

Making a 7/16 -10 Acme Left Hand Tap, version 3

By Gerry Goldberg as told to R. G. Sparber

Pictures by Neil Butterfield

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Background



On 8/13/2011 the Valley Metal Club of Phoenix convened at the shop of Gerry Goldberg. Gerry is a master machinist with skills in many areas. On this particular day, he taught us how to make a tap.

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Before we arrived, Gerry had turned a tap blank from O-1 tool steel. When we arrived, he had the blank between centers and had ground a HSS cutter to the profile of an Acme thread. Dimensions can be found in the Machinery's Handbook[®].

This O-1 tool steel is rather tough so Gerry started by taking 0.003" per pass until the cutter started to load up. Then he went to 0.002" per pass. After a few passes he took only 0.001" per pass. It was slow going but you can see that he is getting excellent results. He is using Tap Magic[®] as his cutting fluid.

Gerry pointed out that this same cutter can be used to make worm gears.



He is making the tap because one of his lathe's cross feed nut is worn out. He has pulled the lead screw and is using the 3 wire method to measure its thread size. The tap will be cut to match it.



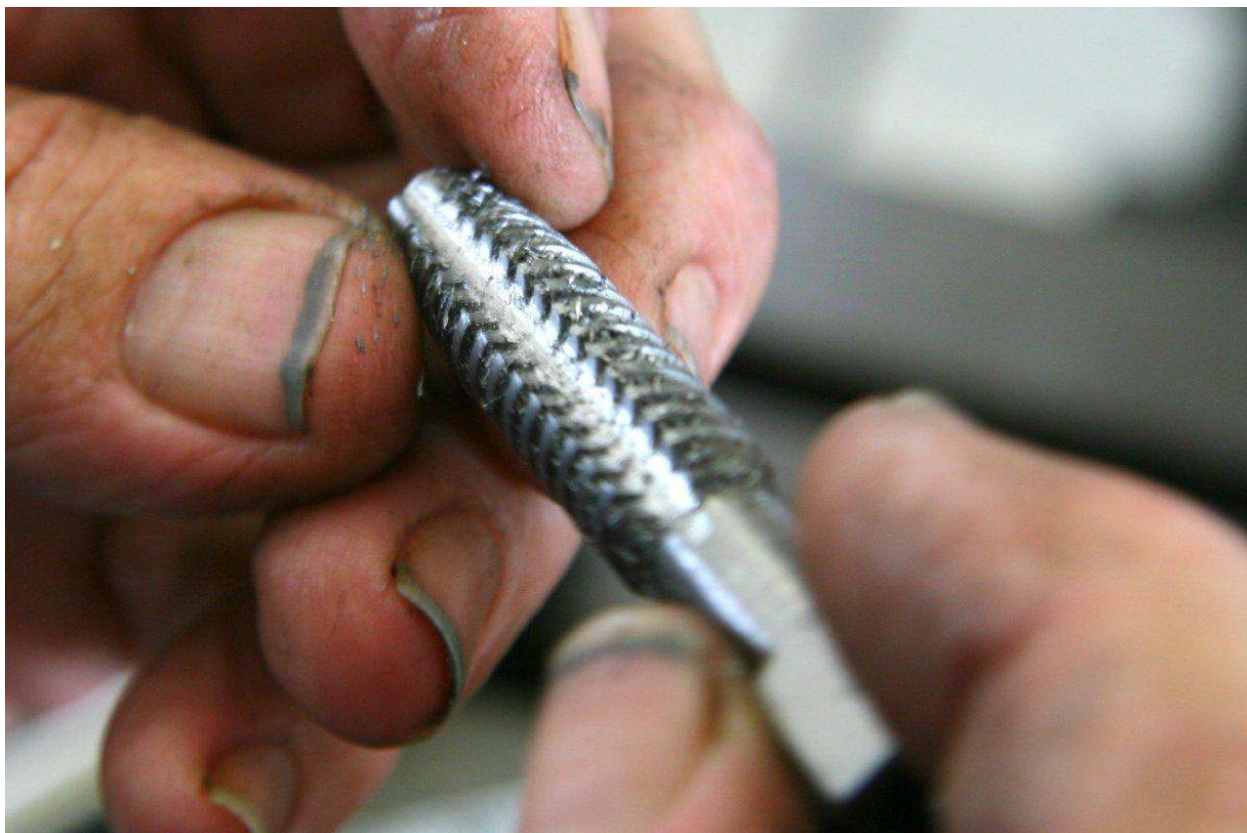
Here he is applying the same 3 wires to the tap and will mic it.



