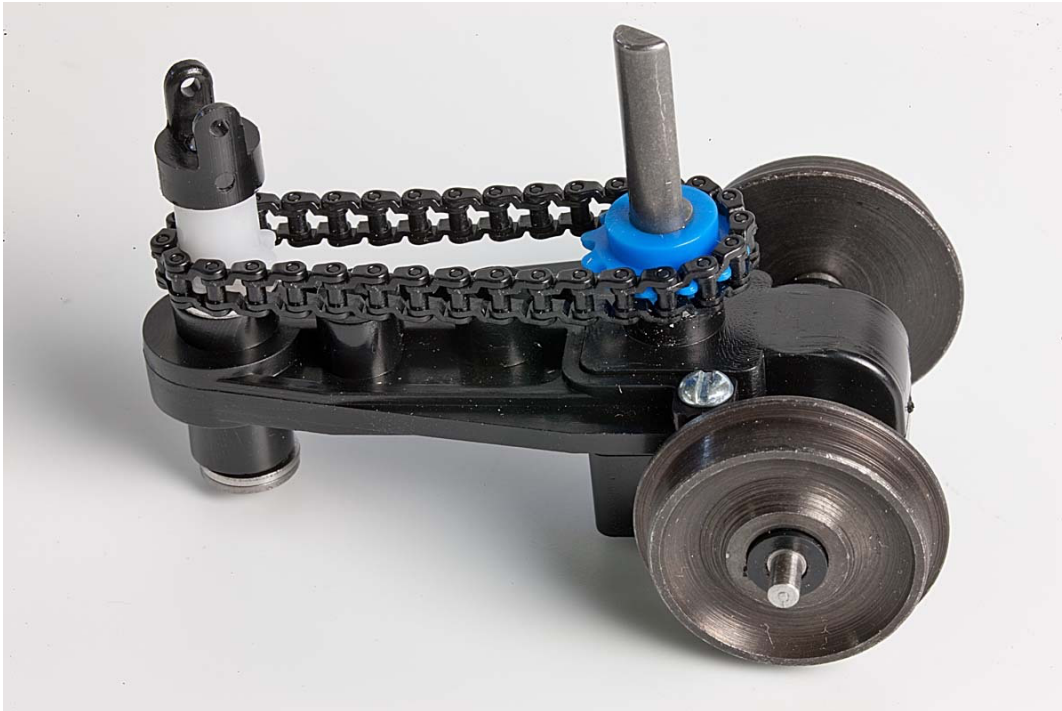


P&D/Weaver gear towers

Bob #1 February 14, 2016, 10:33pm

I recently replaced a cracked sprocket on a P&D GP9 drive train but was surprised with disappointing performance that clearly was not normal (see the thread Sound in Red Caboose GP9s, page 1). The problem was a severe bind occurring twice per revolution of the new white sprocket. It was time to dive in and find out what was *really* going on. Since this has nothing to do with sound, it seems appropriate to start a new discussion.

First, let's examine the patient. The upper 8 tooth sprocket on the left is the new white replacement from P&D. The original was blue, like the 12 tooth lower sprocket on the right.

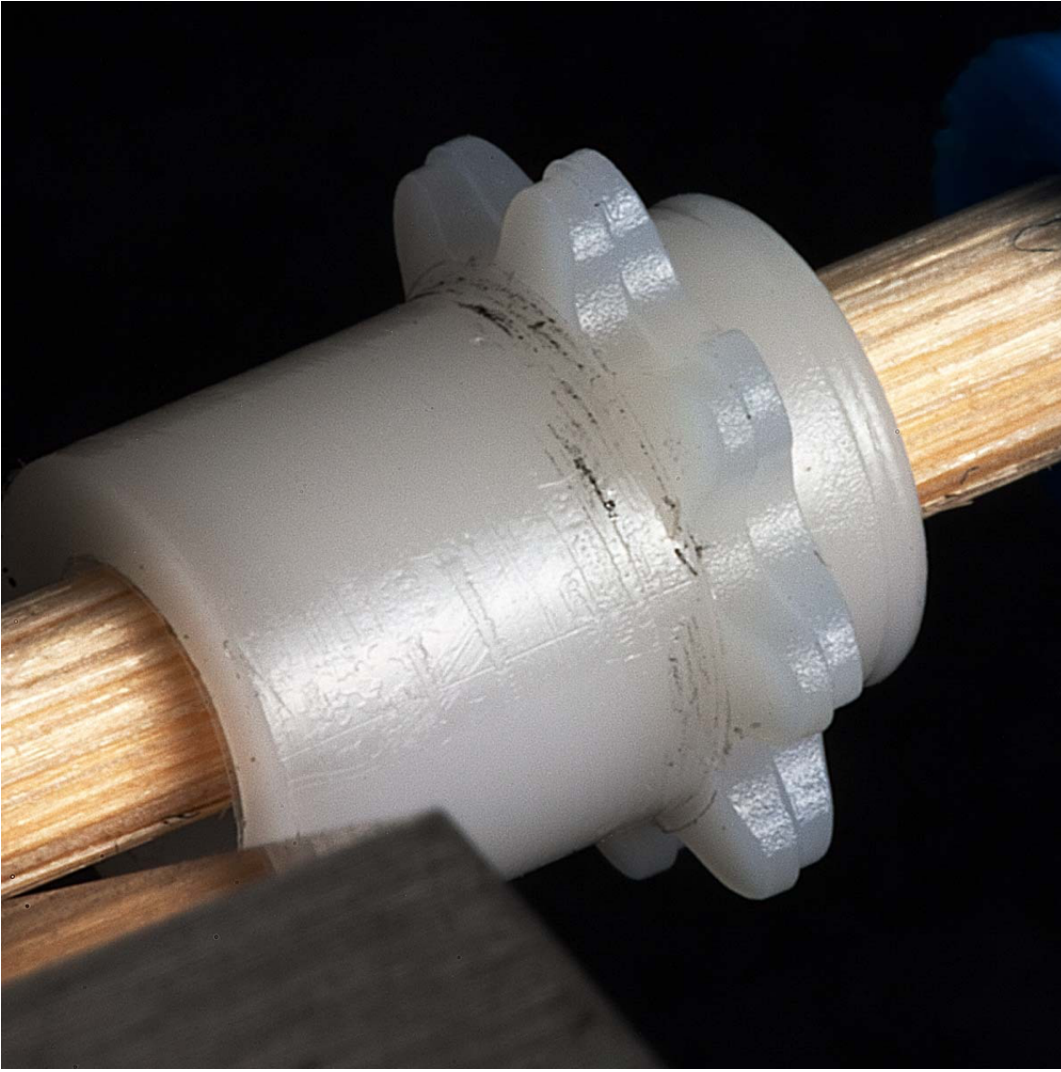


My first peek at it with an Optivisor revealed that the shape of the replacement sprocket teeth had a very different profile compared to the original, and that the replacements were malformed. First, a reference photo of the cracked original.



Notice that the injection mold was made in two halves, with the parting line running through the top of the teeth. The two halves are reasonably-well registered with each other. For some reason, one side of the tooth has a shallow angle and the other side a much steeper angle. The crack from hoop stress is visible near the bottom of the photo.

Examination of the replacement sprocket revealed, perhaps, a different manufacturer, and a clear root cause of the bind.



The tooth shape was very different, but notice how the two halves of the mold were not registered with each other. The right half did not center along the bore axis and was shifted quite a ways away from the camera. The chain can not fit smoothly around the entire circumference of the sprocket without binding.

Here lies the root cause of the problem.

Bob #2 February 14, 2016, 10:33pm

I looked at a number of replacement 8 tooth sprockets in my inventory and found them to all exhibit the same defect. Rats.

There are a lot of online drive train vendors, including the usual suspects including SmallParts and Stock Drive Products, but they did not carry 8 tooth sprockets with a 5/32 or 0.156 inch bore. Double

rats.

In the files section of the OSCALEMODELERS Yahoo group, I finally found a document compiled by Ted Sowirka titled "Weaver_Drive_Tips.pdf. In his compilation, Ted mentions that the upper sprocket is the most likely to crack, which agrees with personal experience. He also advises to order several replacements from P&D: "Order a few and choose the one with the straightest teeth, because production quality isn't always consistent." In my case that was an understatement; hopefully your mileage will vary (for the better.)

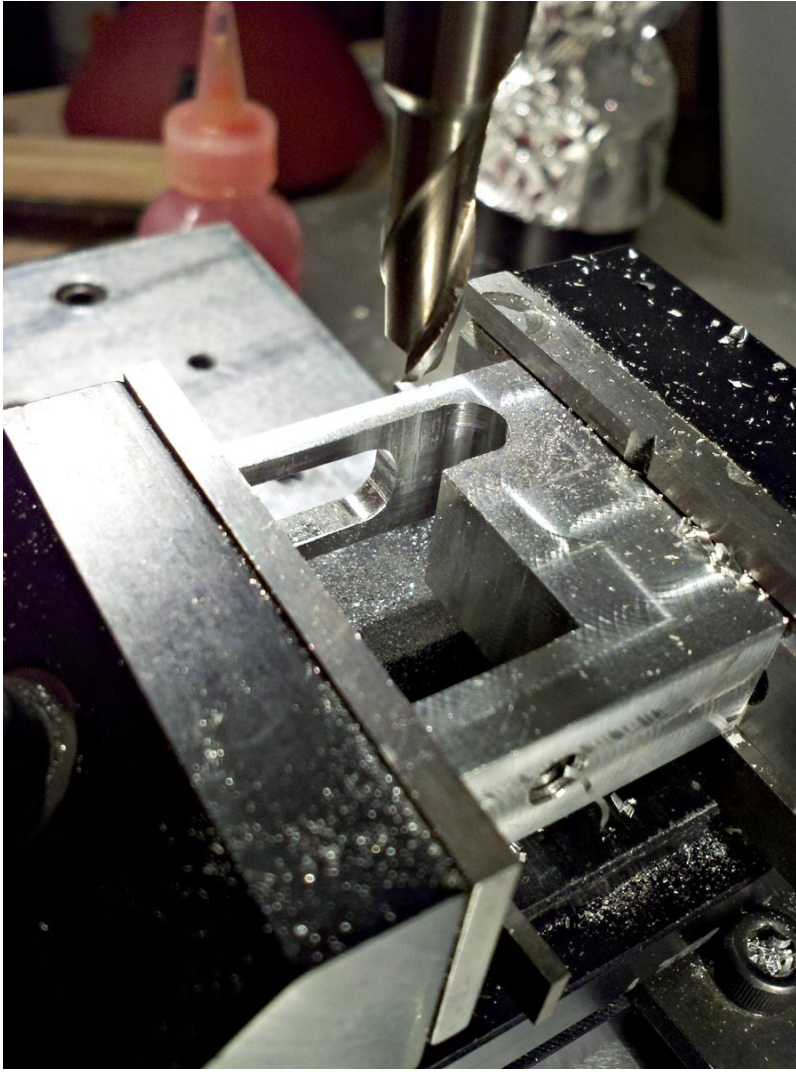
Later in the compilation Ted says that the sprockets are actually made by Serv-O-Link in Fort Worth, Texas. I gave them a call and a representative denied ever making parts with the 5/32 bore, and that they have always used black Acetyl ("Any color as long as it is black" I was told.) The representative offered that some "Chinese" vendors have tried to copy their patented drive chain system for many years. So who made the original blue sprockets, and the later white ones? I have no clue.

I ordered a selection of parts from the Servo web site, knowing that I need to drill and ream the upper sprocket. Considering that the wall thickness will be machined thinner the original design I will need to carefully reduce the knurled part of the P&D upper shaft on the lathe to keep hoop stress to a minimum and hopefully prevent future cracking. Perhaps a drop of Loctite will become a new good friend!

