CONVERTING AN SN3 LOCOMOTIVE TO NWSL MOTOR AND GEARBOX

Regearing an OMI C&S 2-6-0

by Bill Adkins

Several years ago I had the opportunity to purchase an Overland C&S 2-6-0 #6, knowing full well that the model would require upgrading. This was especially true for the mechanism. I decided to take the project on, add a Lenz decoder, and paint and letter the locomotive for my San Miguel & Southern Railway.

Fortunately, NorthWest Short Line proved to be an invaluable resource and together we completed the project so successfully that I purchased an Overland C&S 2-6-0 #9 in order to illustrate this article. Oh yeah, the SM&S Ry. needed the motive power as well!

Hopefully the following photographs and captions will provide the incentive for those of you who have less-than-perfect running Overland Moguls to “get them out of the boxes”, and operating on your layout!

The Barriers

My customary method when approaching a locomotive project is to take my time and disassemble the locomotive, take notes, and label parts as necessary. I also place the parts in an ultrasonic cleaner to remove any lubricating oils. An added benefit is that the ultrasonic process often reveals any poor and/or loose solder joints; now is the time to fix them.

Knowing that I would be replacing the gearbox and motor, my attention was drawn to the driver axle diameter. A complication was identified when it was noted that the driver axles are 2.5 mm in diameter, while the axle provided with the NWSL gearbox is 3.0 mm in diameter. Time to call NWSL.

A second and known complication would be to requarter the drivers. Since the design of the original NWSL Quarterer, locomotive construction methods have changed (with bearings, sound cams, etc.), leaving little or no room to use the original tool, especially in S narrow gauge. Hmmm, what to do?

The Solution(s)

After discussing the axle diameter problem with NWSL, they felt that the best approach would be to turn a new 3.0 mm axle with 2.5 mm ends to match the drivers and bearings, as the rest of the gearbox and gear would fit perfectly. Knowing that others were in the same situation, they offered to manufacture the required part. Problem #1: SOLVED

The quartering dilemma remained and after some brainstorming I decided that I could modify and make do with the original NWSL Quarterer by thinning the inner support brackets to clear the bearings. So equipped with some Evergreen Styrene, a Foredom motor tool and drill press, and some blank inner support brackets for the Quarterer, I successfully made the modification. And with time and tweaking, it worked okay.

When I undertook the second locomotive rebuild, NWSL allowed me to experiment with a pre-production model of their newly redesigned Quartering Tool. What an improvement! This new tool allows perfect quartering as well as the ability to press on the driver(s) in one step. It works in multiple scales, multiple gauges, and even on outside frame locomotives with separate drivers and counterweights. And it’s “Purty ’nuff” to display in your brass case! Best of all, it is now in production. Problem #2: REALLY SOLVED

Enough introductions! It’s time to call NorthWest Short Line and gather up all the parts. Let’s get started.

Parts

Part # 16306-9 16 x 30mm 25 – 2.0mm Single Shaft Motor

Part # 139-6 0.3 Mod Gearbox kit 28:1 for Overland Sn3 Mogul

Part # 2598-6 custom machined axle for Sn3 OMI C&S Mogul #9 upgrade

Part # 164-6 Gearbox 2.0mm input shaft Conversion kit

Part # 3064-5 1.4mm drill and tap set

Part # 21146-5 1.4x 6 mm pan head screws (trim to length)

Tools:

Part # 45-4 The Puller

Part # 50-4 The Sensipress

Part # 5059-4 Sensipress accessories

Part # 44-4 The Quarterer

-or-

Part # 64-4 THE QUARTERER

Other Tools & Supplies

LocTite RC609 Retaining Compound -or- Gap Filling ACC

GE Silicone Sealant or equivalent

Usual modeling tools

Patience

Motor and Gear Box Assembly

Photo 1. Pictured above are the NWSL 16306-9 Motor, 0.3 Mod Idler Gearbox, and 2.0mm Conversion Kit. The motor shaft has been cut to an optimal length of 51mm to accommodate the available clearance. Two holes have been drilled and tapped 4mm from the bottom of the gearbox for 1.4mm pan head screws for the mounting of the torque arm. While not used in this project, the center hole in the circular motor mounting bracket would have to be enlarged and the mounting holes modified to fit the NWSL motor. The modified motor mounting bracket would then have to be resoldered to the torque arm.

Photo 2. The motor shaft and interior of the worm gear were thoroughly cleaned with acetone (use adequate ventilation and skin protection when working with chemicals such as acetone). A shaft bearing and washer were then placed on the shaft, and a very small drop of LocTite RC 609 Retaining Compound was applied to the inside of the worm. The worm was then slipped onto the shaft. Take a minute to remove any excess retaining compound and install the remaining washer and bearing. Now install the idler gear and carefully assemble the gearbox. Stand on end as illustrated and let cure for about six hours. This should ensure that the motor, worm, and idler gear will be properly aligned in the gearbox.

