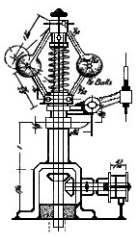

The NEMES Gazette

NEW ENGLAND MODEL ENGINEERING SOCIETY INC.

No. 247 | December 2016 |

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Dues. It's that time of year again. Please bring your 2017 dues to the December meeting. Dues are $25 by cash, check or you can try out our credit card system. If you can't make the meeting, send the dues to NEMES, c/o Rich Baker, 288 Middle Street, West Newbury, MA.

NEMES Apparel. We have NEMES denim button down shirts, t-shirts, sweatshirts, and aprons for sale. They make great Christmas gifts. The aprons are $20, the denim shirts $35, sweatshirts $25, and the t-shirts $15. Contact Rich Baker at 978-257-4101 if you would like to own one.

NEMES Show. We traditionally have the NEMES show on the third Saturday of February, which is February 18, 2017, and we have reserved the Charles River Museum of Industry for that day. The date is approaching fast, and we need to start planning at the December meeting.

Cabin Fever. The Cabin Fever Show in January is also fast approaching. We will not be organizing a bus this year, but many of us will be there. Make your hotel reservations now.

Next Meeting

Thursday, November 3, 2016 7 PM

Charles River Museum of Industry & Innovation

154 Moody Street

Waltham, Massachusetts

Directions are Here.

Speaker for December:

We will have a poster session and a Yankee Swap at the December meeting. If you want to participate in the Swap, please bring a wrapped gift to the meeting. I recommend either something from your shop you no longer want/need or a purchased item of $5 to $10 max. Should be fun, maybe you'll get luckiy!

Deadline for submitting articles is two weeks prior to the next meeting.

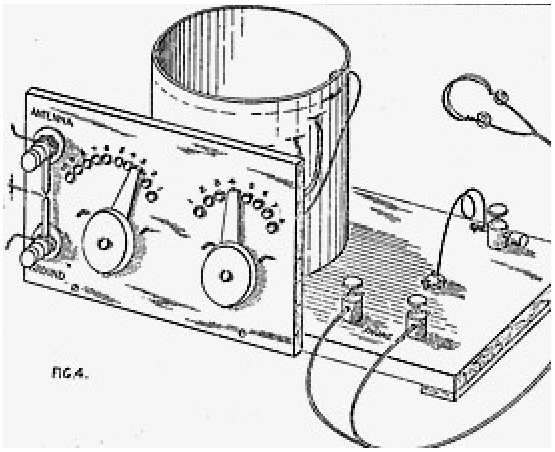
Table of Contents

Shop Talk

Max ben-Aaron

Edwin Howard Armstrong (1890-1954) has been called "the most prolific and influential inventor in radio history". He pioneered more advances in the field of radio communications than most other inventors who have worked in the field; he was the first to develop a regenerative radio receiver, to develop and construct a superheterodyne receiver, and a super-regenerative receiver and he saw the benefits of wideband FM which he again pioneered. Without Edwin H Armstrong, radio communications and broadcast technology would have not developed as fast as it did.

As a result of a disability incurred when Armstrong was a child, and subsequent time out of school, he became withdrawn and undertook many solitary activities. He became particularly interested in mechanical and electrical devices. Reading about the new radio communications technology at the turn of the century fired his imagination. His early research was conducted in the attic of his parent's house where he started by building crystal sets.



One of the issues Armstrong faced when making crystal sets was that he needed a large antenna and even then the signals were weak and would not be easy to listen to, so he erected a large antenna in the garden of his parents' home. He loved heights and constructed a makeshift backyard antenna tower that included a bosun's chair for hoisting himself up and down its length, to the concern of neighbors.

Admitted to Columbia University in New York in 1909, Armstrong entered the Department of Electrical Engineering and with a characteristic enquiring mind and a level of determination, immersed himself in his studies, Never taking anything for granted, he needed to fully understand everything. One of his instructors, John Mmorecroft, later remembered Armstrong as being intensely focused on the topics that interested him, but somewhat indifferent to the rest of his studies. He was known for challenging conventional wisdom and being quick to question the opinions of both professors and peers. He had no patience with those who bluffed about their knowledge and experience and occasionally the manner of his questioning was mistaken for arrogance.