When the thread is finally done, it is time to cut the two flutes. Ideally he would support the end of the tap with a jack but did not have one handy. So instead he will be taking 0.01" deep cuts for a total depth of 0.1".



The 3/16" ball end mill has been carefully centered on the longitudinal axis of the tap and is ready to cut the first flute.



Here is the first flute. The top edges are very sharp.



The second flute is now being cut.



Here is the tap fully machined. Gerry next ground a bright spot on the square shark to make it easier to see color changes during heat treating.



A can full of old oil is ready to quench the tap. Gerry is using an Oxy-Acetylene torch to evenly heat the tap. Care must be taken not to heat the part so much that those sharp edges burn off. If sparks are seen, tiny bits of metal are being lost.

The edge can be restored by grinding if necessary.



The tap is heated to cherry red but only around the threads. The shank is left un-hardened.



Towards the end of the heating, Gerry put the tap on some fire bricks.



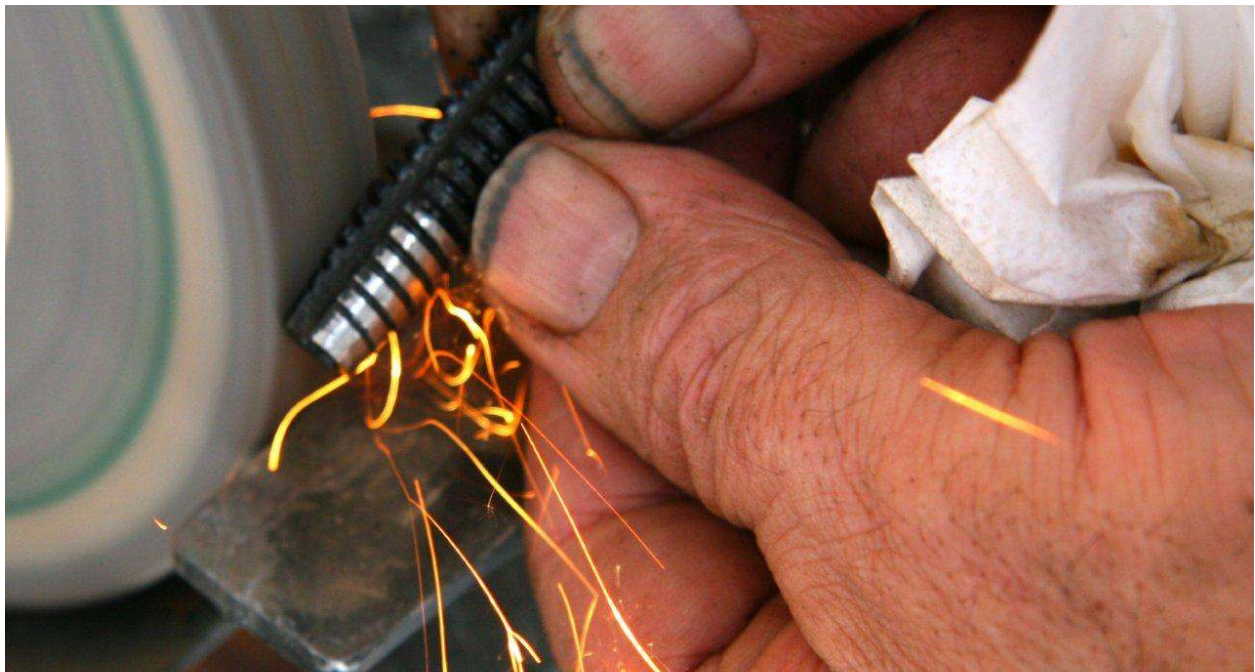
When the proper temperature was reached, the tap was plunged into the oil. If fully submerged, there will be minimal flame. You can buy special quenching oil that does not flame much.



The tap is too hot to handle but has now been fully quenched and is ready for grinding.