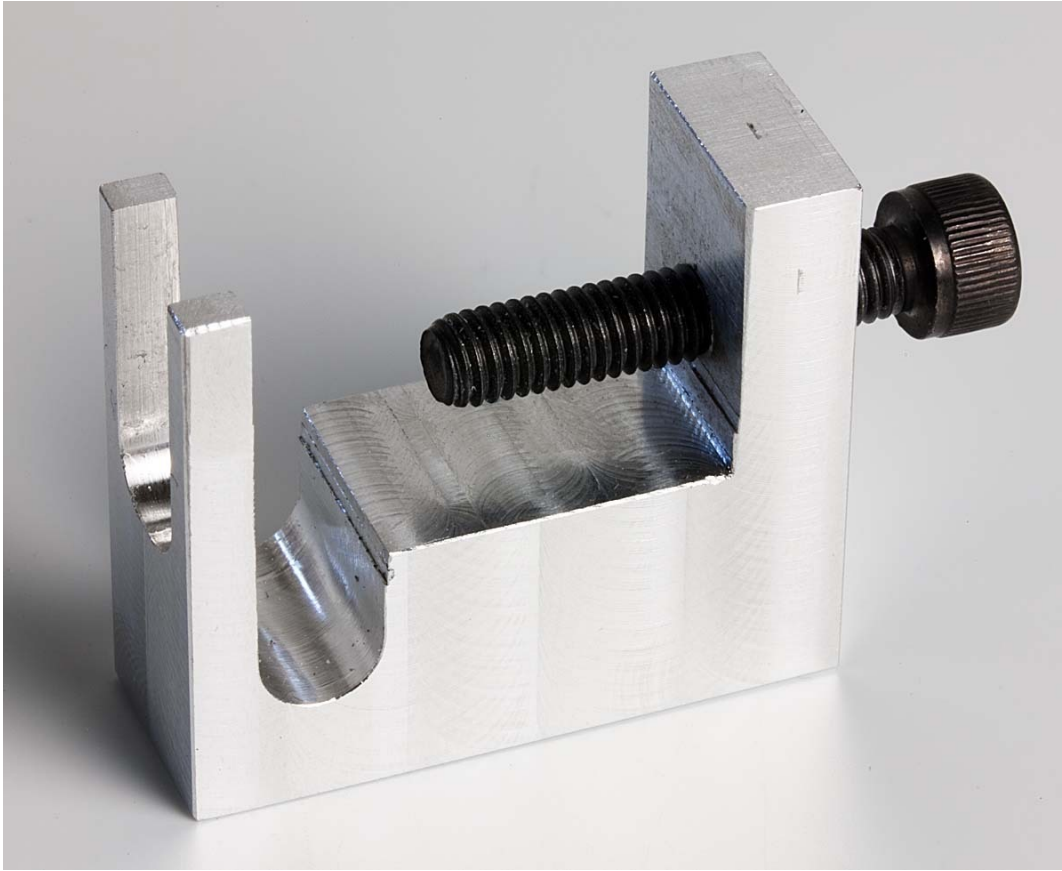
Bob #3 February 14, 2016, 10:33pm

Hmm... while a P&D drive tower is out of the model, why not consider re-gearing it? With various bottom sprockets coming from Serv-O-Link from 12 to 20 tooth, the possibility of regearing from 8:12 or 1:1.5 down to 8:20 or 1:2.5 seems a distinct possibility. This could optimize the drive for switching service, which is the main use of all locomotives on the A&O.

While waiting for the ServOLink order to arrive, it was time to head back into the "man-cave" (a/k/a basement) to turn a block of aluminum into a lower tower sprocket puller. The primary method employed was to stare at the block then mill away anything that didn't look like a sprocket puller. That's a very different approach for me, who usually over-analyzes the situation before taking any action.



Here's the finished puller.



Bob #4 February 14, 2016, 10:33pm

Today sample sprockets arrived from Serv-O-Link. Every one I've tried fits on the Delrin chain like a glove. Here is the 8-tooth sprocket. It comes with a 1/8 inch bore instead of a 5/32, so it will need to be drilled out.



Notice that there is no mismatched mold parting line running through the tooth profile. The teeth are considerably wider than the original P&D sprockets, and this may require more careful alignment with the mating sprocket. When I wrapped chain around the largest sprocket I purchased, there was very little “give” along the axis of the shaft that would allow for misalignment.

Bob #5 February 14, 2016, 10:33pm

The chain hangs over the end of the upper sprocket hub, both on the P&D original and the ServOLink replacement. P&D used a steel washer to avoid a high-speed Delrin-on-Delrin thrust bearing condition. Unfortunately, the chain could (and sometimes did) briefly hang-up on the outer edge of the steel washer.



One solution is to make a custom shoulder washer. The nearest larger number drill (in this case, #12) offers a much tighter fit against the shaft and far less wobble. The small diameter faces the sprocket. Once the lathe is set up, you might as well make a big pile of them. This Saturday morning I turned over 30, enough for the P&D drives I have and a few for friends.



When installed on the shaft, the new shoulder washer affords more than adequate clearance for the chain, about 0.020" shoulder depth, and with far less radial slop than the OEM washer.



Craig #6 February 14, 2016, 10:33pm

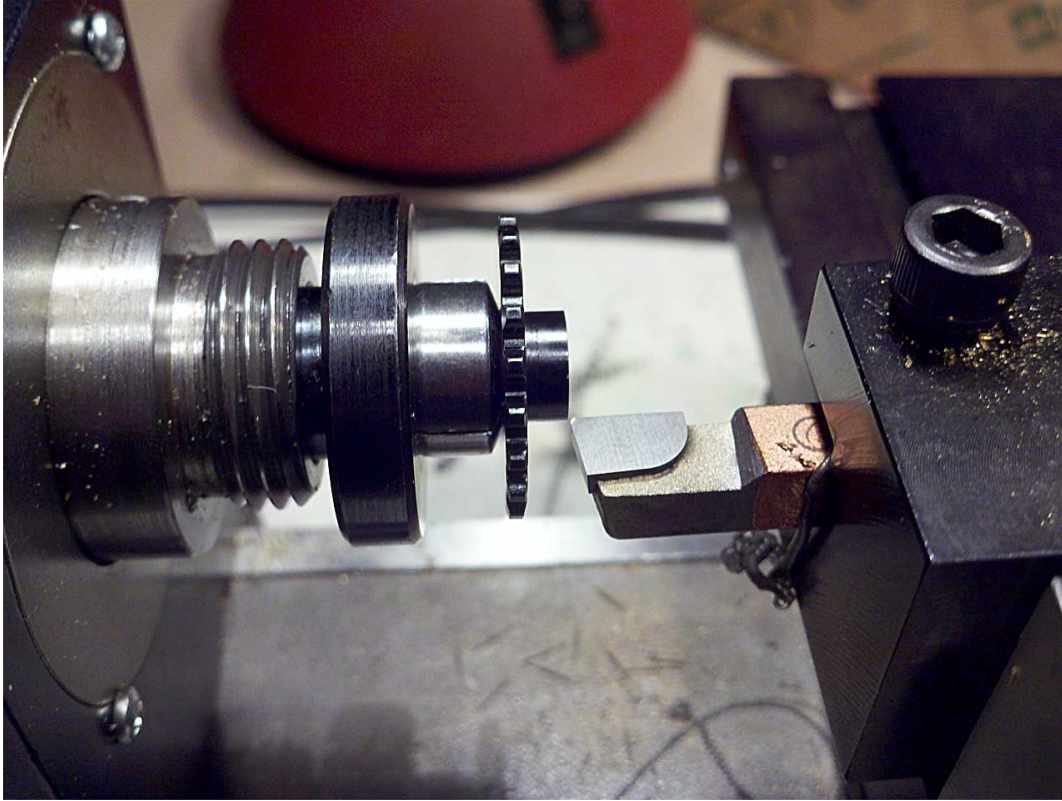
Cool information here Bob. Big kudo's for taking this head on and trying to figure it out. It looks like to me you definitely have a winner!!

Once I start mine up I will definitely be using this site as a reference.

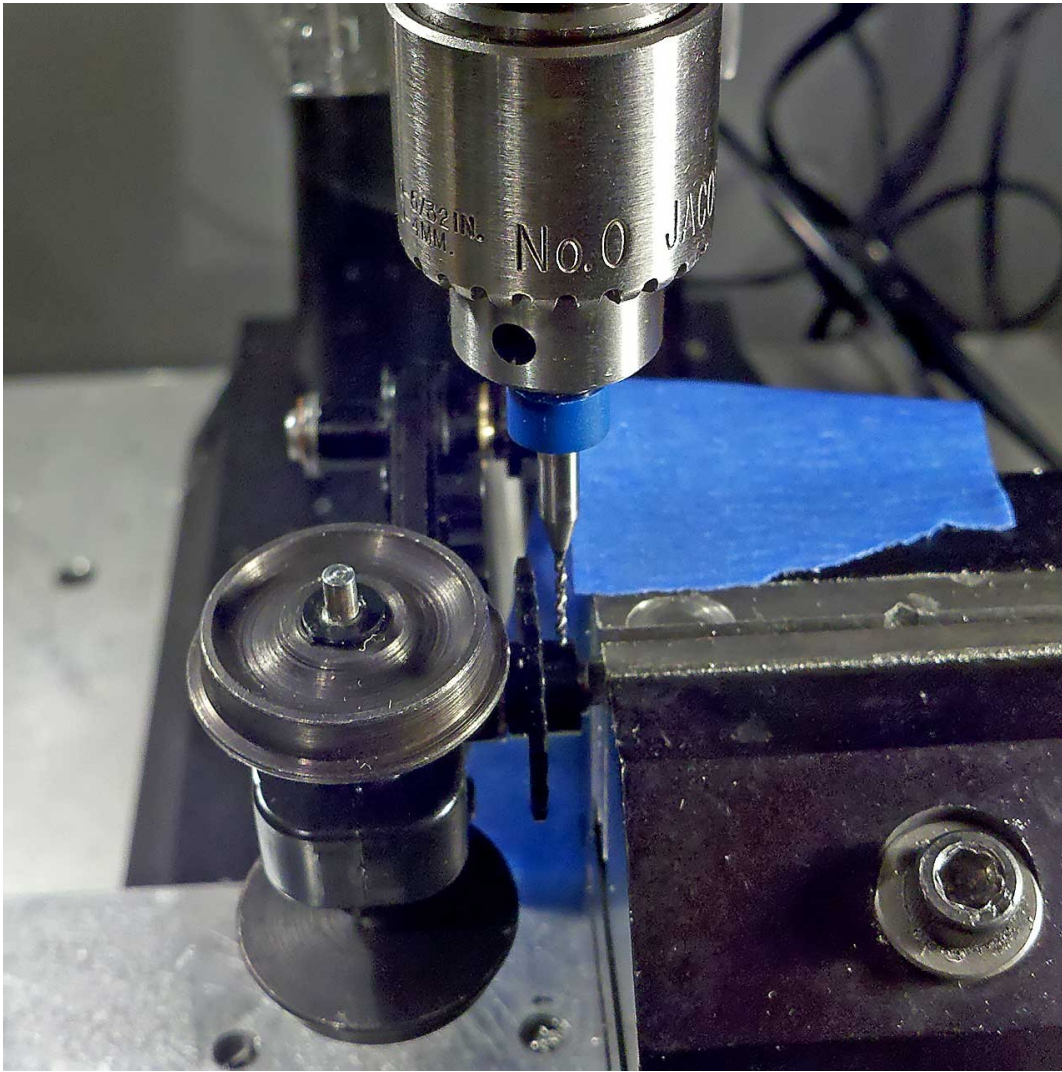
Bob #7 February 14, 2016, 10:33pm

Thanks, Craig. The first 2.5:1 drive train took a bit of figurin', but it is now finished.

The lower 20T sprocket comes with a hub that is too long in this application. No problem. There is just enough length on the opposite hub to hold it securely in a WW (Webster-Whitcomb) collet. Sherline is very proud of their WW collet set and charge\$ accordingly, but it has proven many times to be a life and time saver. The regular Sherline 3 or 4 jaw chucks could never hold this part securely.