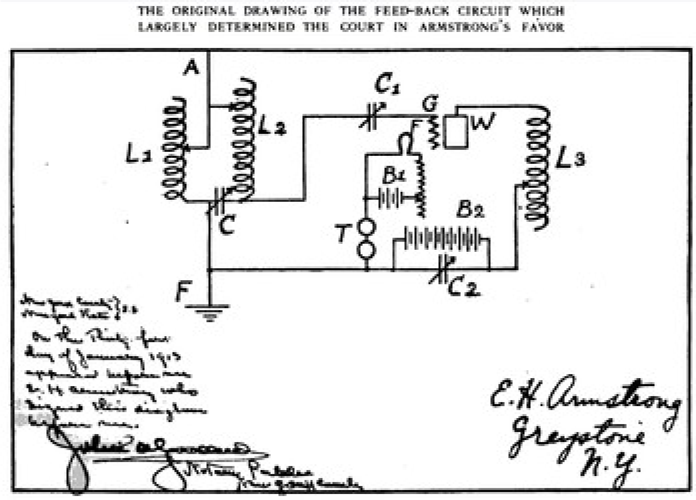
Professor Michael Pupin, an experienced pioneer in the field of electrical science and communications, mentored and supported Armstrong and gave him access to a basement laboratory where he was able to develop and test some of his ideas A new device, the triode valve, developed by Lee De Forest (see Max's column in the September NEMES Gazette), was a development of the thermionic valve, or vacuum tube diode, invented by Ambrose Fleming of University College London. Called the Audion, it intrigued Armstrong and he began to investigate it.

While he was still a student at Columbia University Armstrong invented the regenerative radio receiver. His idea was revolutionary; he applied for a patent in 1913 and this was duly granted the following year.

De Forest's initial Audions did not have a high vacuum and developed a blue glow at modest plate voltages. Although De Forest improved the vacuum for Federal Telegraph, it had only been used for rectifying and detecting radio signals. Armstrong studied the Audion, for a number of years, and had a better understanding of its operation than the inventor himself. Using an Audion he amplified the signal, and also provided positive feedback. In this mode he was able to achieve very high levels of gain, and listen to distant signals previously unattainable.

Armstrong completed his studies and graduated with a degree in electrical engineering in 1913. After graduating Armstrong was offered the position of assistant. During his time as a postgraduate at Columbia he set up a large antenna and was able to demonstrate long distance radio communications reception to his departmental head, Pupin, and then to many others including David Sarnoff and also De Forest. This was the first time that de Forest had seen his Audion work as an amplifying device.

His breakthrough discovery was determining that employing positive feedback (also known as "regeneration") could produce amplification hundreds of times greater than previously attained. With the amplified signals now strong enough, receivers could use loudspeakers instead of headphones. Further investigation revealed that, when the feedback was increased beyond a certain level, a vacuum-tube would go into oscillation, thus could also be used as a continuous-wave radio transmitter.



Armstrong's "feed back" circuit drawing: from *Radio Broadcast* vol. 1 no. 1 1922.

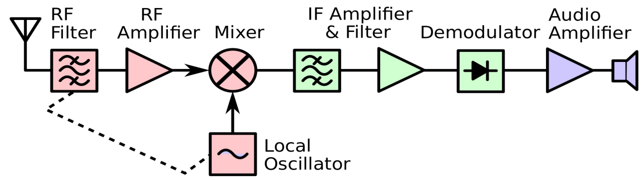
As soon as De Forest saw the way Armstrong used the Audion, he began to claim that the idea was his. He had observed the howling cause by feedback and had tried to reduce it, but he was never able to control it or include it in any circuits. It was also clear that he did not properly understand the operation of the Audion, whereas Armstrong's grasp was much better.

After the end of the First World War, in which Armstrong served with distinction, De Forest instigated legal proceedings against Armstrong He was backed by A T & T who had purchased his patents. Given their backing he could bring far greater resources to bear. Initially Armstrong won, but after many appeals and repeat actions, De Forest finally won a US Supreme Court decision in 1934, on a technicality rather than technical merit. Despite this, the scientific community gave the credit to Armstrong

Armstrong's 'regeneration' legal battle produced a serendipitous outcome for him, super-regeneration. While preparing a demonstration apparatus to counteract a claim made by a patent attorney, he "accidentally ran into the phenomenon of super-regeneration"; by rapidly 'quenching' the vacuum-tube oscillations he was able to achieve higher levels of amplification.