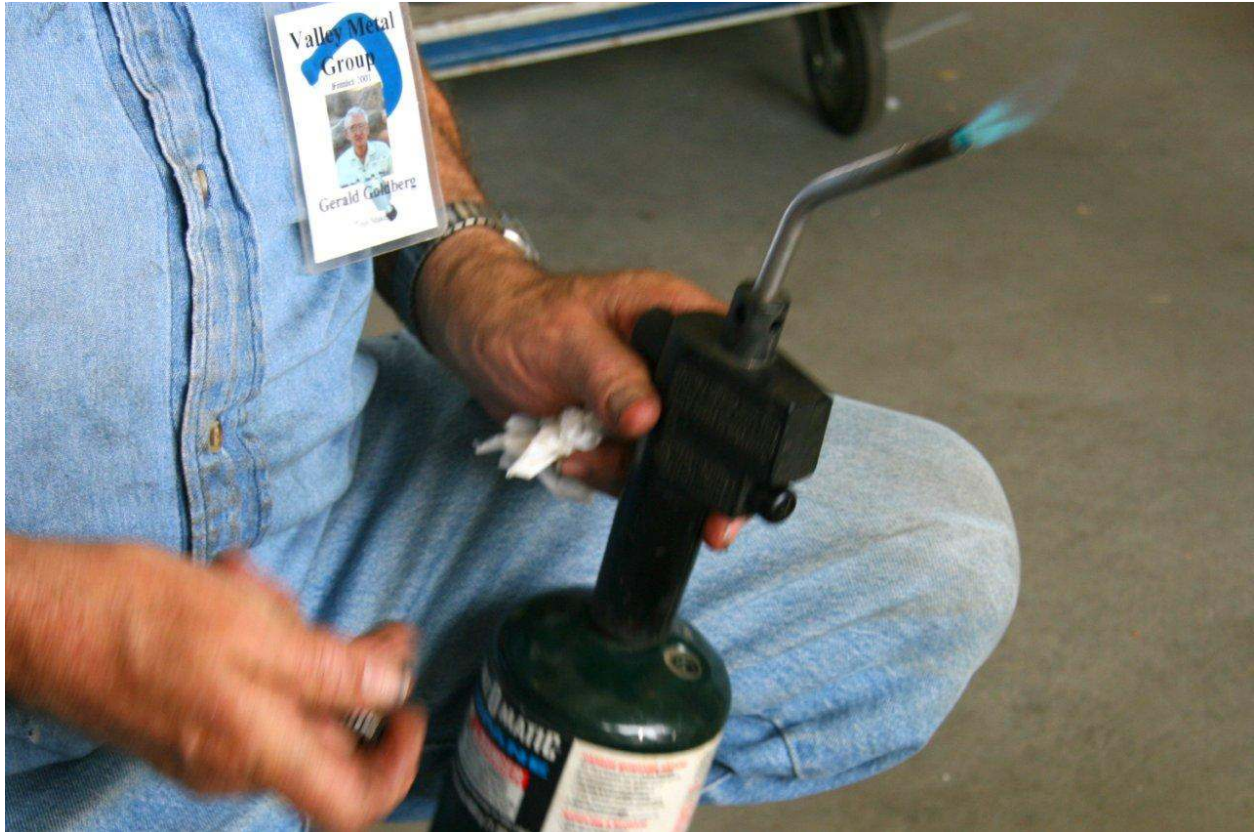
First Gerry runs it under the tap for final cooling.



Using a diamond coated wheel, back relief is ground into the end of the tap. This could be done with a surface grinder but free hand is fine.



The cutting edge is right at the flute and the perimeter behind it has been ground away a little to provide the necessary back relief.