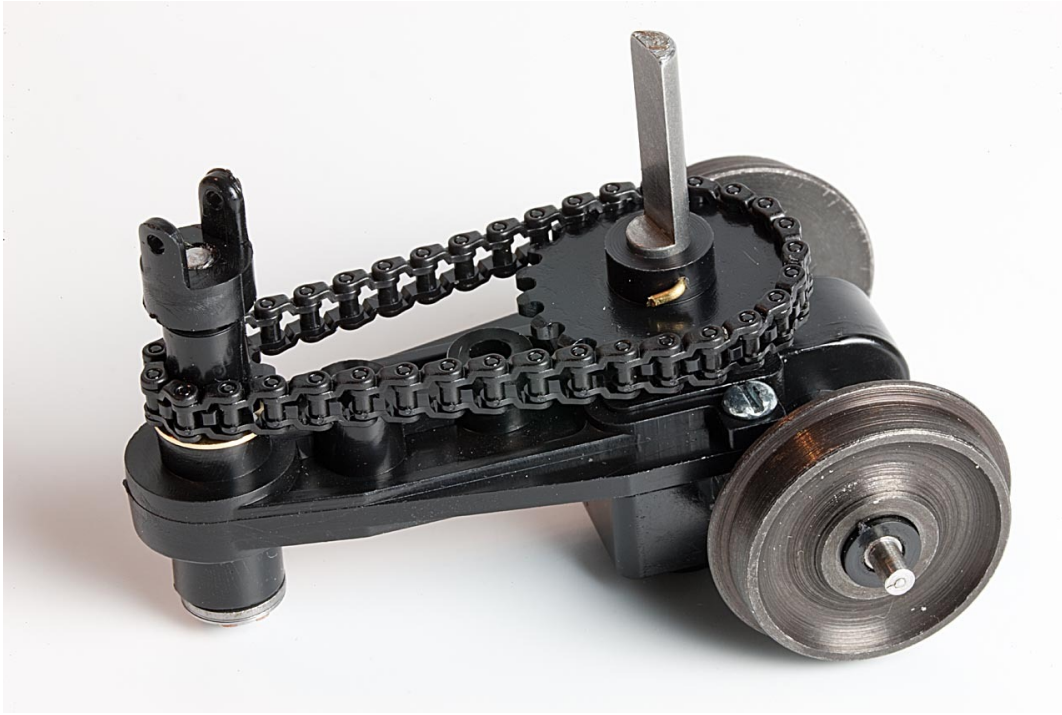
The new 20T sprocket bore is too loose to fit without slipping on the lower P&D drive shaft, so it needs to be pinned in place. I'm drilling for 0.032 diameter brass wire. The blue painter's tape keeps the upper sprocket from flopping around and possibly breaking the carbide drill.



Finally here is the first finished drive tower. This one spins like butter, free from any sort of binding.

The new ServOLink chain fits with extremely low backlash. Each combination of top and bottom sprockets requires a slightly different optimal shaft center distance, and some pairs may mandate a loose chain. In this case, I was lucky. According to their online calculator, the 8-20 combination requires 0.015 greater distance between shaft centers with 36 links than the original 8-12 combination. 8:12 requires 1.341 inches between the shaft centers, and 8:20 requires 1.388 inches. Regardless, the new chain system seems to run with less slop than the original one. I don't know why.

Please note that the 20T sprocket is the largest that can be put on the lower shaft without total occlusion of the screw heads that hold the two halves of the gear box together. Even with 20T sprockets, it would be far easier to open the gearbox after removing the chain.



Here is a hint for installing chain on these P&D/Weaver drives. Wrap the chain around both sprockets so that the two ends meet at bottom of the large sprocket (far right end in the photo above.) Adjust them so that the part with the two small pins and roller lies flush against the bottom of the sprocket, with the other forked end resting against the pins and to the outside. Now press the fork in place with fingernails, while holding the sprocket so that it doesn't turn. The teeth of the sprocket hold the two ends of the chain in perfect alignment and eliminate the need for any anglo-saxon invectives.

up148 #8 February 14, 2016, 10:33pm

Very, very informative Bob. Have you noticed if the new drive is any quieter than the original which could "sing" at higher speeds. What kind of speeds have you realized or expect with the 8:20 drive? Is it strictly switcher speeds or can you run 60-70 scale mph without running the motor all out?

BTW, your photos always amaze me. The clarity is outstanding. You ought to submit some of these conversion procedures to OST as your instructions are very easy to follow and the photos are as I said "outstanding".

I have several RC GP9's I'll be upgrading so I'm following all your threads. I can learn more reading your threads in a few minutes than chatting with other modelers for years.

I remember Brian Scace did an article on changing out the sprockets on some weaver (same) drives and I believe he got his parts from the same vendor as you have.

Very interesting doings please tell us and show us more!

Thank you.

Butch

Craig #9 February 14, 2016, 10:33pm

I agree Butch. Bob always does a superb job at finding solutions to problems and being able to tell how he fixed it.

I will be using this as well when I start on my O-Scale GP-9 in C&NW (that is Cheap & Nothing Wasted...or is that Can't & Never Will... 😊). Those little gems are from my uncle who worked for the C&NW for about 10 yrs. hehehehehe

Bob #10 February 14, 2016, 10:33pm

Butch:

Thanks for your kind words. Several folks including Brian, another fellow, and even Joe G (on his blog) have added to the collective knowledge on reworking the P&D drive for a RC shell, so the subject may have already been adequately covered from a magazine standpoint. FYI the photos in this discussion were shot with both a cell phone camera 😊 and a giant Canon digital SLR with a macro lens and extension tube. 📷

To answer your question, I would expect the drive to still make a bit of chain and gearbox noise but I have yet to button one up. The new sprockets fit the chain like a glove, unlike the original blue P&D sprockets that were quite narrow or the white replacements that were not well made. I'm also replacing the chain in case there was a difference in quality. These factors do make the drive a lot smoother, so it may also be a bit quieter.

Regarding top speed, on the A&O 1.0 we ran quite slowly. With mostly sound-equipped locomotives, slow running with long coal drags made running a Track Warrant last longer, and gave the dispatcher more time to think. Most of the track was closer to eye level, so dropping down and getting an eyeball close by as a train snaked past was a popular pastime. I would not expect the modified drive to run 60 MPH. It should, however, offer smoother low-speed control while switching. To keep the original top speed, just install a 12 tooth bottom sprocket.

By the way, I believe you may still have an unread PM reply to you about mills and lathes from many moons ago. If not, I will delete and resend.

All the best.

up148 #11 February 14, 2016, 10:33pm

Bob,

I know the RC conversion has been mentioned on Joe's blog and elsewhere, but not to the degree of your postings. You might be right about overexposure but I doubt it; I think the professionalism of your photos and to the point descriptions would be the selling point for a magazine.

I kinda figured with better tolerances of the new gears and chain the drive would be quieter, so do let us know. I don't need a race horse GP9 but know that a high revving motor can add significantly to the operating noise. Since I'm modeling the UP in Utah and Wyoming some of my roster needs to run at road speeds without maxing on RPM's. So, I'll be looking at both 12 and 20 teeth sprockets.

I didn't know about the PM and am still in the market for a mill. I check it out. Thanks for letting me know.

Butch

Fred_Mullins #12 February 14, 2016, 10:33pm

Bob,

Let me add my thanks for posting your progress with the red caboose geep! I hope to build mine one day and this info will be very usefull!

v/r

Fred

Craig #13 February 14, 2016, 10:33pm

Hey Bob,

I need to pick your way back part of your brain here 😊

I was re-reading all of your posts and noted you mentioned that you used a 8 tooth and a 20 tooth sprocket. On the 8 tooth you said you got a 1/8" hole, however on the Serv-o-link site they only list a 8 tooth with a 3/32" hole size. Am I looking at the wrong location of the site? Or am I reading your post wrong? Below is the site I was looking at:

servolink.com/gearspec.htm

What I am hoping for is the PN's of the items you used on your towers to re-construct your trucks. I'm starting to get my part list together here to see how much my GP-9 is going to take me Moolah wise, and I'm not able to figure out what you ordered from the Serv-o-link people (2 sprockets and 1 chain).

Any information would be greatly appreciated.

Thanks,

Bob #14 February 14, 2016, 10:33pm

Craig -

Sorry, I didn't accurately recall the diameter when I wrote the post. Serv-O-Link only sells one size of the 8 tooth. 😊 Regardless the hub is too small for the upper shaft and must be drilled out. I can do that on the lathe for you to be certain that the bore is straight.

The lower sprocket is a slip-fit, so it needs to be pinned to the shaft. There is no knurling on the lower shaft since it needs to slip cleanly through the gearbox. The sprocket hub also needs to be shortened a bit to keep it from hitting the end of the half-shaft from the other gearbox (see earlier post.) I can do that for you or you can do it yourself.

You might as well order a pile of sprockets as there is a \$60 minimum order (ouch!) and the sprockets are really inexpensive per part. I'll gladly take a bunch off your hands, since I only ordered 20 each in various sizes, not being entirely certain which ones I wanted to use. I presume Eric will want sprockets for his pair of GP9s, but given the length of the Colorado Midland mainline in Denver Union Station he might not want to gear them for lowest switching speeds. The original gearing was 8T:12T or 1.5:1 reduction

When I get around to it, I have 9 single tower F-units to retrofit and 4 dual-tower GP9s which only leaves 3 spares of each sprocket. That's not counting a couple of unassembled P&D B units that a friend has, and who may or may not request a rebuild.

The sprocket part numbers are, for a 2.5:1 drive:

S082 8 tooth upper sprocket \$0.39 each
S203 20 tooth lower sprocket \$0.55 each
C1227 chain \$4/foot

If you want a slightly faster drive I would opt for a 10 tooth upper sprocket to eliminate the need for a custom shoulder washer.

Another upgrade you might want to consider would be NWSL wheel sets, perhaps the 0.145 tread width. Some of the P&D axle gears will crack over time from hoop stress. I replaced two axles in my ABA set of F3s and now have one cracked gear in the first GP9 drive kit. Alternatively, P&D sells replacement axles.

Fred_Mullins #15 February 14, 2016, 10:33pm

Bob/Craig,

I have a pair of red caboose GP-9's that I would like to make the upgrades too. So I'm interested in getting the parts needed to do this and would be willing to buy some of the extras you will have to meet your mim order. Bob would you be willing to hire yourself out to do the milling for me as well? Let me know what the cost would be and I can send a check. Craig please let me know what you want for your parts and if Bob is willing, the cost of forwarding the parts to him?

Thanks and Merry Christmas!

Fred

Craig #16 February 14, 2016, 10:33pm

I'll get a big ole batch order in at one time guys, probably will be over my Christmas break (next week).

Fred - so you need 4 sets of gears (enough for two engines)? Do you want the 8 to 20 gear like Bob Mentioned ... or do you want the original gearing of the 8 to 12?

Bob - How much chain to you estimate I will need to get? If Fred has 2 sets he wants to do, Eric has two, I have one, and you have a couple. Do you think that 6 feet would be enough or should I got up to 8 feet?

Thanks for the info.

Bob #17 February 14, 2016, 10:33pm

Fred -
"I'm willing."

Craig -
Each tower should require a bit less than 5 inches of chain. I don't know who made the original P&D chain, but I'm just replacing it with the Serv-O-Link chain on my gear towers.

Serv-O-Link has a lot of design information on their web pages, including a nice online calculator that gives the number of links of chain given the number of teeth on each sprocket and the desired center distance (about 1.36 inches for the P&D tower.) An 8T:20T setup would require 36 links. There are actually 36 on the prototype drive. At .1227 inches/sprocket that would require... you can do the math... OK, about 4.5 inches.

Fred_Mullins #18 February 14, 2016, 10:33pm

Craig,
I would like the 8 to 20 ratio and yes need enough to do two units!

Bob,
Thanks for the assist!

Bob/Craig: please let me know what I owe you and address to send payment!
If you want contact me offlist.
Fred

rnb3 #19 February 14, 2016, 10:33pm

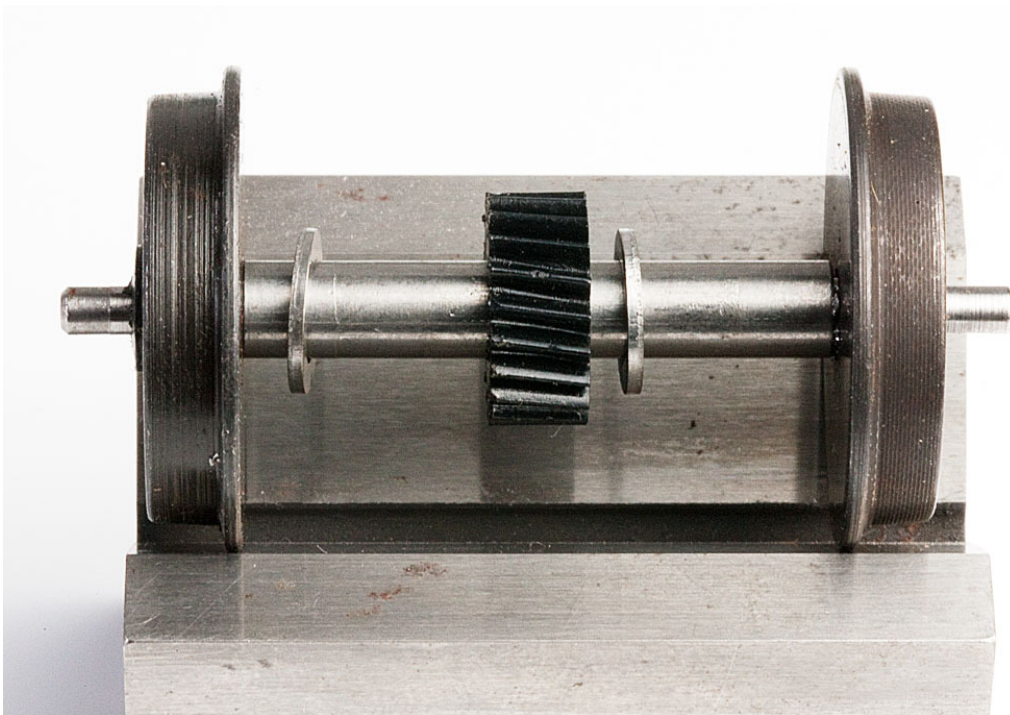
Craig,
I would love to get in on this! I could use 6 sets for what I have on hand. (2 GP9s, 1 GP38, 1 GP40, 1 GP35, and an experiment to convert an Atlas SD35 to P&D drive.)