A year later, in 1922, Armstrong sold his super-regeneration patent to RCA for $200,000 plus 60,000 shares of corporation stock, which was later increased to 80,000 shares in payment for consulting services. This made Armstrong RCA's largest shareholder, and he noted that "The sale of that invention was to net me more than the sale of the regenerative circuit and the superheterodyne combined". RCA envisioned selling a line of super-regenerative receivers until superheterodyne sets could be perfected for general use, however, it turned out the circuit was not selective enough to make it practical for broadcast receivers.

The superheterodyne process is still extensively used, eighty years after its invention. FM broadcasting is still used internationally, and remains the dominant system employed for audio broadcasting services although its technology has started to be supplemented, and in some cases replaced, by more efficient digital technologies. The introduction of digital television eliminated the FM audio channel that had been used by analog television.



Block diagram of a typical superheterodyne receiver. Red parts are those that handle the incoming radio frequency (RF) signal; green are parts that operate at the intermediate frequency (IF), while blue parts operate at the modulation (audio) frequency. The dotted line indicates that the local oscillator and RF filter must be tuned in tandem.

Armstrong's life story was one of of great intelligence and technical achievement, but also one of great personal turmoil and tragedy. He was primarily a scientist and inventor and not a businessman. He always stressed the practical over the theoretical, saying that progress was more likely the product of experimentation and work based on physical reasoning than on the mathematical calculation and formulae of 'mathematical physics'. He said: "I could never accept findings based almost exclusively on mathematics" and "Men substitute words for realities and then talk about the words".

From the Gazette Archives

From the January 2001 Gazette

Ron Langlois set up the speaker for the night, Dave Carpenter. Dave is the president of the Jet Pioneers of America and retired recently from GE at 55 after spending 36 years there. He likes to think of himself as the only guy at GE who has his hobby funded by the company. He runs the museum at the Riverworks in

Lynn and has published several books on Jet Engines. The talk he gave at the meeting is very similar to one he gave recently in Germany.

He brought a very nice quarter scale cutaway model of the GE J-47 engine. It plugs in, lights up, and spins to show how the full size engine works. At one time the J-47 was the most produced jet engine in the world. It was in production from 1946 to 1956 and powered the F-86 fighter and the B-47 bomber. 35,000 of them were made.

Dave wanted one for his museum, and got a call from someone that a scrap dealer in Miami had one in a can that had come from Germany, where at one time it had powered an F-86. They wanted $6000 for it, which was too much for his budget. It sat there for quite a while until finally Dave decided to call and try again to see if he could get it for less, as he'd heard they were going to break it up for metal. When he called the can was open and they had pulled a couple of hoses off it in the process of turning it into scrap metal. He couldn't get the guy to budge from $6000, but finally got him to take $1 a pound. That's why he now knows that a J-47 weighs in at 2300 pounds.

In 1892 the Thompson Houston Company and the Edison General Electric Company combined and became General Electric. Edison was not happy about the New York financiers dropping his name and is reported to have not set foot in GE for 31 years. Thompson Houston had fewer buildings and people than Edison GE did prior to the merger, but made more money. Electric motors were made in Lynn, and electric arc welding was developed there. From1903 until 1986 there was an apprentice shop in Lynn. The end of the apprentice program in 1986 marked the end of the GE company as it used to be.

The Phantom I jet fighter was originally proposed with 6 engines mounted in the wing, 3 on each side. Westinghouse was developing a 9½-inch diameter turbojet to develop 400 pounds of thrust. When they were done it only put out 250 pounds, so the 6-engine version was never built. In the end the Phantom I used a Westinghouse J-30 engine that put out 1600 pounds of thrust. Pratt & Whitney copied the J-30as their initial entry into manufacturing jet engines.

One of the books Dave has published is about the JB-1 Flying Wing Bomb. It was a hush-hush WWII project here in the United States designed around the 400 lb thrust 9½-inch diameter engine. Nobody knew anything about the JB-1, but Dave saw something in a WWII GE works newsletter. It was a picture that looked like it was a GE turbo supercharger converted into a jet engine.