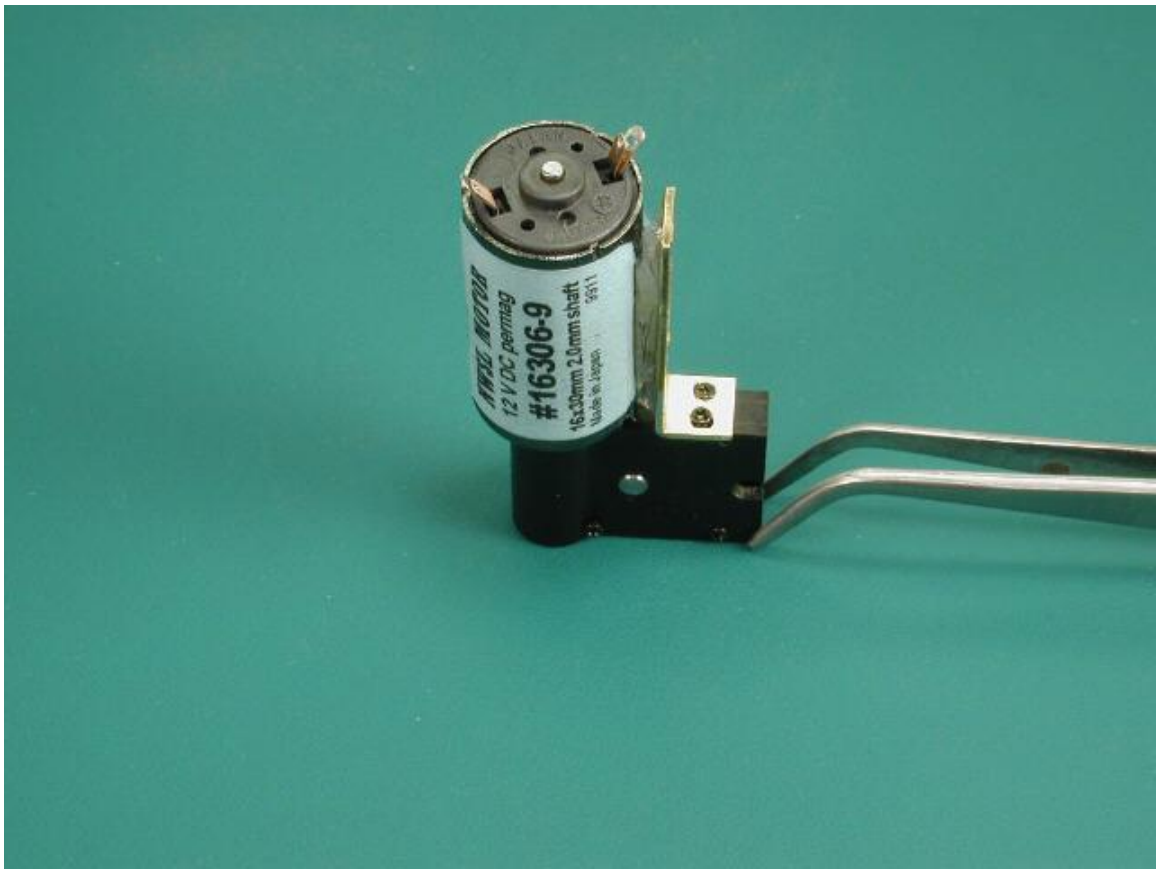

Photo 3. Once everything has had time to cure, the gearbox is disassembled to ensure that any excess LocTite did not bind the shaft to the bearings or washers. If this has happened, an X-ACTO blade or single edge razor blade can separate the washer or bearings. In my particular case, I removed the front washer to allow for adequate endplay. Once you are satisfied that all operates smoothly, screw the torque arm on to the gearbox, and install some GE Silicone Sealant between the torque arem and the motor. Once again, stand the assembly on end and let cure for a full 24 hours. This completes the motor and gearbox assembly.

Driver Quartering

What used to be a dreaded part of a locomotive rebuild or tune-up is now much easier, thanks to NorthWest Short Lines' new Quartering Jig. But do remember to work carefully and accurately, as we want to insure a tight press fit by limiting the number of times a wheel is "pulled" from the axle. Note that your production model of the New Quarterer may differ slightly from the photos, but the methods will likely be the same.

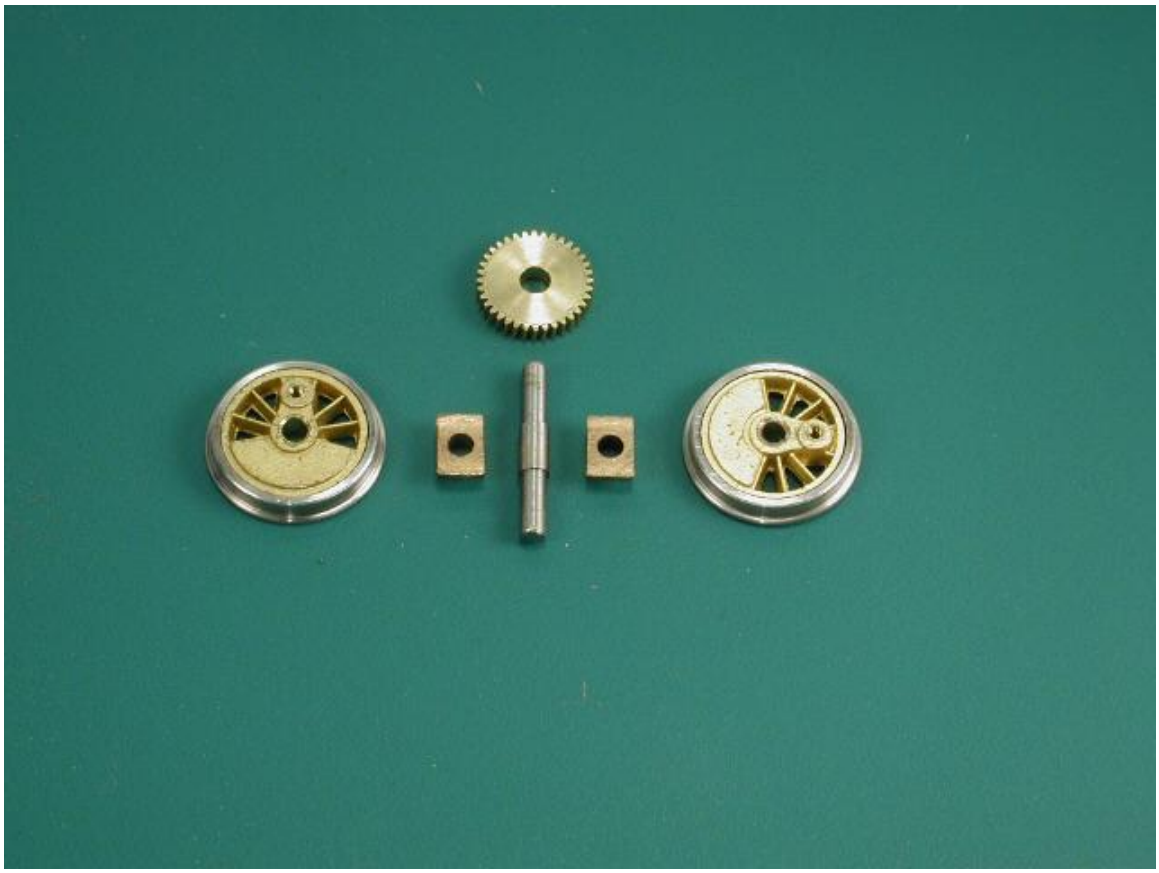

Photo 4. Using the NWSL Puller, both wheels and both bearings have been removed from the original geared axle. The new axle and gear are pictured, along with the drivers and bearings.