Bob #20 February 14, 2016, 10:33pm

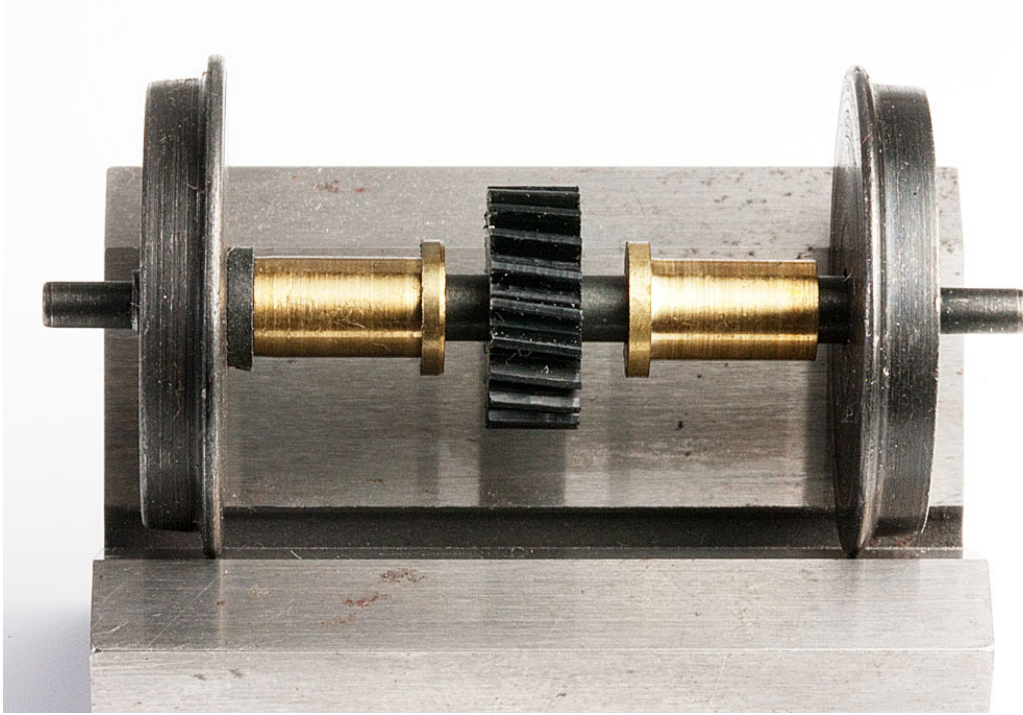
If you are planning to “run the wheels off” your rebuilt P&D drive, you might want to look into two additional items:

1. P&D ball bearings (\$\$\$) for the brass trucks. I have not yet tried these, but they should cut down on bearing cap wear. I would also expect that they require drilling out the bearing caps to fit the tiny ball bearings.
2. NWSL replacement wheel sets, available in different tread widths.

Here is a stock .178 wide tread P&D wheel set, with a flange maximum diameter of 0.925 inch and a tread diameter of 0.827. This gives a flange depth of $(.925-.827)/2 = 0.049$. You can see on the right hand tread the effects of tool “chatter”, indicating a poor combination of lathe feed & speed.



And here is a Northwest Short Line 0.145 tread width replacement, 0.921 diameter and a tread diameter of 0.830. This gives a flange depth of $(0.921-0.830)/2 = 0.0455$. Note that this wheelset was made by the “old” NWSL prior to selling the business to a new owner and it was still in my personal drive rebuilding “stock.” I presume the new ones are just as good as the old.



The worm gear seems to have a little bit different tooth profile, but runs just fine in one P&D A unit that I converted about 2002 for running on A&O 1.0. (The worm is the driving gear that looks like a screw.) It seems to have fewer rough edges than the OEM. Also, the shaft has a pair of brass or bronze sleeve bearings to reduce wear on the acetyl gear box cases.

Also notice something subtle. The lathe that cut the wheels left a little bit smoother tread on the NWSL replacement. This might equate to less dirt pickup and more robust electrical contact during use. The right tread is quite smooth, but the left wheel tread is about as rough as the original P&D.

Although it would not as good at gripping the rail, solid nickel-silver wheels would be superior in repelling track dirt and gunk. The alloy is hard to find in diameters suitable for a 40 scale inch wheel plus flanges (I've searched) and the alloy (not real silver) is extremely expensive. It is also notorious for being difficult to machine. I wonder if a bunch of O-scalers got together and asked politely for a big pile of NS axles if NWSL would agree to machining them for us. I would take 52 wheel sets if I could get them!

Craig #21 February 14, 2016, 10:33pm

OK Guys...Here are the quantities that I have. Please review and provide any feedback.

Bob - S082 x 15 (7.5 sets); S203 x 15 (7.5 sets); C1227 x 10'

Fred - S082 x 4 (2 sets); S203 x 4 (2 sets); C1227 x 2' (figured 6" per tower)

Rick - S082 x 12 (6 sets); S203 x 12 (6 sets); C1227 x 6' (figured 6" per tower)

Craig - S082 x 4 (2 sets); S203 x 4 (2 sets); C1227 x 2' (figured 6" per tower)

Eric - S082 x 8 (4 sets); S203 x 8 (4 sets); C1227 x 4' (figured 6" per tower)

Legend:

S082 = SPROCKET, 8 teeth, 1/8 bore

S203 = SPROCKET, 20 teeth, 3/16 bore

C1227 = Chain

I will place the order after Christmas (27th or 28th) so you have some time to review. Please see if your quantities are correct or if you want anything more of any of these (or different numbers)... please let me know. I will split up the costs of our stuff once I have a finally tally of what it will run.

Merry Christmas!!!

Bob #22 February 14, 2016, 10:33pm

Craig -

15 pairs for me, not 30, unless you know something I don't know! Most of what I have is a single tower, not double tower drive in P&D F-units. And I suppose that all these guys will want shoulder washers for each gear tower... Guess I need to buy another piece of brass round to machine them.

Craig #23 February 14, 2016, 10:33pm

Sounds good Bob. I was reading that being 15 pairs (pairs being 2). heheheheh

I will back yours down to 15...and wait to hear on the others 😊

Merry Christmas Bob!!

Fred_Mullins #24 February 14, 2016, 10:33pm

Craig,

Looks like you have the right listing for me!

Bob,
Yes will need the rings as well!

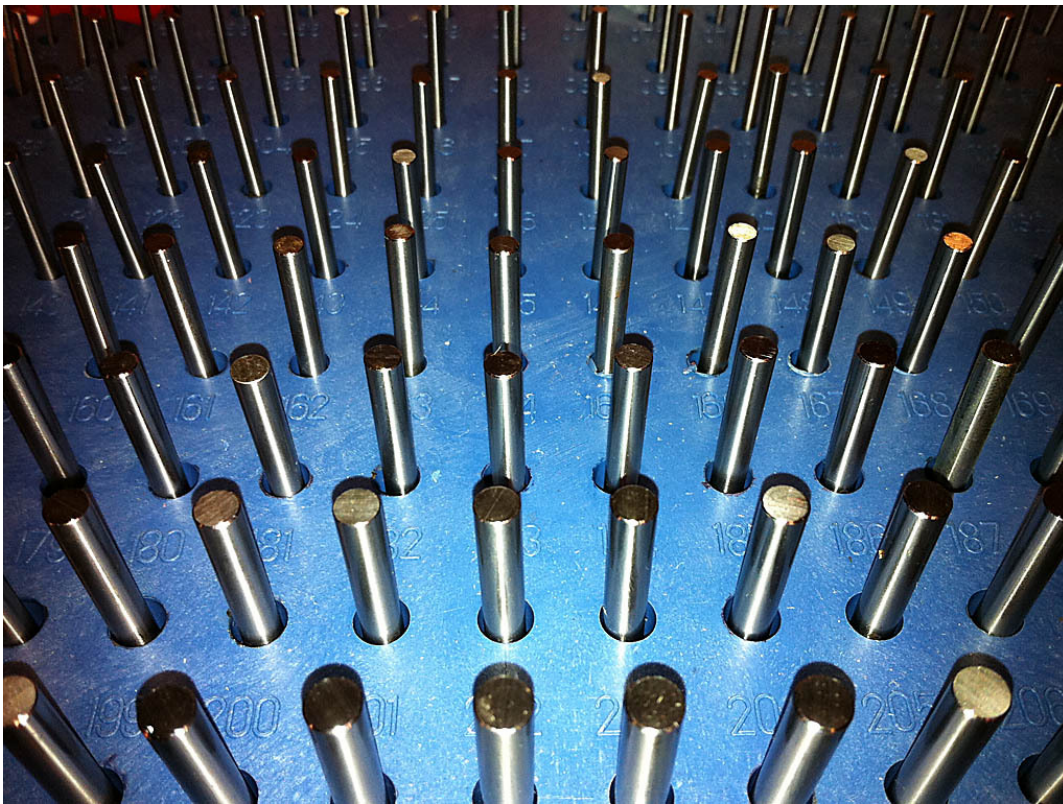
Merry Christmas to ALL!!!

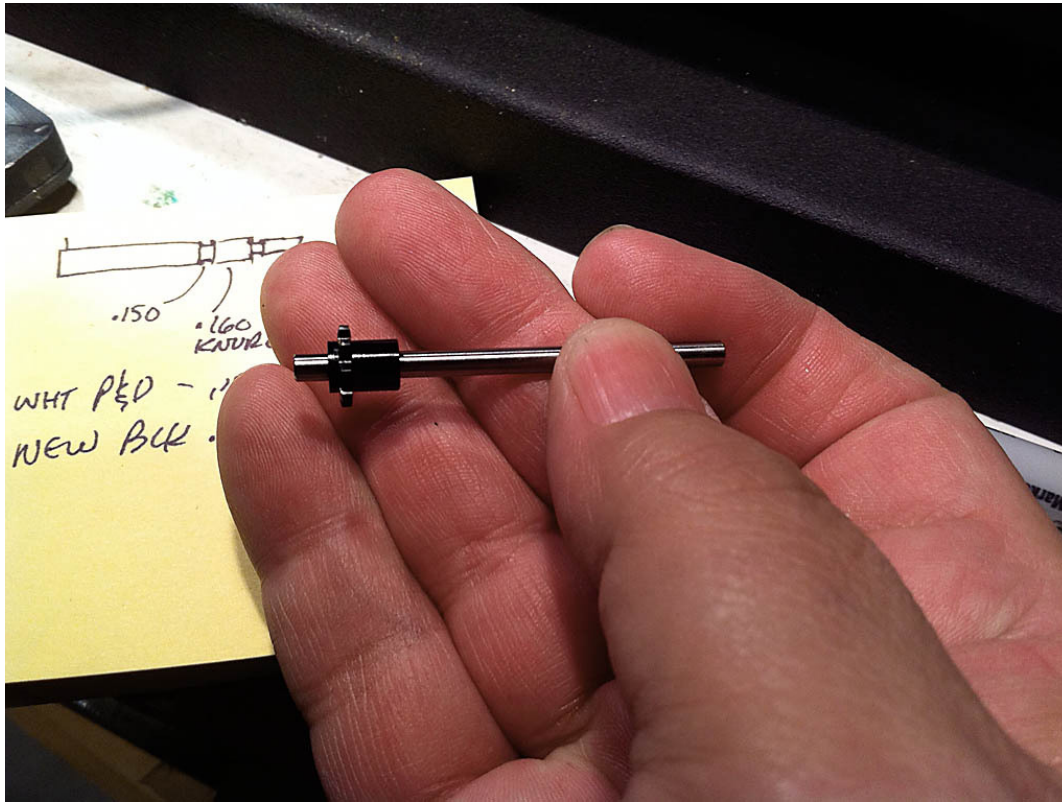
Fred

Bob #25 February 14, 2016, 10:33pm

No problem, Fred. I'll toss shoulder washers in too. And Merry Christmas, my friend!