In WWI, the GE Company manufactured the first turbo supercharger, which was tested at the top of Pikes Peak on a Liberty Engine. In 1941 GE built a plant in Everett, Mass. and another one in Indiana to build turbo superchargers. During WWII they made 300,000 of them.

Each unit had to be tested. The test rig consisted of a 500 HP compressor, feeding into a pipe where oil was burned to heat it before the hot air was piped to the turbine section of the supercharger.

In 1943 a man named Stokley who was working on the testing of the superchargers decided that there had to be an easier way to test them. He hooked a combustor up between the compressor output and the turbine input to eliminate the need for the 500 HP compressor. In doing so he walked right into a super secret project that was being worked on – the jet engine.

He had virtually duplicated the work of Whittle when in 1937 he first produced a demo jet engine. Stokley reported on the test rig he'd developed to his boss – who was in on the jet engine secret. The boss told him he was out of line, there was a war on and he should get rid of the unauthorized test rig right away and concentrate on properly testing production. The boss also reported the security breach to the army man in charge.

The Army at this point was concerned about the problems with the 9½-inch Westinghouse engine. They needed it for the JB-1, which was the answer to the German V-1 Buzz Bomb. The JB-1 had been tested as a manned glider (the glider version still exists in the Hawthorne Museum in California) but at 200 lbs thrust the 9½-inch engine was inadequate for the flying bomb.

So, looking for a backup for the Westinghouse engine that didn't look like it was ever going to be up to the needed thrust, the Army asked GE if the turbo charger engine could put out 400 lbs of thrust. The JB-1A was designed to use the GE turbocharger engine. One was built and launched, powered by two of the turbochargers. The plan was to use a 400-foot track and 5000 lbs of thrust from booster rockets.

Fifty-six years ago on December 4, 1944 the JB-1A made its first flight. Air bottles were used to start the two engines. The bomb was set up at a high angle of attack to get low-speed lift. One engine failed before launch, but it was launched anyway. With inadequate thrust from only one engine after the booster rocket cut out it took off at a high rate of climb, lost speed and crashed after only flying 400 or 500 feet.

The JB-1 gave way to the proven design of the JB-2 – a copy of the German V-1. Ford made the pulse jet engines for it, and Willys Overland was tooling up to make 1000 of the airframes a month when the war ended and the program was cancelled.

At the end of WWI, GE was making turbo superchargers. If Sanford Morse at GE had taken the existing turbo chargers and hooked them up with a combustor unit the way that Stokley did in 1943 he would have had a jet engine. It could have happened any time in the 1920s or 1930s.

Perhaps the primary reason it didn't happen is that instead of just trying it to see what would happen they did a bunch of analysis to prove they couldn't do it. Whittle didn't know he wasn't supposed to be able to do it, so he did it. In 1907 a French journal had an article on a water-cooledcombustor with steam from the cooling used on the turbine to add to the energy extracted by the unit. So, all the parts needed to put the jet engine together had existed for years before anyone put the parts together into an actual engine. What would things have been like if the jet engine had been developed in 1925 or 1930?

General Electric jet engines powered a lot of first designs. The first cruise missile (the Matador) was powered by the J-47. The GAM-82 was designed as a decoy for the B-52, which could carry 6 or 8 of them to fly interference for it. The engine for this, the J-85,was designed in the 1950's. It graduated from the GAM-82 to become the power for the T-38 and F-5 series of planes. GE recently was awarded a contract to rebuild a bunch of J-85 engines and it is projected that it will still be in service in 2046.That will make it the longest active engine in military service at 90+ years of use.

Dave only writes books about firsts. Now he's writing a book about the atomic-powered jet. The engine would start on jet fuel and slowly switch over to the reactor to provide the heat. At 40,000 feet it would be running on all atomic power. The idea was that the bomber with the atomic engines could stay up for long periods of time, ready to head out and destroy the enemy at a moments notice. The engine was run on the ground, with an "all up" weight of 600,000 lbs. The engine consisted of two J-47s connected up with the reactor in the middle and supplementary combustors around the central reactor to provide the energy at lower altitudes before going to atomic power.