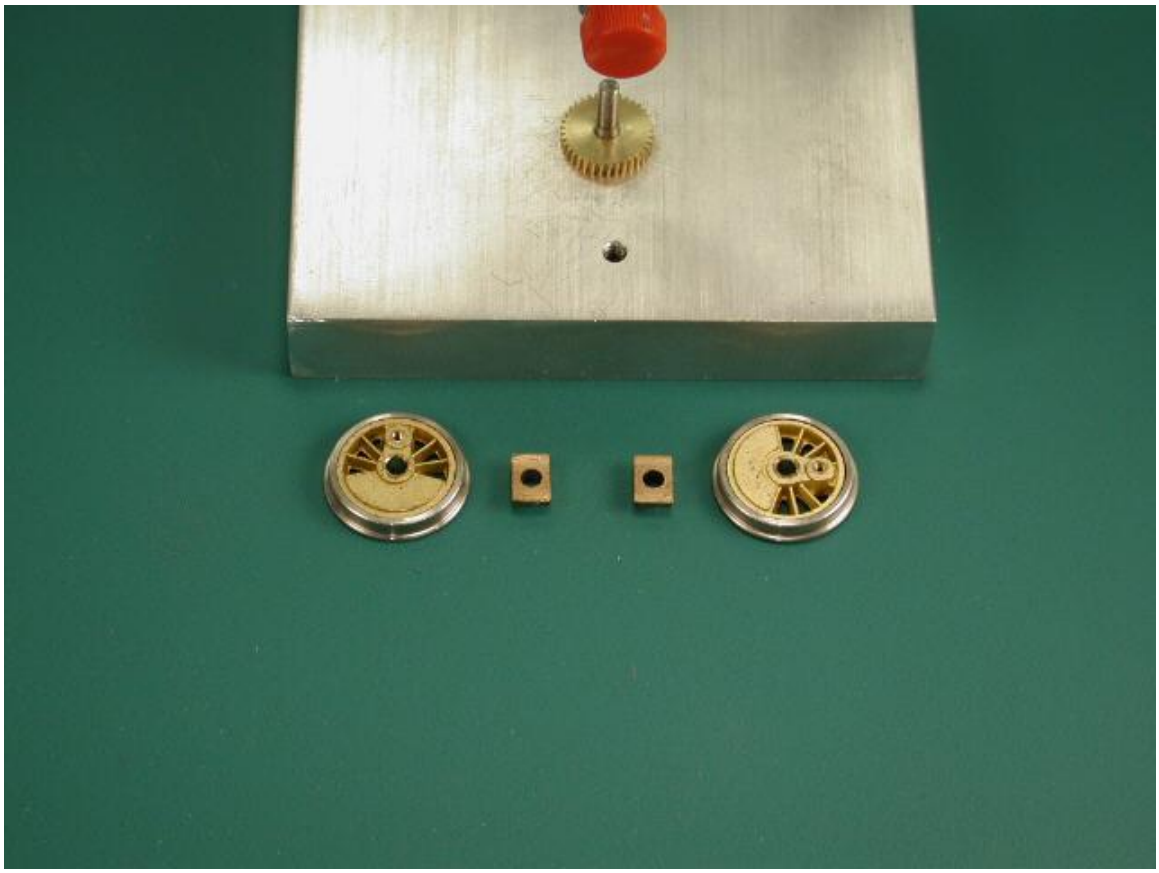

Photo 5. Using the NWSL Sensipress, the new gear is pressed to the exact center of the new axle, true and square.