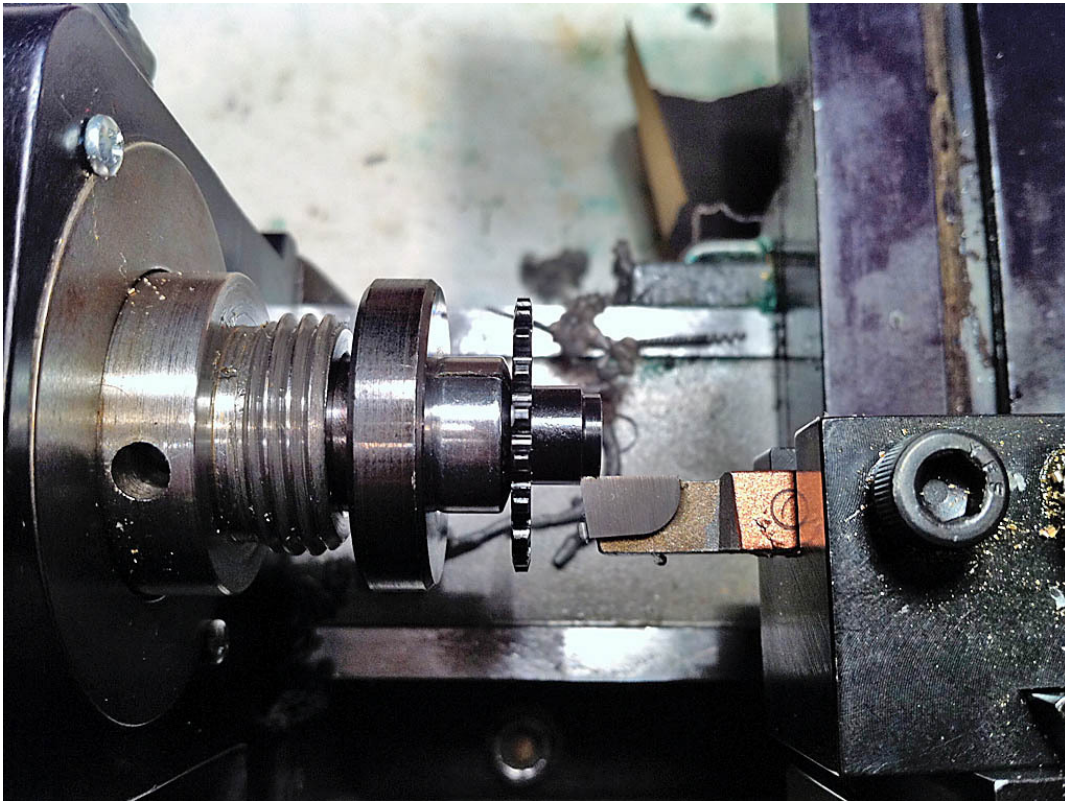
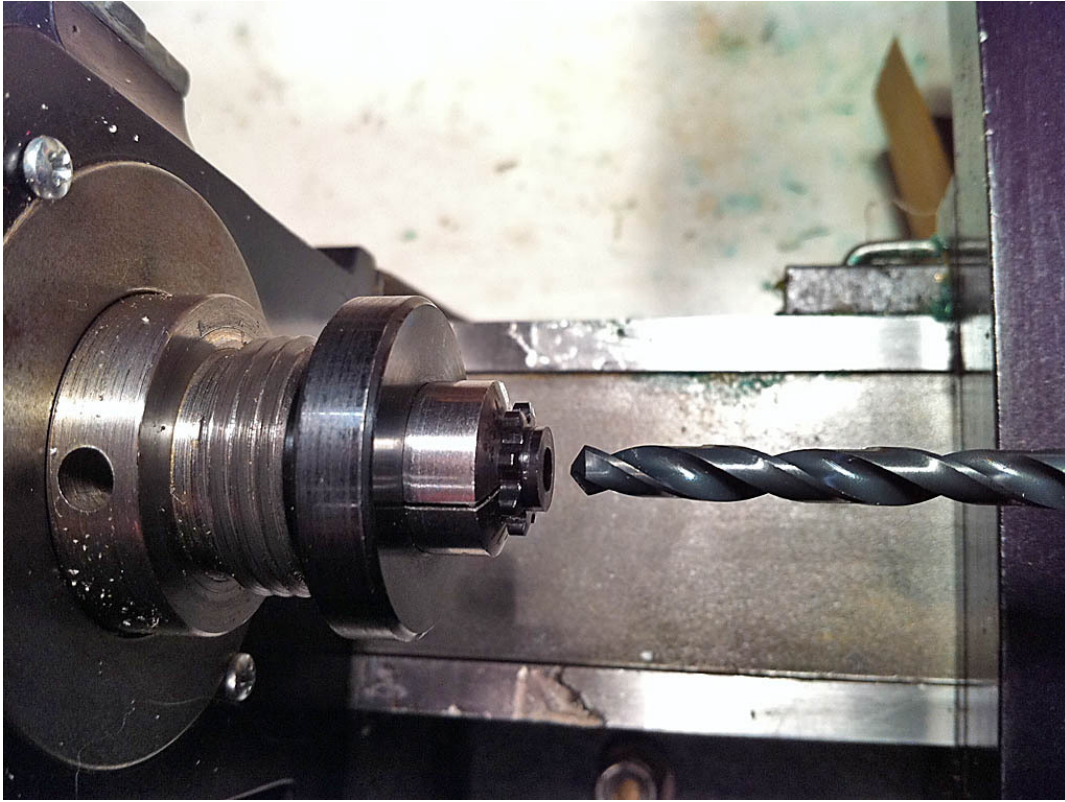
This afternoon I prepared all the sprockets I have on hand so we can get reworked parts to folks a bit quicker. Since I couldn't find my original notes it took almost as long to sort out what to do to the parts than it did to modify the parts. The P&D white replacement upper sprockets have a 0.156 inch bore. A set of plug gages makes measurement easy, even if they do look like instruments of torture...





Bob #26 February 14, 2016, 10:33pm

Here we are drilling the upper sprockets and shortening the lower ones. It took longer to swap parts than to make the cuts.



Sorry about the latest and lower quality photos as they are quick iPhone 4 grabs. The other machining photos were made with the better camera in a Droid X or on a photo sweep with my Canon DSLR and 100mm L macro lens.

Bob #27 February 14, 2016, 10:33pm

Another drive train hint just came to mind. Before assembling the P&D black acetyl couplings that allow the length of the upper motor drive shaft to change length, apply a **dry lube** such as graphite for Kadee couplers, hardware store lock dry graphite, or molybdenum disulphide (moly) powder (my preference) on the sliding parts.

I learned this the hard way on the first 3 P&D F-units I built. When dismantled for maintenance the couplings would barely slide against each other, but a bit of dry lube fixed them in a flash. I first tried oils and they were absolutely of no help. Don't even bother! A good friend and very-experienced mechanical engineer explained that normally acetyl would be run dry against a metal such as steel. When acetyl-on-acetyl wears over time there can be a co-mingling surface roughening that introduces stickiness.

Craig #28 February 14, 2016, 10:33pm

That is a REALLY good idea Bob. Going to have to pick up some of the graphite when I get a chance.

Just an FYI for you guys. I got the order placed with Serv-o-link this morning. Not sure when we will see it, but as soon as I have any tracking information I'll pass it along.

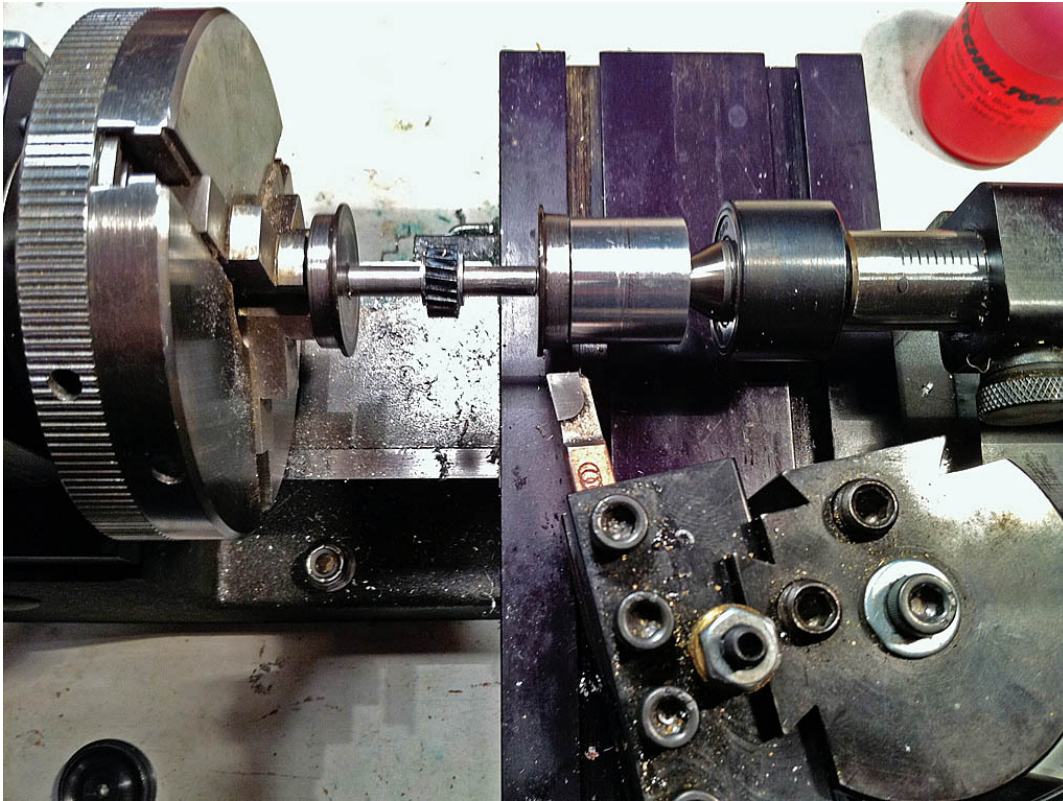
I do have a final tally on the costs, so please email me at drgw346 (at) gmail (dot) com so I can give your portion of the bill 😊

Bob #29 February 14, 2016, 10:33pm

On A&O 1.0 the steel P&D wheels always seemed to crud-up faster than plated wheels on brass imports. The wheel treads are rough with grooves left-over from the CNC lathe, and I wondered if turning or polishing them out would help. A fellow on the OSCALEMODELERS Yahoo group came through with an answer. Matt Forsyth noticed the same thing and for years he has been truing them with a file while turning them in a lathe. He then polishes them with 220 and 320 grit emery cloth. According to Matt traction was not reduced, and the polished wheels needed very little cleaning.

Instead of freehanding it with a file, I tried misusing the end of a brazed carbide lathe bit. There tends to be some chatter, but the wheels come out nice and clean! This is the test setup. Since it seemed