The Nuclear Powered Jet Engine was known as the "Billion Dollar Rat Hole" and President Eisenhower wanted to kill it. He couldn't though because an article had been planted in Aviation Week about the Russian Version of the Nuclear Powered Airplane. The totally phony story provided the incentive to keep the project going until by the early 60's when in-flight refueling and the advent of the ICBM made the need for a nuclear plane capable of staying up for days at a time less vital. Eisenhower knew the story was a plant and that the Russians didn't have any nuclear powered planes, but the politics of the situation kept him from being able to expose the fraud so the program continued. No wonder he warned about the Military Industrial Complex when he left office

A Tangential Tool Holder for the QCTP

John Moran

A tangential toolholder was on my list of things to try for a while but I procrastinated because I didn't want to lose the convenience of my QCTP: the ease of adjusting tool height plus the ability to instantly change tools is very hard to give up. The picture shows my attempt to have my cake and eat it too ;-)

There seem to be two common designs for tangential tool holders, the Freeby and the Burke. As best I can tell from the pictures, the Freeby is side-tangential while the Burke is corner-tangential. The Freeby design has been used and documented by Ralph Patterson and Richard Hagenbuch (passed away Dec 2014), both of whom provided information and advice during construction of my version of the Freeby design. Both Ralph and Richard used aluminum for their tool holders so I did likewise, mainly because it is so much easier to work than steel.

The concept of Freeby Berger's design is to tip the bit forward and left by 12 degrees and slope the top of the bit opposite to these tilts at 30 degrees in a diagonal direction (the interaction of these angles is hard to visualize without the tool to look at). The result is the side (or the front) of the bit cuts with relief provided by the mounting angle of the tool and rake provided by the angle ground into the end of the tool. Unlike regular tools used in the QCTP, the Freeby tangential setup can do both turning and facing without moving the position of the toolholder to another face of the QCTP.

Of course there are some limitations to this tangential arrangement: cutoff isn't handled, boring isn't handled, threading requires some contortions and a special tool, left to right cutting requires adding a bit to the other end of the toolholder and perhaps some rotation of the QCTP (depending on the task). The QCTP provides the missing capabilities nicely using conventional toolholders.

A 3x1.5x1 chunk of aluminum was the raw material. After the dovetail was cut, the outer side was milled at a 12 degree angle such that the bottom one inch is angled. A 3/16" slot was milled into the angled section of the side at an angle of 12 degrees to the front -- the picture will help in understanding what needs to be done. The centermost edge of the slot intersects the top of the angled side 1 inch up from the bottom - another view. A hole was drilled and tapped 10-32 for the button head locking screw. Experience showed that it was difficult to see the bit in use so the area above the bit was milled away to improve visibility (this could be done more elegantly with a tilting vise). John Gedde built an AXA holder from my description and shared his drawing pdf. Interesting build method here.

A major convenience with the Freeby design is the ease of constructing and using a sharpening fixture. I used a scrap of aluminum, angling it at 30 degrees and then adding a V to the 30 degree face. The bottom was milled to leave a shoulder along the rear edge; this slides along the grinder's guide to allow moving the bit across the wheel - the dimensions are specific to the grinder so adjust as needed.

In use, the bit is placed in the V, the fixture is placed on the grinder's guide and the bit is held down with finger pressure; the fixture is slid back and forth to use the whole width of the wheel. The bit will have the end slightly hollow ground at a 30 degree angle. Because the wheel passes across the bit toward the cutting edge a hooked (wire) edge will result; after grinding, hone the sides on a sheet of fine carborundum paper over a flat surface to remove these hooked edges. It takes a few minutes for the initial grinding but re-sharpening is very quick using the fixture. The aluminum fixture seems to absorb heat well, especially if a drop of water is placed in the V before grinding. To reduce the rake angle and thus produce a bit for use on brass, pack the front of the guide up slightly.

The tangential is different than normal QCTP toolholders because the bit is so close to the toolholder, making it harder to see from some angles. The big surprise was the finish achieved on steel; it was clearly smoother than I was able to achieve with my other tools. Further, chips formed long curls when taking fine cuts (something I couldn't do on my steel test bar with regular tools), the curl goes to the left of the bit rather than to the right. I suspect that the difference in results is because the tool is sharper than my best grinding efforts on regular bits plus the rake angle is steeper than most of my tools.