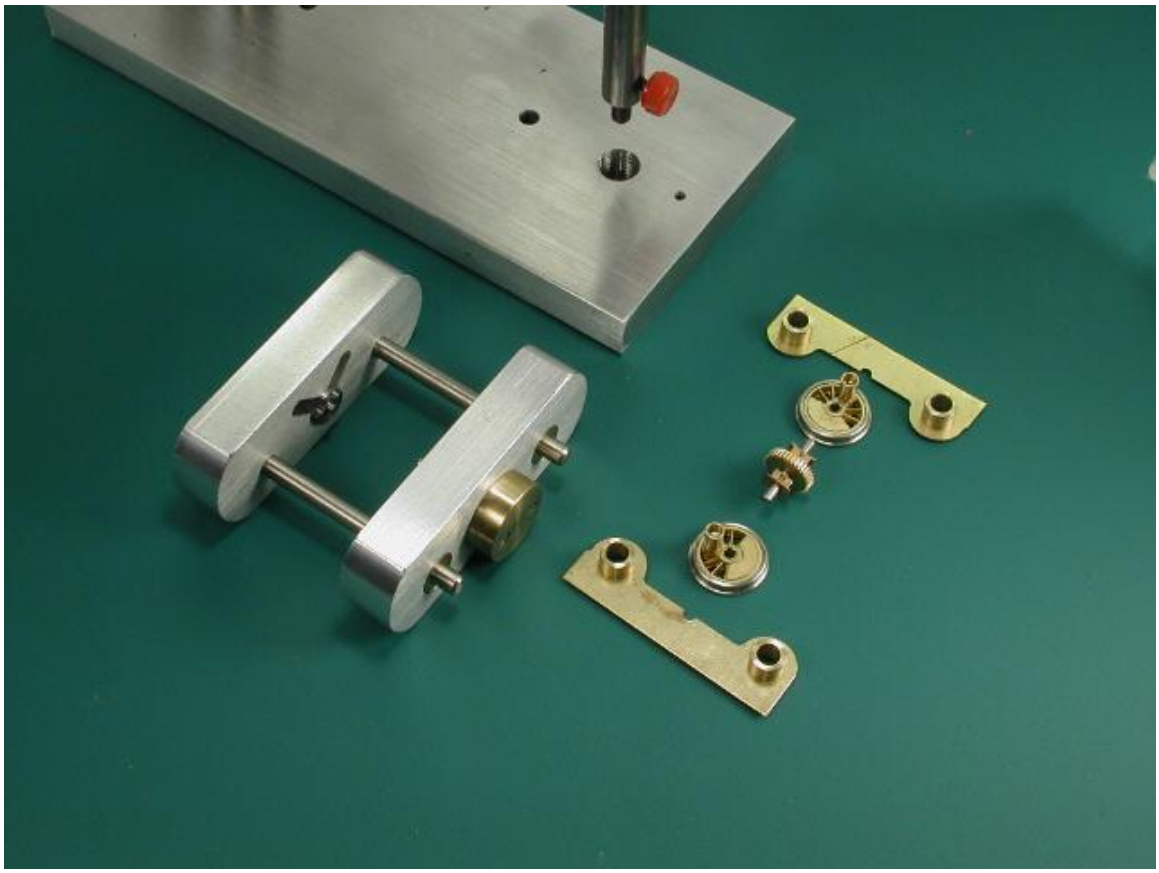

Photo 6. The bearings – flanged side out – have been placed on the axle, and the drivers and the geared axle are now ready to be mounted in the Quarterer. Two sets of brass alignment plates are required for this project – 3.0mm for the second axle, and 2.5mm for the first and third axles. This is necessary because of the differing axle diameters…remember?

Photo 7. The main driver kingpin screw will be used to secure the brass collets to each driver. One 3.0mm alignment plate, notch up, is placed on the ends of the Quarterer's alignment pins. While the geared axle is held in place, the second 3.0mm alignment plate, notch down, is placed on the ends of the Quarterer pins. This results in a "sandwich", which keeps the geared axle perpendicular and centered in the jig. Using the RIGHT side of the jig as reference, the INSULATED driver is placed with the brass collets in the FORWARD slot and the driver hole on the centering pin. Then the "sandwich" is slid snug against the right driver. (Think "RIF")

The uninsulated driver is similarly placed on the left side of the jig, with the collets in the rear slot driver hole on the centering pin. This procedure is much easier to do than to describe, but it may take you an attempt or two to align everything perfectly. Did you remember the bearings, and orient them correctly?

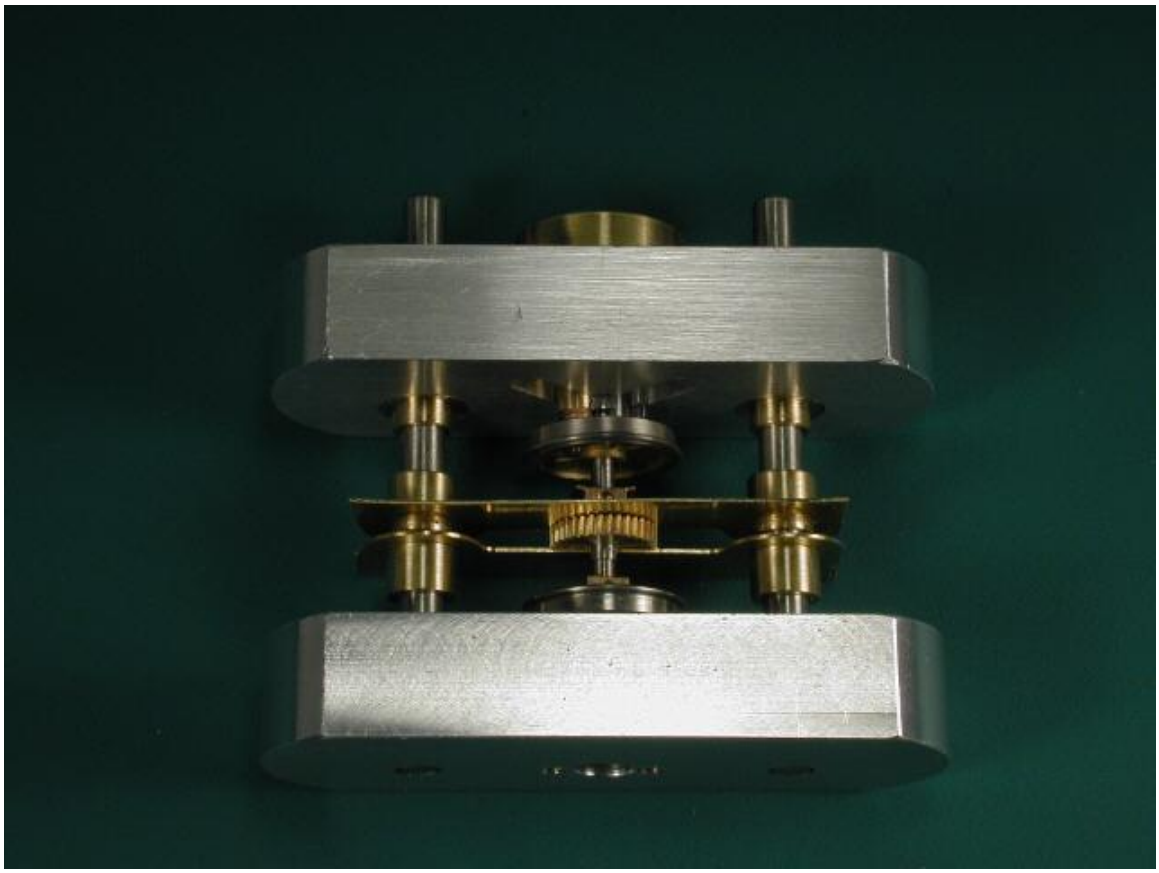

Photo 8. Another view of the drivers and geared axle aligned in the jig. Careful examination of the photograph reveals the insulated driver on the bottom, collets forward (right), bearing, 3.0mm alignment plate with notch up, gear, 3.0mm alignment plate with notch down, bearing and uninsulated driver on top with collets back (left).