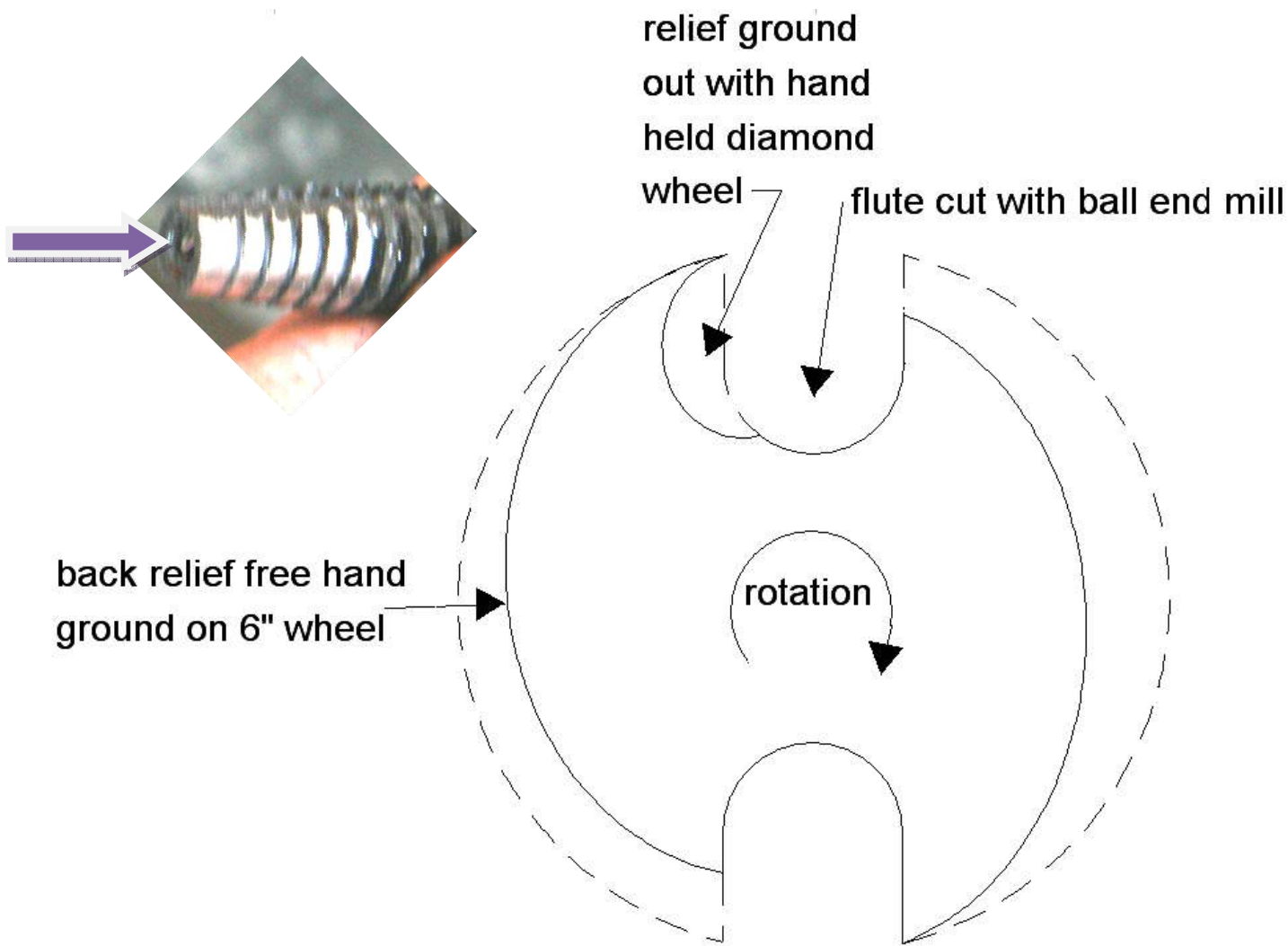


The tap is now very hard and can snap if stressed. So to give the tap back a little flexibility, Gerry will use a MAPP gas torch to bring the tap up to straw color which is around 400° F. We all watched as Gerry got it to the right color. I for one could not tell when it was straw color. All I know is that if it turns blue, you went too far and must start over with hardening.

Once the proper temperature is reached, Gerry quenched the tap in oil to stop the annealing process. Then the tap was again cooled in water.



The final step was to use a diamond coated wheel to cut some relief inside each of the flutes.



The second flute's relief has not been cut yet. This is an end view looking into the cutting point. Remember, this is a left hand tap.



Here is the first trial of the tap going through brass. It is a left hand tap so it is easy to forget and turn it the wrong way.



As a final test, the leadscrew is threaded through the hole.



Well, the next time I need some crazy size tap, I will certainly try to make it myself.

Rick Sparber (ghost writing for Gerry).