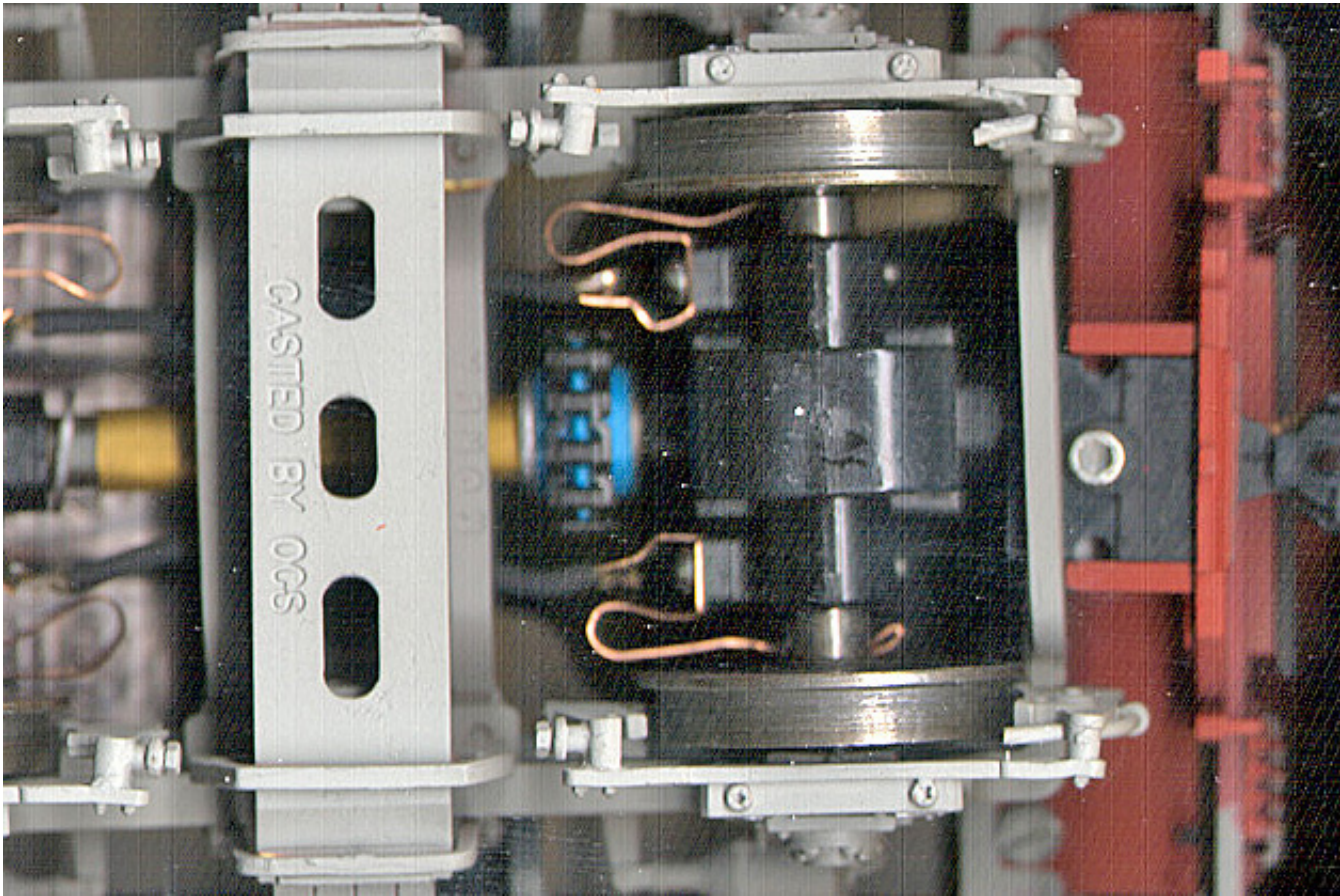
successful on a junk axle (with a cracked gear), I honed a cheap Chinese carbide tool to give it a nice radius for the corner where the flange meets the tread.



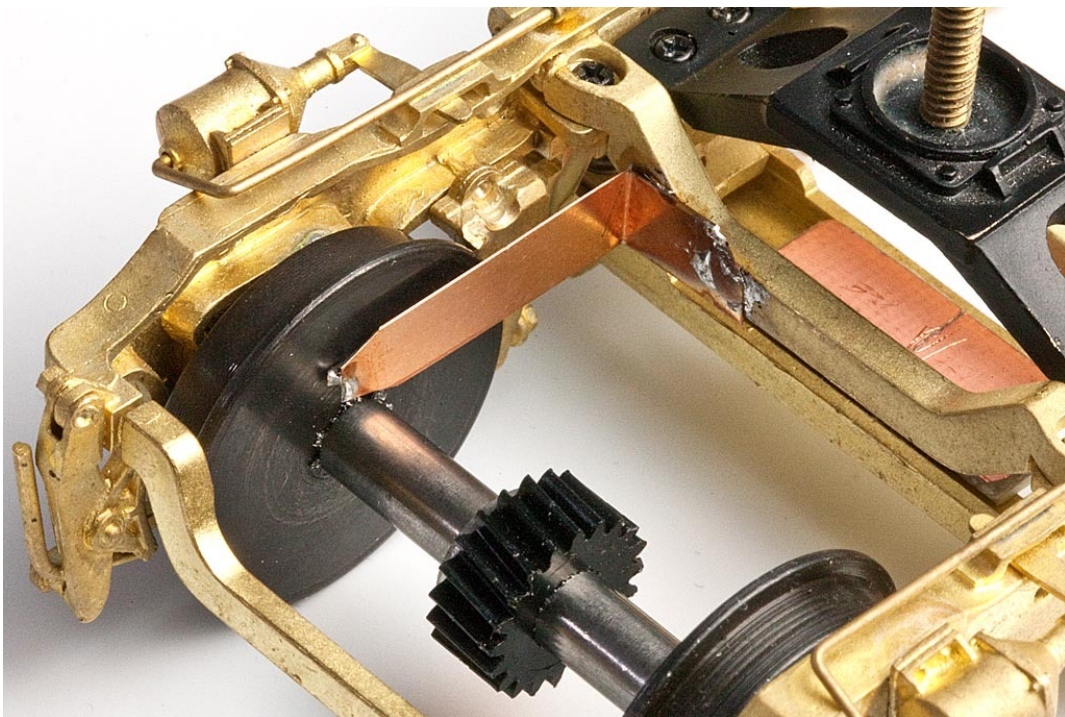
So... now I have another big chore to do! While I have the wheels out of the gear boxes, I will kiss the back of each wheel to smooth out the grooves and knock off the oil finish. That will offer better electrical pickup to wipers.

Bob #30 February 14, 2016, 10:33pm

Switching to a larger lower sprocket makes attaching pickup wipers to the back of the wheels a lot harder. Here is how I used to do it, in this case a P&D F3A. These wipers were troublesome and tended to be very squeaky. The bigger sprocket makes it difficult to get a screwdriver in there and there would also be no room for a tab to attach a wire.



Now what to do? Here is an experiment from this morning.



To stop squeaking, drag at the contact point acts in a straight line along the 0.005 phosphor bronze

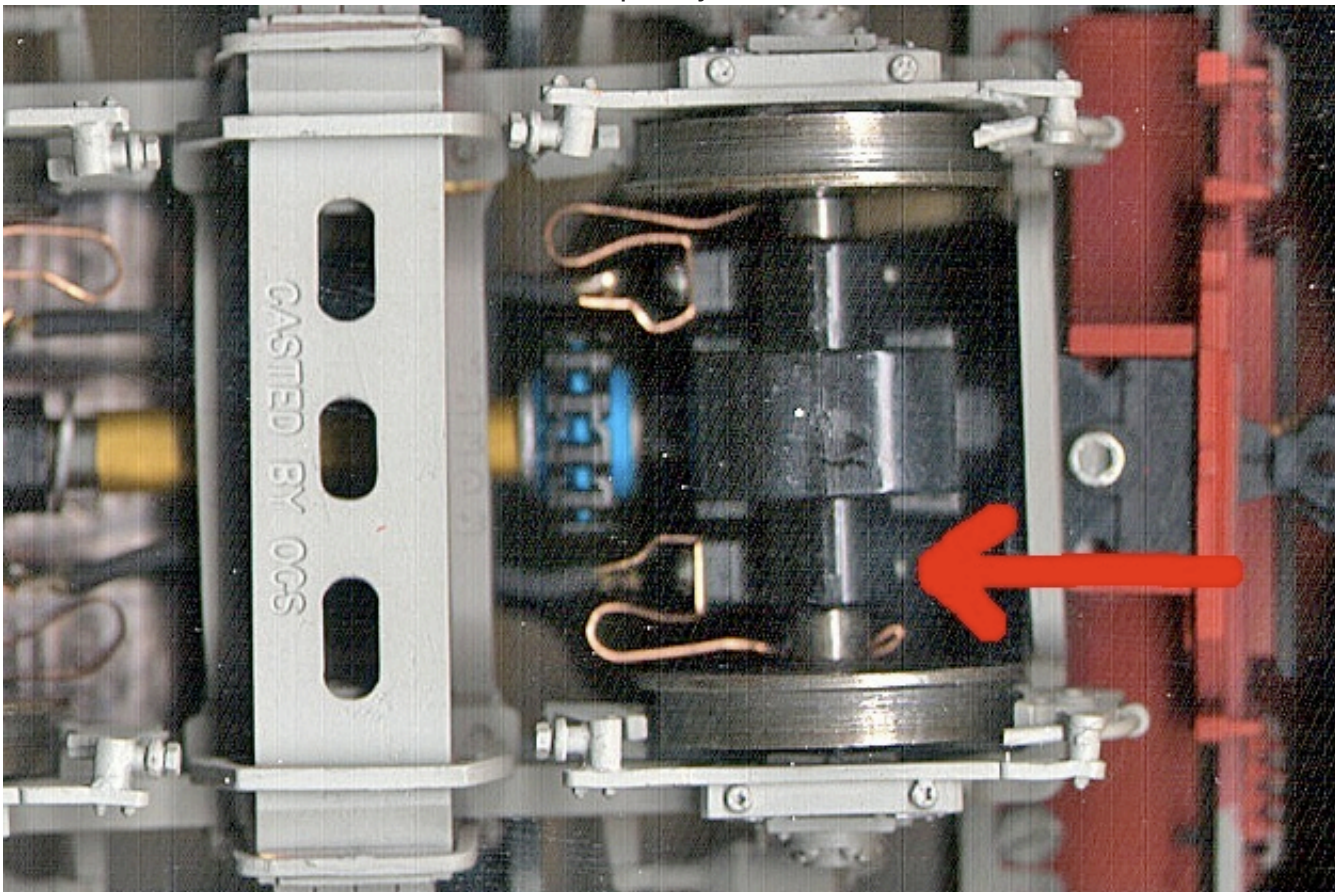
wiper There is also a small piece of 0.032 phosphor bronze wire soldered to the tip of the pickup to act as the wear surface. Obviously the oil blacking on the back of the wheel must be removed. That can be done on the lathe after truing and polishing the treads.

The near side wipers are a bit trickier, as they must be insulated from the frame. A small piece of double-sided PC board should do the trick. It will have to be bolted, resistance soldered or epoxied in place.

It will also be tricky getting the truck reassembled without bending the short pickups.

rnb3 #31 February 14, 2016, 10:34pm

So why can't the pick up be flipped to the other side of the gear box? Also, what about flipping the screw/nut so that the screw head is away from the gear with the nut behind the gear. The nut can be held from the side and the head will be completely accessible.

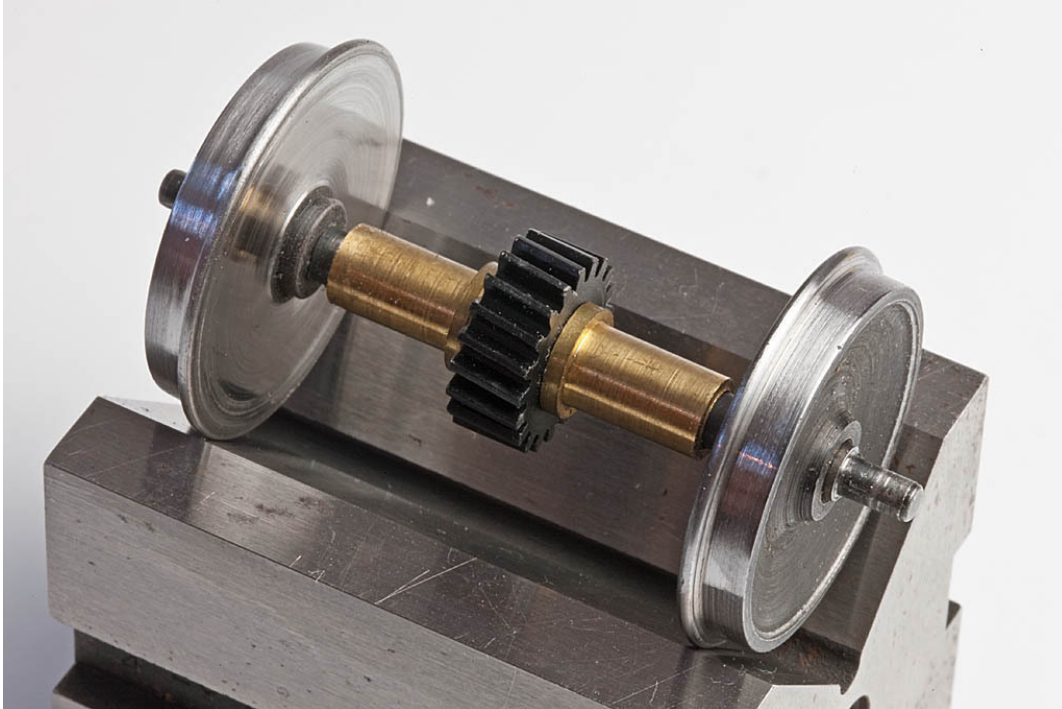


Bob #32 February 14, 2016, 10:34pm

Here is a Northwest Short Line axle that has been polished. For this one I followed Matt's recommendation and used a mill bastard file to remove the grooves, then sanded and polished with paper. I also used a miniature swiss round needle file to get into the corner where the flange meets the tread.

The wheel backs were polished by taking a skim cut on the lathe then following up with paper.