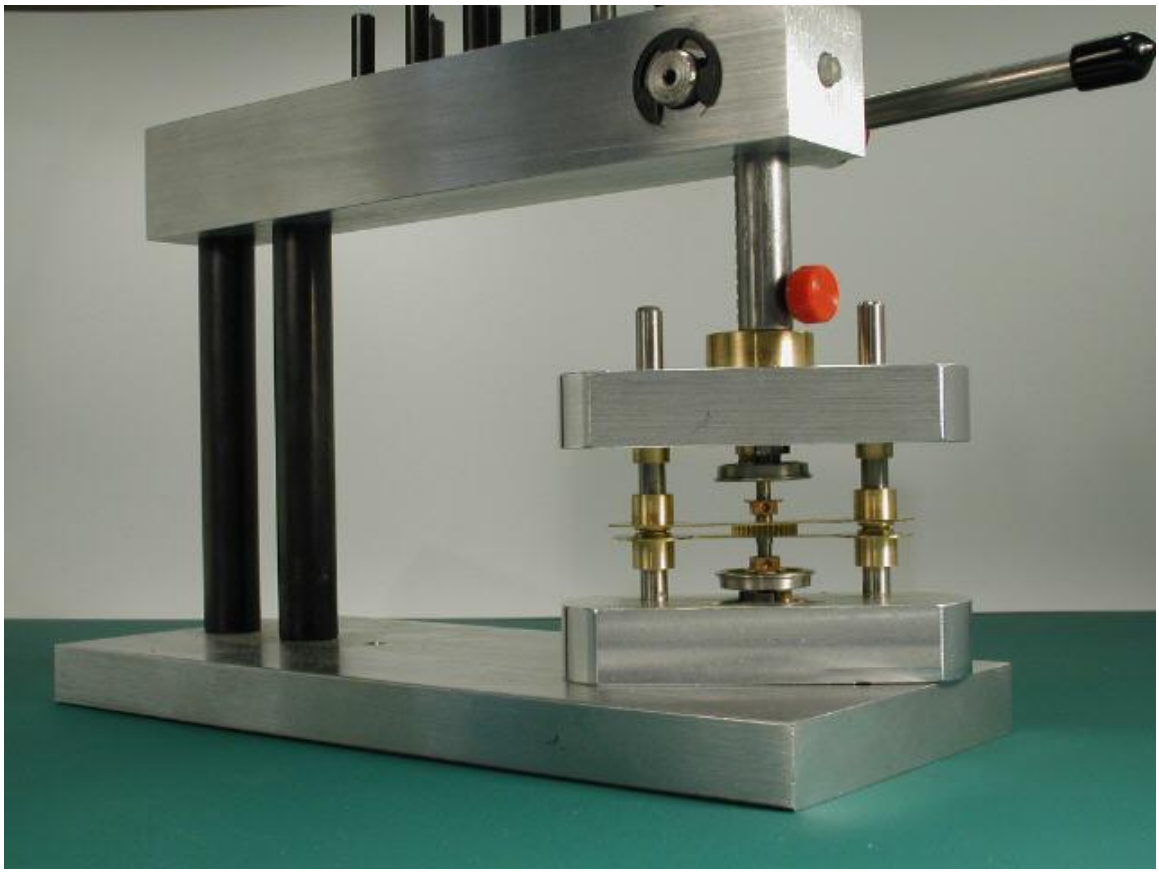

Photo 9. The driver assembly and jig is now placed in the NWSL Sensipress, and the assembly is pressed home. Is this cool or what ?!!