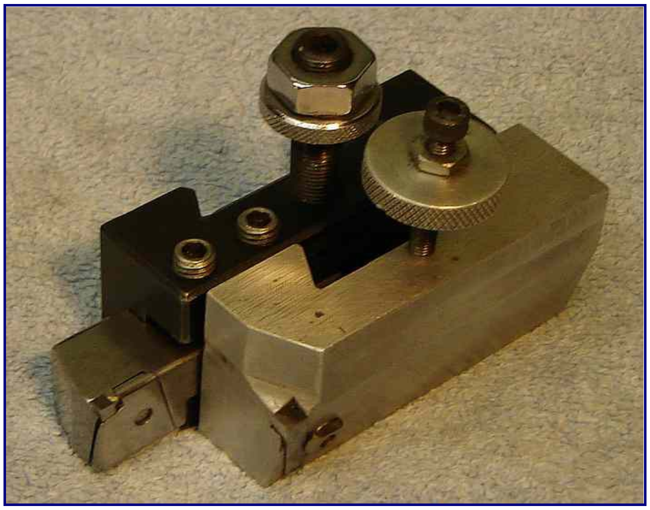
The picture shows the normal clearance angle and the chip curling to the left; for improved finish, rotate the toolpost slightly CCW to reduce this angle. The washer was removed and the top of the button head was faced to provide clearance when facing large items.

After polishing a turned steel cylinder I noted a thread-like pattern with 32/64/128 tpi (varied along the length) faintly visible. I tracked this to slight binding in the gears; I reduced the meshing depth and lightly filed a couple of teeth on one of the 20 tooth metal gears to solve the problem. I find that for most turning and facing I reach for this tool first so it is definitely a keeper.

One detail on the bit: I cut it in half because the protruding end was a problem both in use and when storing the holder while using another on the QCTP.

Some observations based on a couple year's experience with the tangential toolholder. The tangential cuts normally moving toward the headstock and can take very deep cuts (I sometimes cut 100 thou in steel) where the feed rate must be reduced to accommodate deep cuts. Surface finish is generally poorer than normal when taking deep cuts. Avoid deep interrupted cuts - the tool will be driven lower in the slot by the hammering; a piece of paper, cut to width and placed in the bottom of the slot improves the grip a bit (pun intended). The tangential provides a much improved finish when cutting while moving away from the headstock however the cut should be minimal, say 2 or 3 thou. I use this tool whenever possible (in preference to other tools) so it has been sharpened repeatedly - about 1/3 of the bit is now gone.

Update: In replacing the original bit I found its replacement didn't face properly because it wasn't square. I checked a number of bits and many weren't square so this is a generic problem. A square bit is necessary with my design to make the angles come out right so I'll order a Mo-Max since they seem to be ground square.



Update 2: Apparently I got lucky with the parallelogram shaped tool bit (noted above) which worked well for years - but hid a design problem. Because the 12° rotations are done sequentially when machining the holder, the tool angle is off such that the bit needs to be rotated about its axis (looking down) CCW by about 2 degrees. I haven't figured out a simple way to machine this in my shop... so I use a narrow paper shim under the bit to get the angles symmetrical for turning and facing. If you look through this thread a different way of producing the tangential holder is described which may make getting the angles right easier. Info on calculating the compound angle in posts 4/5 of this forum thread.

I got tired of changing the height setting when moving the tangential between my two lathes so I built a second tangential tool but made it to fit a regular toolholder. It doesn't work as well as the dovetail version, probably because the extra distance from toolpost to tool tip (see picture) makes it less rigid. In addition, the bit sticks out farther than regular bits in QCTP toolholders so when swapping back and forth I have to wind the CS in and out. I *much* prefer the original design so eventually I shimmed the Rockwell QCTP up to match the 7x12 so all my holders now work on either lathe without tweaking height.

Coming Events

Errol Groff

3 & 4 December. New England Model Train Expo

Show flyer HERE and HERE

10 December, 7th Annual NEMES HOLIDAY Dinner/Get Together @ Woodman's Restaurant in Essex MA

121 Main St, Essex, MA Time 2:00PM

No tickets or reservations. Just show up enjoy! (you may have reservations but come anyway)

11 December Straw Hollow Engine Works Frostbite Crank-up at WCD Garage Rt. 20 Northborough, Ma