I sure hope the results are worth all the effort!



rnb3 #33 February 14, 2016, 10:34pm

Looks good Bob! About how much time do you think these can be turn-out in? I'm going to have to see if I can rig a fixture for my mill to do this to mine!

Bob #34 February 14, 2016, 10:34pm

Rick -

I just did 5 more axles and it took 90 minutes, so about 18 minutes each. Some of the extra time comes-in when I use a brazed carbide tool to gently re-cut the back of the wheel. The finish pass is only about 1 thou and I feed extremely slowly, generating only dust. That saves a lot of time polishing the backs with sandpaper.

I suppose you could hold the axle with a Jacobs chuck but something with a bearing would be helpful to hold the free end. We don't want to overheat the plastic insulating washer. And I suppose using a drill chuck might give you the clearance needed to get a file in the space between the chuck and the tread. There is no way I want a file or my knuckles getting close to the jaws of a lathe chuck so I've been filing and polishing the treads on the end next to the adapter and live center.

By the way, I was able to reduce cycle time by switching to a new 4-inch Nicholson smooth cut file for truing the tires. It only takes a few seconds to make the cut at 1000 RPM, but it leaves a smoother finish than the mill bastard cut. *Note that it is critical to stay away from the flange with a square edged file, as we don't want to remove the round fillet.* The miniature round file quickly cleans the fillet and flange.

I did consider flipping the wiper around to the outside of the gear box, but there is even less room to form a decent u-shaped spring. I don't want to hear any more wipers singing an off-key 8-part harmony like the ones on the F-unit.



The late philosopher Charles Schultz once noted "Happiness is a warm puppy." Right now I'm just glad I'm done polishing wheels for a while!

Bob #35 February 14, 2016, 10:34pm

After discovering that I needed 3 instead of 4 sets of wheels for GP-9s I went rummaging through my old wheel sets and came across this one that was run on A&O 1.0 and replaced with one from Northwest Short Line. I apologize for the size of the photo (actually, not) but it seemed informative to get an up-close and dirty look at what was happening.



Observe how the crud seems to pack into the depths of the grooves then start to smear across the face of the wheel. Although difficult to see, as it is out-of-focus, the fillet between the flange and tread is much too sharp. This area often had to be cleaned out with a knife. Note that I've increased contrast and heavily sharpened the photo in Photoshop to make the details easier to see. The photo was made with a Canon 100mm L macro lens and a 1 inch extension tube for extra magnification.

When polishing the treads on these, I keep the flat file well away from the fillet so that it doesn't get any sharper.

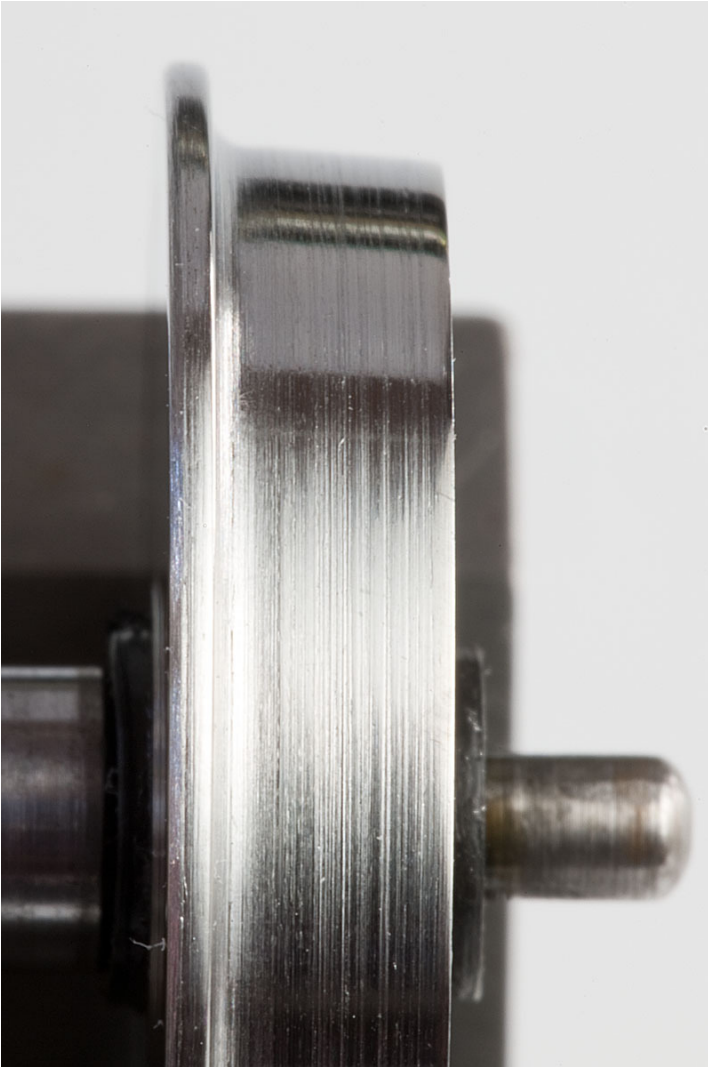
Next I re-cut the fillet with the very tip of a miniature round swiss file, using mostly side pressure. Wearing high magnification during the process reveals a steady stream of steel dust coming out of the corner as the fillet is re-cut. Sliding the file along its length and adjusting its angle of attack removes any new groove filed in the flange or the tread.

I'll post a matching photo of this wheel after it receives polishing. It won't be perfect, but should be a lot smoother.

Bob #36 February 14, 2016, 10:34pm

Here is the same wheel after polishing. It isn't perfect, but it is at least a lot smoother than it was. The deep grooves are gone and the fillet rounded to a broader radius. I also knocked the sharp edges off the flange.

Also notice the bright steel color compared to the original wheel. That one had most of the factory oil blackening removed with a brass brush on a rotary tool before being put on the track. Perhaps the oil finish also had a chemical affinity for track crud.



The crud on this wheel really loaded-up the file!

Craig #37 February 14, 2016, 10:34pm

That is insane Bob. It really does show you that those wheels really are done at the cheapest supplier.

For those of us that don't have capability to do this, does NWSL have sufficient wheels that are filed down properly?

Craig

Craig #38 February 14, 2016, 10:34pm

Gents.

I just wanted to let you know that the gears and chain have arrived.

Fred - I will get with Bob to see if we need to drill out your gears before we send them off. Can you email me (drgw346(at)gmail(dot)com) with your address and I will get these out to you (I'll also email back the total costs of your piece).

Thanks,

Craig

Bob #39 February 14, 2016, 10:34pm

Craig -

As far as I know, NWSL never turned and polished them like I (and before me, Matt Forsyth did.) All the wheels I currently have started out with a brown oil finish and had grooves about as deep as the P&D wheels. "Rough roh!"

The first two photos on page 4 of this thread, the ones that have brass sleeve bearings, are NWSL wheels that I polished. Axles without brass sleeves are original P&D. After turning a lot of them, now I really don't see any significant difference in tread roughness, but the ones I bought while NWSL was under the original owner did seem to start out with a little larger radius fillet where the tread and flange join. I can't speak for ones made under current NWSL ownership as I have not ordered any; hopefully they are as good or better.

Fred -

As I said earlier, "I am willing." If you agree, I will enlarge the bore of the 8T sprockets to fit the upper drive shaft, and shorten the hub of the 20T lower sprocket so that it does not interfere with the mating half-shaft, and toss-in brass shoulder washers. You should polish off any rough edges on the shoulder washers with 400 to 600 grit carbide paper, wetted with water or oil, so that the smaller shoulder diameter does not eventually cut into the edge of the upper sprocket and cut a groove over time.

You will need to cross-drill and pin the lower sprocket with something like brass wire. Find a drill that is one or two thousandths of an inch larger in diameter than the wire and pin them in place. I recommend clamping the half-shaft in a small vice and drilling the sprocket and shaft in a drill press (a small precision unit preferred; I used a Sherline mill but a Dremel drill press should work fine as

long as the shaft is clamped in a vise.) This may be especially helpful if you use a carbide drill, as the tiny diameter drills will shatter with the smallest side force. Use proper safety glasses! I always do.

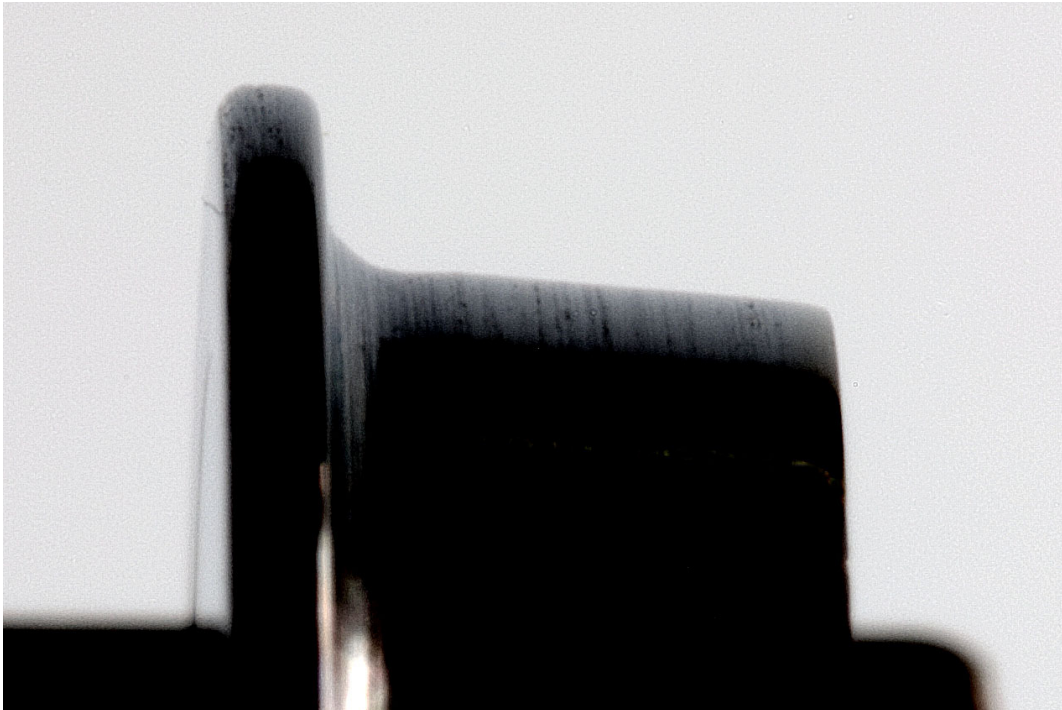
Bob #40 February 14, 2016, 10:34pm

All -

You may be able to file and polish a wheel set in an ordinary drill press, although I have not tried it. One friend reported success using a Sherline mill, holding the axle in a Jacobs chuck. I would not recommend a cheap Chinese import drill press. Stick to one with a real US Jacobs chuck or better. Don't apply a lot of side pressure against the spindle as a Morse taper chuck can and will fall out under side pressure, creating an ugly and hazardous scenario.

Avoid filing too hard against the tread with the miniature Swiss round file, and keep most pressure against the flange. Stop frequently and examine the tread under great magnification and with a strong back light. Don't file a flat in the tread adjacent to the fillet.

Here is an example of almost filing the fillet too far. There is a second slope on the tread. It is not quite flat, but we must not file any deeper. By the way, it is exactly the same wheel in the previous post, but the focus and exposure were changed to optimize seeing the fillet.