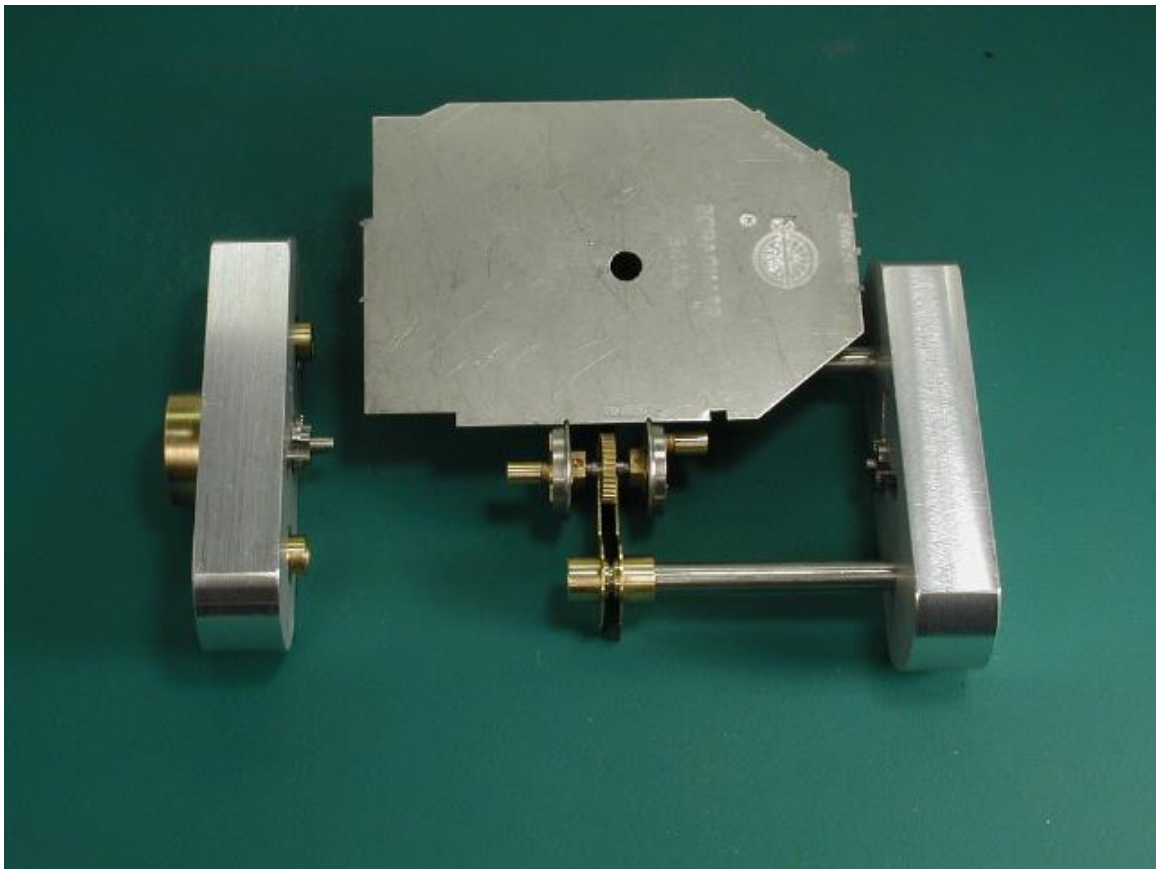

Photo 10. The Quarterer has been opened up and the gauge of the wheels is checked. It may be necessary to "tweak" the drivers slightly, by using either the NWSL Puller and/or the NWSL Sensipress to ensure perfect gauge. Just remember to work carefully, so as to keep the fit tight.

It will be necessary to repeat the process for the first and third driver sets, but using the 2.5mm brass alignment plates. However, this time you will only have to remove one driver (I would suggest the uninsulated driver) but remember "RIF"! The end result will be three driver sets, perfectly quartered and gauged. I repeat…IS THIS COOL, OR WHAT ?!!

Reassembly

With the motor and gearbox completed, new axle gear installed, and all drivers quartered, it's now time to reassemble the locomotive, lubricate it, and put it on the test stand for some running-in time.

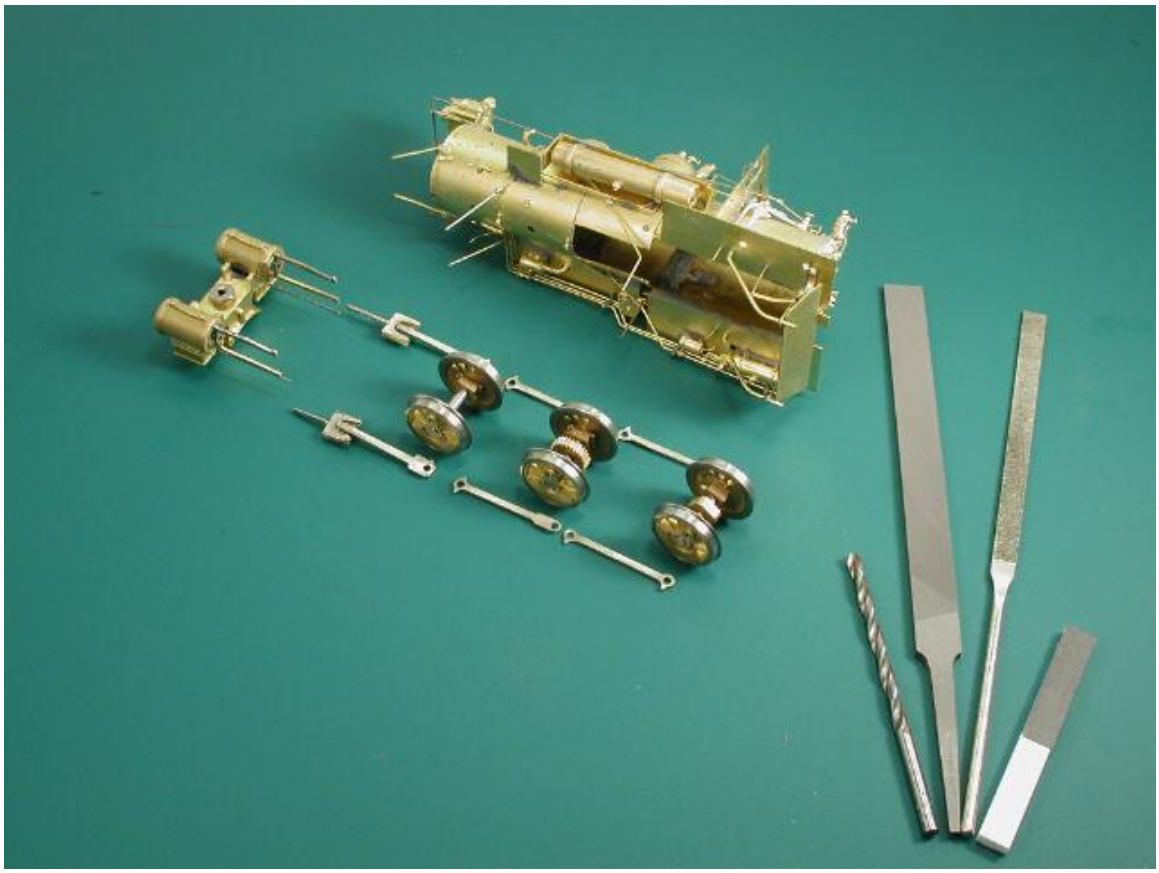

Photo 11. At this stage, we will want to identify and remove any additional sources of friction that may cause binds to the mechanism. An initial approach is to examine all parts that are put into motion and remove any burrs that are caused by manufacturing. As an example, gently slide your fingers over the inside edges of the side rods – feel the sharp edges? We need to remove them, to prevent any chance of binds. Same for the slide valve guides, etc.. Tools as illustrated include a drill bit for the side rod holes, fine-toothed files, and a polishing stick made from a piece of 1/8″ x 1/4″ styrene strip with a small piece of 660 grit sandpaper attached with spray adhesive. The polishing stick is used to polish all bearing surfaces on the drivers, as well as the side rods.

