I spent six weeks in Eindhoven, Holland. I was there for a series of training courses at Philips for the equipment I work on. With five weekends free, I spent some time doing tourist things. One of the things I did was visit the DAF Museum. The museum rightly features their bread and butter center stage: big trucks. Retired Dakar Rally trucks, fire trucks, road hauling trucks, military trucks, and a few prototypes greet the visitor front and center. To one side of the main hall is the entrance to a shop that has all the blacksmith and machine tools that started DAF, all set up and ready to work. As you continue around the museum you will find production cars and race cars, some visuals, and eventually you will come across a small display that is home to a cut-away of the very first mass production Continuously Variable Transmission. The first CVT is one of the few dynamic displays in the museum. It can be controlled by the viewer with a rheostat for the electric motor powering the transmission. It can be sped up, slowed, and reversed. It is fascinating to watch in action. Reverse is interesting because cars equipped with this CVT could go as fast backwards as they could forward. (There was an odd, lighthearted race series in Europe in the 1960s that was run with the cars in reverse. The DAF cars were banned.)

Hub was a prolific inventor. His name is on over 180 patents. When he turned his thoughts to building a car, from the first, he wanted an automatic transmission. He invented the CVT based on concepts of the variable speed conveyors used in his factory. Hub's design was a dual belt affair that required frequent adjustment and regular belt replacements. The belts ran in the open, vulnerable to road hazards. The aptly named Variomatic was also notorious for snapping axles when even slightly abused. The rubber belts limited the amount of torque it could transmit. Right next to the first CVT is a cut-a-way of a later design that utilized a single steel belt. As in the rubber belted transmission, the pulleys open and close depending on speed and vacuum signal from the engine. The steel belt resolved the problems of high maintenance and limited torque ability of the rubber belts and they ran in an enclosed transmission; removing them from dangers of road debris. But they had problems of their own. They tended to run hot and consumed excessive power due to high friction. These problems vexed Hub. His determination to improve the design was legendary among the employees at DAF. The sight of Mr. Hub, as his employees knew him, scurrying from his office to consult with his engineers was well known to one and all.

Despite the inherent problems, the Variomatic was sound enough to use behind a 600cc engine built in house. Hub showed the prototype car at the 1954 Paris Auto Show. He came home with over ten thousand orders! Within two years of initial production the engine grew to 750cc. The cars were imaginatively named the "600" and "750", respectively. The 750cc boxer engine and rubber belted CVT was available in the base Daffodil model along side a larger model with a bigger water cooled engine driving a steel belt CVT until 1975.

In 1965 Hub retired as president and CEO at DAF and Wim took the reins. Hub had a machine shop in his home and was in contact with his engineers. He also had access to anything he wanted at DAF. Still driven to improve the design, he spent more and more time in his workshop trying to resolve problems inherent to the steel belt CVT. In 1968 Hub went to one of his engineer friends with an idea. What if the belt is made to work as a push belt instead of a pull belt? His own experiments at home proved to him that it would work with minor changes to the links. In 1972 Hub formed a new company, Van Doorne Tranmissie, BV. Sometime in the mid-seventies, I never did find an exact date, Bosch became a ten percent holder in the company. I can assume the Bosch involvement was due to a realization at Van Doorne Transmissie that further improvemnts to the CVT was going to require electronic controls. Then, as today, Bosch was the world leader in automotive electronics.

Mr. Hub passed away in 1979 before seeing his push belt CVT in commercial production. But he had solved the major problems and just a few months later the very first push belt transmissions rolled off the assembly line.

In 1995 the CVT factory and all the patents it held was sold outright to Bosch. Bosch continues to research and improve upon the CVT. They build transmissions for many automotive companies. They also license the rights to use the push belt to other companies (Nissan, Honda, and Toyota are three of the larger companies). Every push belt ECVT now in production or ever to be produced pays royalty to Bosch. Today the ECVT is the most common transmission used in hybrid vehicles. The ECVT will soon overtake the conventional automatic in numbers on the road. Millions have been built and many millions more will be. Smart folks at Bosch, eh?

The consumer has been slow to appreciate the advantages of the ECVT. The engine doesn't "sound right" because the transmission keeps the engine in the power band needed, raising the RPM for power and lowering it for economy. The result is an initial high RPM time during take-off followed by a slow drop in RPM until road speed is matched to the torque curve of the engine for maximum efficiency. Some manufacturers have resorted to computer control of engine RPM and "shift" points to make the ECVT behave more like a conventional automatic. Fuel costs will eventually cause most consumers to overlook the "odd" engine sounds because the ECVT is very efficient; as high 98% efficient. And it does this at all ratios, even in very high overdrive configurations. A manual transmission achieves similar efficiency only in 1:1 couple. The conventional automatic lags far behind at around 88% efficient. With ever increasing mandates to squeeze every BTU out of every drop of fuel, the ECVT is certain to become the dominant automobile transmission.

Today we have millions of ECVT equipped vehicles based on decades of R&D done by a blacksmith who got a lucky break because he impressed a brewery owner.

Links for more reading

Martin van Doorne biography (in Dutch, use Google Translate for "almost" English):
http://www.deurnewiki.nl/wiki/index.php?title=Martinus_van_Doorne_%281870-1912%29

Petronella van Doorne biography (in Dutch):
http://www.deurnewiki.nl/wiki/index.php?title=Petronella_Vervoort

Insane asylum in Vught:
http://books.google.com/books?id=uYLclT40VIUC&lpg=PA593&ots=zY-fcVZknk&dq=insane%20asylum%20in%20Vught&pg=PA593 - v=onepage&q&f=false

Hub's apprentice salary and growth of the company:
http://www.eindhovenfotos.nl/daf_eindhoven.htm

Dr. Wiegersma biography (in Dutch):
http://nl.wikipedia.org/wiki/Hendrik_Wiegersma

DAF History (this is an excellent read):
http://books.google.com/books?id=1q2-Wvd2eX0C&lpg=PA8&ots=mEfDxrgodh&dq=Huenges%20brewery&pg=PA8-v=onepage&q&f=false

Another good bit of information from the Deurnewiki (in Dutch):
http://www.deurnewiki.nl/wiki/index.php?title=Van_schoenpoetser_tot_Captain_of_Industry

Classic DAF -- best Hub van Doorne biography:
http://www.classic-daf.nl/specials/hvd/index.html

DAF company milestones:
http://www.dafmuseum.nl/EN/Een-stukje-historie/Pages/Mijlpalen.aspx

DAF Variomatic -- good history of DAF racing:
http://8w.forix.com/altpower-cvts.html

Paul Van Doorne and the Formula 3 car:
http://whereflowerspickthemselves.wordpress.com/2011/07/03/paul-van-doorne-the-daf-variomatic-transmission/

Bosch Automotive Technology:
http://www.bosch-kraftfahrzeugtechnik.de/en/de/homepage/homepage_1.html

Bosch Transmission Technology:
http://www.bosch.nl/content/language2/html/5835.htm

Abstract on CVT -vs- manual & auto transmissions:
http://www.123seminarsonly.com/Seminar-Reports/005/34368943-cvt.pdf

Thesis on slip control in CVT:
alexandria.tue.nl/extra2/200612241.pdf

CVT Movie:
http://www.bosch.nl/content/language2/downloads/Bosch_CVT_animation_English.wmv

Documents:
http://www.bosch.nl/content/language2/html/5908.htm

Links dead and alive:
http://www.mybookmarks.com/public/cvt/ - current