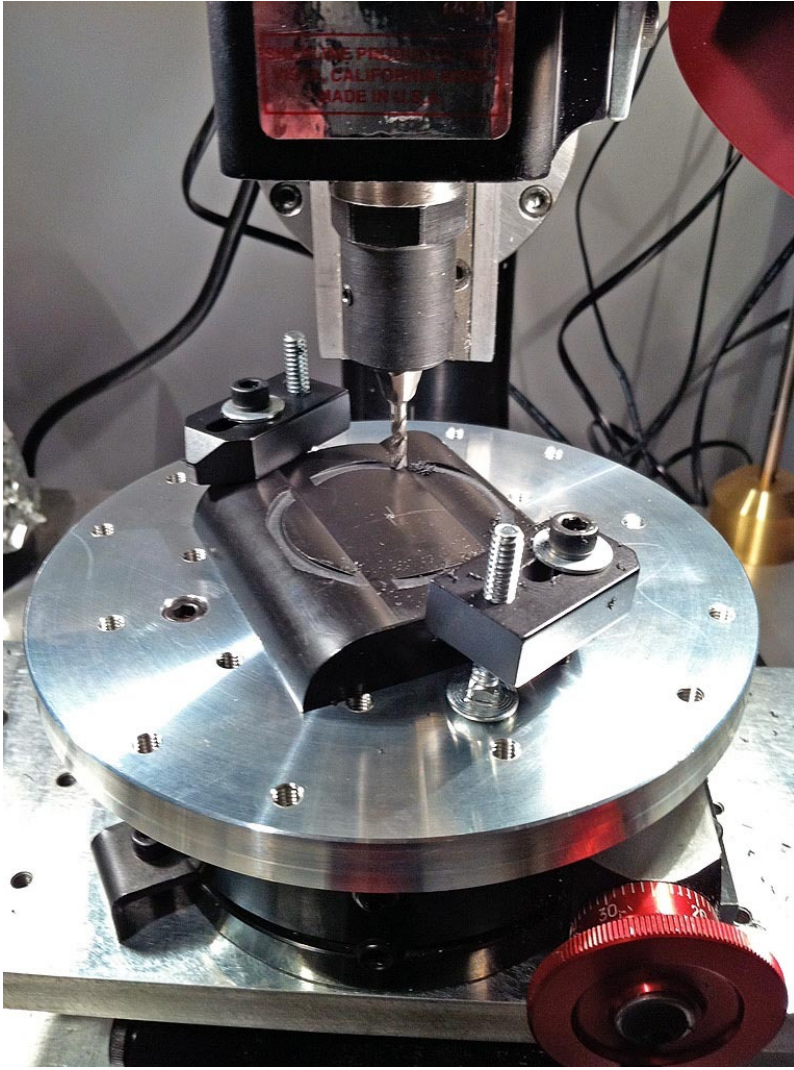
Bob #41 February 14, 2016, 10:34pm

OK, guys -

For those of you who contacted Craig for sprockets, parts are back from the machine shop and the kits are ready for Craig to add the chain prior to shipping. Don't panic because the TA prices 😲 are only "MSRP" and Craig is free to offer whatever discount he wishes. 😊



For you other guys who requested that I mill speaker doughnut holes out of your GP9 fuel tanks, that work is done too. A new tooling plate ordered for this sort of work extended the work envelope of the Sherline rotary table and made clamping a lot easier.



The holes came out fine, with minor flash to clean up. I saved the fuel tanks in case you can find a use for the scrap. (Or was I supposed to cut the tank and scrap the doughnut hole?) 🙄 Remember that these will now only fit the QSI 2.07 inch High Bass speaker. It is currently the best “rumble machine” I was able to find and fit in the locomotive. The Soundtraxx equalizer can do wonders with this speaker.



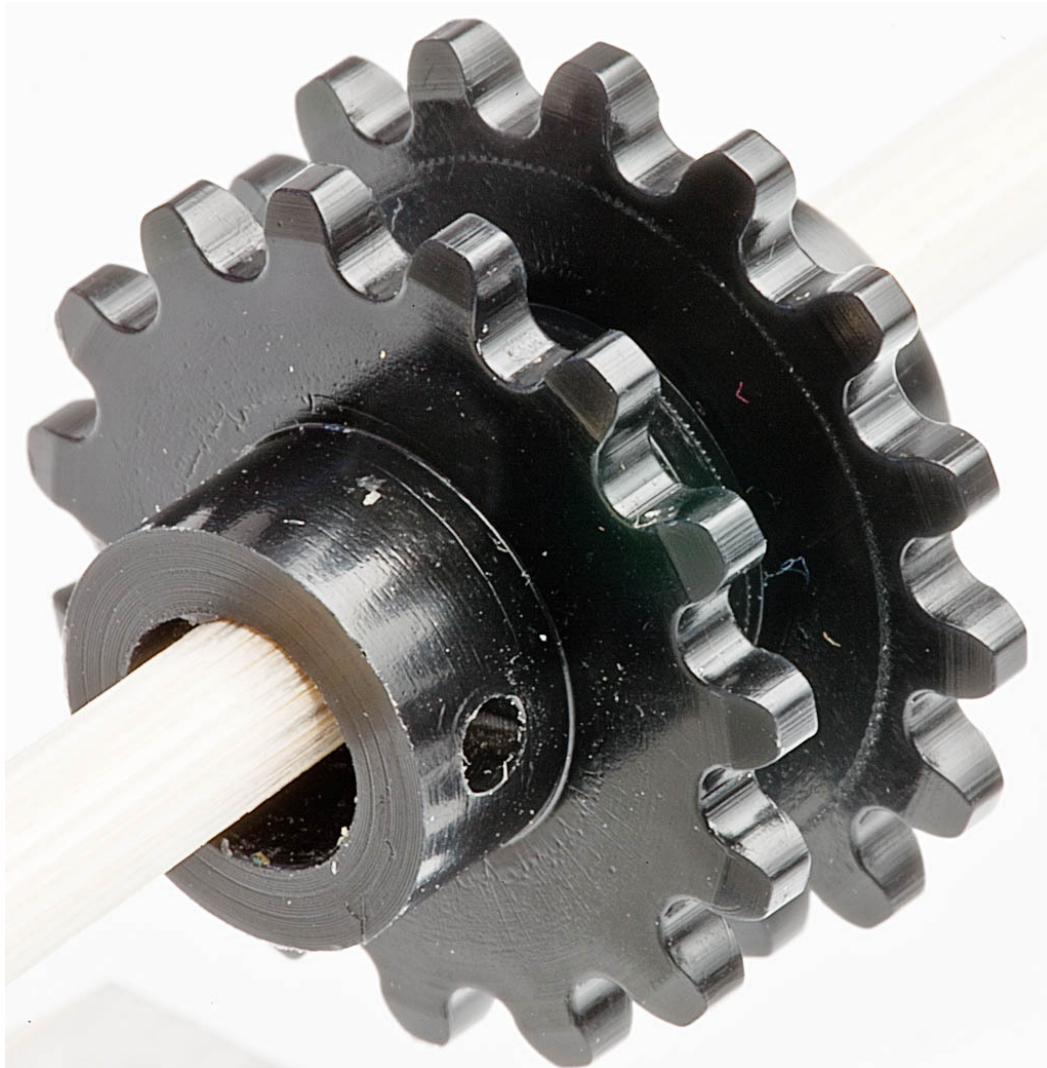
Note that the paper gasket on the QSI speaker tends to be out-of-round, so a bit of coercive force may be required. You will also need to run a “screaming banshee hand mill” to knock down the high spots on the interior flutes and sides of the tank so that the speaker can actually fit into the hole instead of sitting proud of the opening. I installed my speakers with generous amounts of ordinary Elmer’s school kid rubber cement to fill the interior gaps and make the installation air tight. This cement not only does an outstanding job of gluing school kids together, it also works well in this application and easily removes from either! 😊 Just kidding.

Bob #42 February 14, 2016, 10:34pm

Guys -
Chester, one of the forum members, asked me to install new sprockets on his Weaver gear tower. He procured them along with new chain from Stock Drive Products. Once installed the chain would not

run smoothly. Every time a link of the chain needed to settle into the valley between sprocket teeth it did so with hesitation. The chain would not wrap around either sprocket without being lightly pressed in place with a finger. In doing so it would make an audible snapping noise. And once a link was tightly wrapped around the sprocket, it did not want to easily fall out under just the influence of gravity. Sprockets from ServOLink, the company that developed and patented the drive system, nestle in place without any force.

Here is a comparison photo that shows the two brands have slightly different tooth profiles. A 15T sprocket from SDP/SI is in the front and a 16T from ServOLink is in the back. The 15T was cross-drilled while on the lower drive shaft for a 1/16 spring pin. (Those pins can be real buggers to install; for the next one I'll make a magnetized tool to hold them in my mill.)



Barely visible is a difference in the root or valley between teeth. It is broader on the ServOLink sprocket. Also the top of the teeth are rounded more on the ServOLink one. Is that the cause? I don't know. But I do know that there is a huge difference in running quality between the two of them. I will donate new sprockets to the cause.

One final note. Changing the drive ratio often requires a different distance between the drive shafts. With 8T and 15T sprockets, the chain fits rather loosely and flops around a bit. The 8T-20T combination fits rather nicely. We shall see how the 8T-16T combination fits.

Bob #43 February 14, 2016, 10:34pm

Hey, guys -

All of you who chimed-in on Craig's sprocket order, be advised that some of the upper drive shafts are smaller in diameter than the ones I've replaced so far. 😊 If you find that the 8T sprocket is a loose fit, let me know and I will send a smaller one. I'll need to know the hole size you want to fit the knurling on the shaft. For that take measurements all around the shaft and report the minimum and maximum. Or, if you prefer I can send one undrilled.

If you don't already own a digital caliper from Harbor Freight (or better), a 4 inch one on sale usually sells for about \$14. The only downside is that they eat several batteries per year. I checked the accuracy on mine, using Starrett Webber gage blocks, and found the caliper to read +/- 0.001" at the distances checked. But for under \$20, your mileage may vary.

Bob #44 February 14, 2016, 10:34pm

One more observation, which can be important -

After assembling Chester's drive tower, and using the SDP/SI chain he provided, it turned out that the center hole spacing for the sprockets was too far for the 8:16 sprocket combination. The chain was under tension all the time, and that added drag.

I got a "wild hair" and decided to remove the chain and lay it flat against a ServOLink chain. The first thing I noticed was that the ServO version was incredibly limber by comparison. Next I noticed that the ServO was longer when laid out flat. The spacing between rollers was a tiny fraction longer which added up over the length of the chain.

Installing the ServO chain gave just enough extra length to remove the "rubber band" tension and make the drive run a lot more smoothly.

For now I would recommend ServOLink sprocket drive products, even though the minimum order is \$30. I personally do not plan to order replacement sprockets and chain from either P&D or from SDP/SI.

Your mileage may vary.

jaybeckham #45 June 5, 2016, 3:02pm

Bob, what size and model of Metal Lathe and Milling Machine are you using? I have a 12 inch x 36 Jet lathe with a milling attachment. I have a number of Weaver engines with bad gears to fix. Continuing the discussion from P&D/Weaver gear towers.

Also would you share the dimensions on the sprocket puller?

I already ordered chain and sprockets from Serv-O-Link and would like to get started.

Thanks!

Bob #46 June 8, 2016, 4:44pm

Jay - Good to hear from you!

Your Jet mill/lathe has a LOT more iron than mine! (Conventional wisdom says a lot of iron is a really good thing as it makes the machines a lot stiffer.)

I use a Sherline 2000 mill and 4400 17 inch bed lathe. Both are equipped with DROs and if purchasing again I'd *gladly* pay the extra for that feature. So far I have been the limitation, not the equipment. I do enjoy the fact that I can easily pick up either one and carry it around.

Curiously, I have a change of opinion to report regarding gear towers. Reducing the gear ratio certainly slows down a P&D drive and improves the low-speed crawl using a conventional decoder such as an NCE 408. So what changed?

Before reworking the drive in one of my F3s, I temporarily installed a Lokpilot XL decoder to evaluate ESU's motor control with the stock drive. After a couple CV tweaks (less back-EMF feedback to avoid jumpiness) and reducing the top speed by changing the reference voltage, the B unit would smoothly crawl at about 1 tie per 2 seconds.

I found two issues with changing the drive ratio as I have already done on 3 F units. They are:

1. Increased chain noise because the chain on the upper sprocket turns faster. This can be objectionable with a dual-tower drive.

2. The optimum spacing between the input and output shaft changes with the sprocket change. (There is a shaft spacing calculator on the Serv-O-Link web site.) Excessive tension on the sprocket increases friction, so the motor current goes up, and also chain noise.

I was able to *somewhat* mitigate excessive chain tension by repeatedly heating the P&D towers with a heat gun, bending them to reduce the distance between the sprockets, then letting each cool under tension. A more sophisticated solution has been made by a guy with a CNC mill who sells both adjustable height gear towers and a replacement aluminum frame+steel weights for Red Caboose GP9 kits. Edit: The parts are available from [finescale360](#).

Because the Lokpilot exhibited near perfection in its motor control, and frequent flurry of releases of new and excellent sound files coming for the V4 decoders, I've decided to standardizes on Loksound V4 L decoders. I have yet to try the newest "Full Throttle" sound files.

I'll have to find the sprocket puller and take approximate dimensions. That project wasn't a precision job. I had a *lot* of fun starting with a squared block of aluminum and "milling away everything that didn't look like a sprocket puller."

All the best, Jay!

[jaybeckham](#) #47 June 5, 2016, 7:20pm

Bob, thanks for the reply and the information. I am not sure but I don't think I ordered sprockets to change the ratio, just replacements, but I will have look. I will look forward to the dimensions however just approximate is fine. Again thanks and tell David I said Hi.

Jay