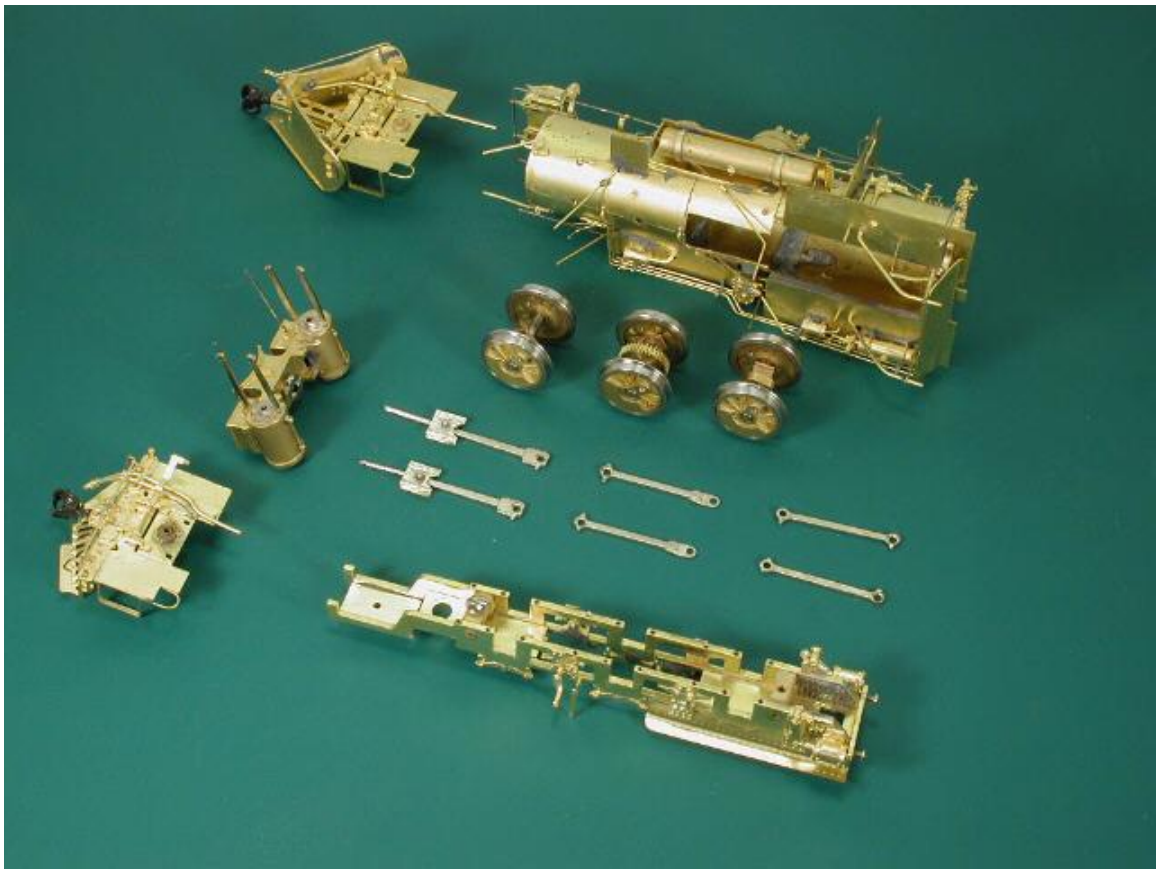

Photo 12. A lot has been accomplished in this photograph! We have used the tools illustrated in the previous photo to polish all bearing surfaces to prevent binds. We have also installed working self-centering couplers on both pilots, and material has been removed from the underside of the boiler up to the nearest boiler band to accommodate the new gearbox. As well, a hole has been drilled in the frame and tapped for a 1.4mm pan head screw that we will use to attach our ground wire to. A close examination of the back of the cylinder heads revealed that the manufacturer had already removed some material to prevent the cylinders from contacting the first driver due to lateral motion. It will be necessary to remove a little more material, especially if you intend to install a DCC decoder, to be absolutely certain that intermittent shorts will not occur.

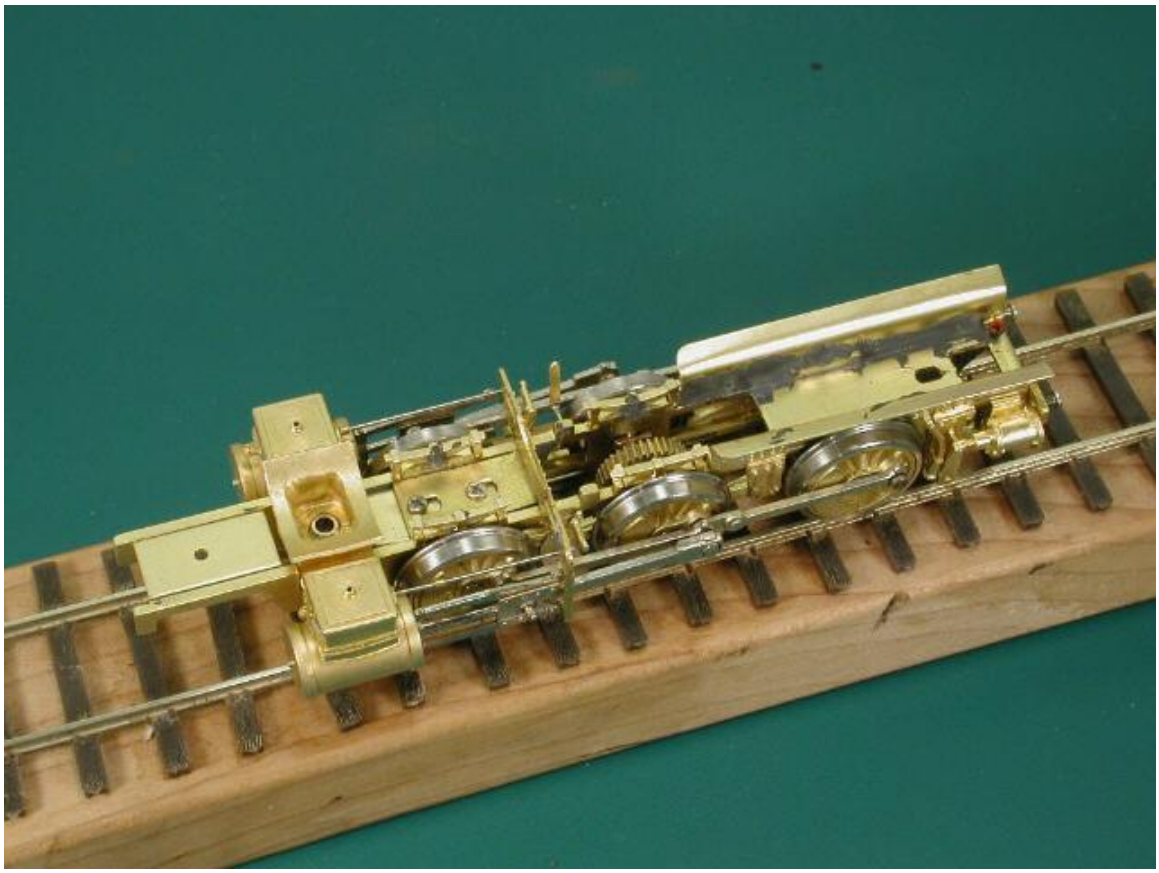

Photo 13. Use your polishing stick and polish both the frame and driver bearing surfaces for a smooth fit. As you discovered when disassembling the locomotive, you now have three driver sets, six retaining plates and twelve 1.0 mm screws to reattach. Take your time! I put a very small drop of ACC in the dimple of each axle bearing and using a non-magnetic pair of tweezers, placed the driver spring on the bearing and let it set up for a few minutes before installing the driver. With all three driver sets installed, roll the frame back and forth on a piece of track to check for binds. Install the side rods for the second and third driver sets, and again test the rolling quality. Then install the side rods for the first and second driver sets and do the same. Any drivers out of quarter or siderod binds should be identified, and corrected. Install the cylinder chest, valve gear hanger, and main rods. Examine for clearance between the front drivers, cylinders and other moving parts of the mechanism. Adjust as necessary. Even though we haven't applied any lubricant yet, our mechanism should roll smoothly and without binds. Note on the rear right hand side of the mechanism the 1.4 mm grounding screw, which is painted red for clarity.

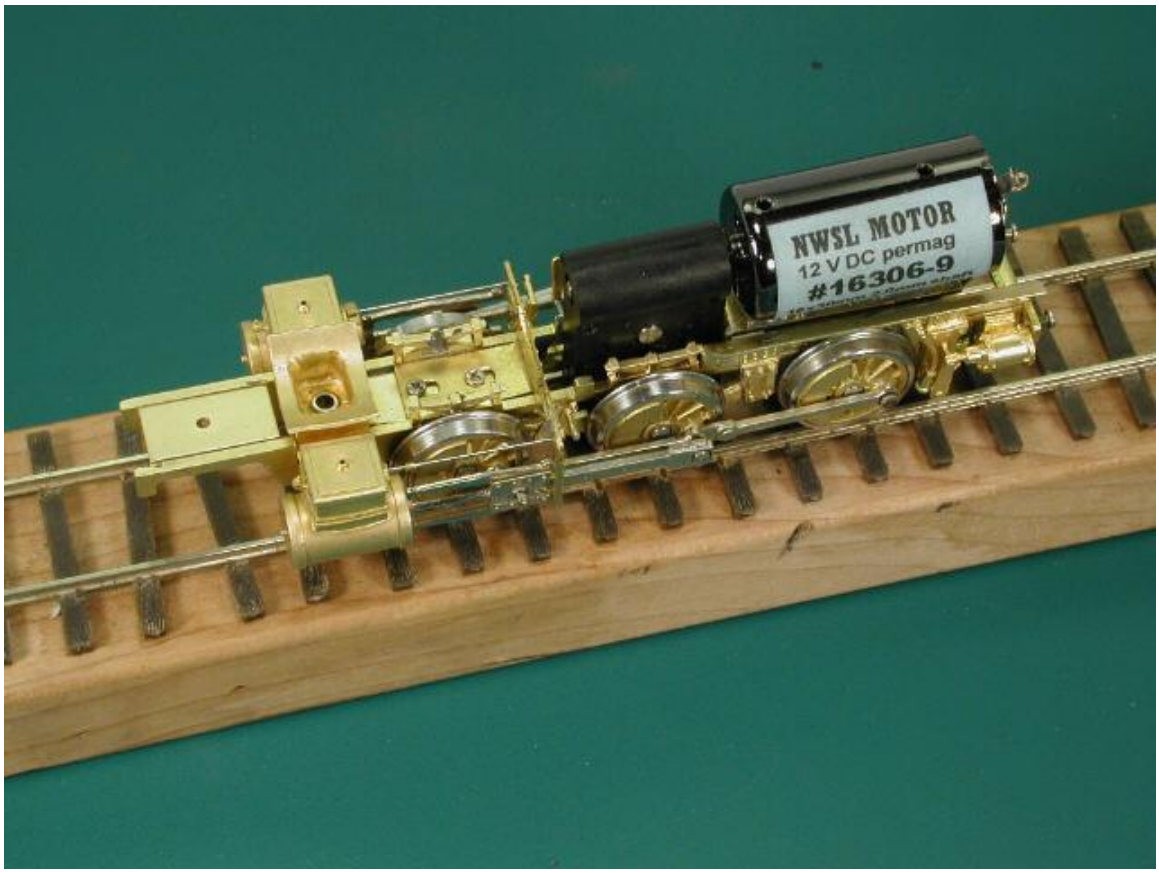

Photo 14. Before attaching the gearbox to the mechanism, a small amount of silicone grease was applied to the gears. After attaching the gearbox and torque bar to the mechanism, a small amount of oil will be placed on all bearing surfaces: crosshead guides, side rod screws, etc.. Next we will prop up the mechanism on a couple of pieces of wood to clear the drivers, apply a few volts of DC, and run the locomotive in for about 15 minutes in each direction. Perfection !!!

Conclusion

This appears to be a good place to end this article, as the rest of the project is traditional and customary. At this point, I reassembled the locomotive, added weight to the boiler, and thoroughly tested it on conventional DC. The locomotive was then disassembled (again!), cleaned, and is currently awaiting its turn in the Paint Shop. When it emerges – with a DCC decoder installed – it will take up its place on the SM&S roster as #17.

Good luck with your upgrade, and if you have questions or need clarifications just let me know.
Bill Adkins