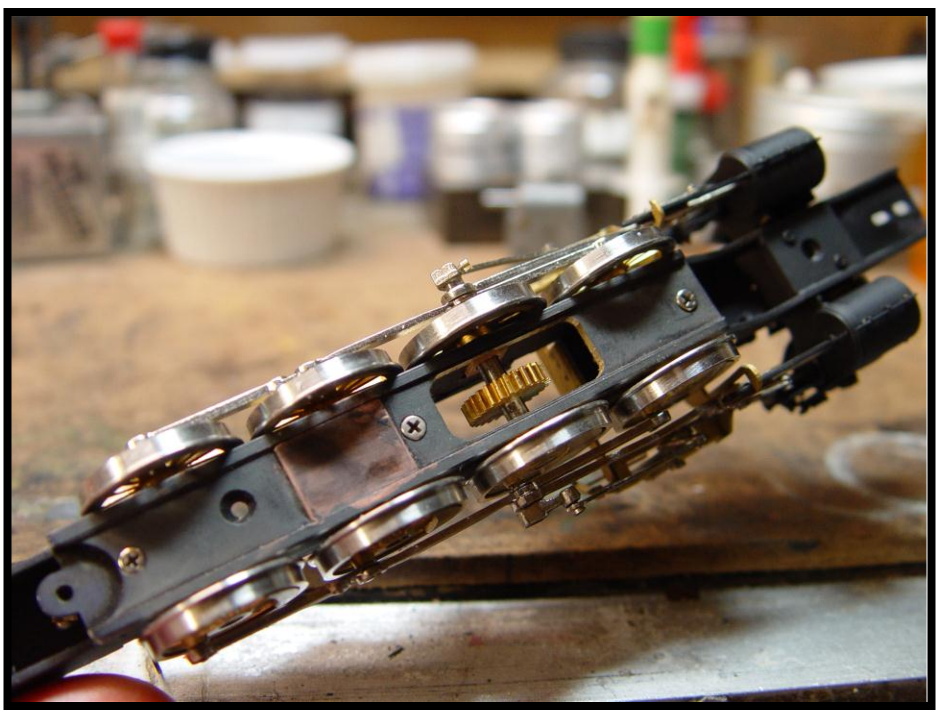
Modeling the O&W
A tune-up for the NPP Class Y-2 4-8-2 – Part II
No. 46 in a Series
By Mal Houck

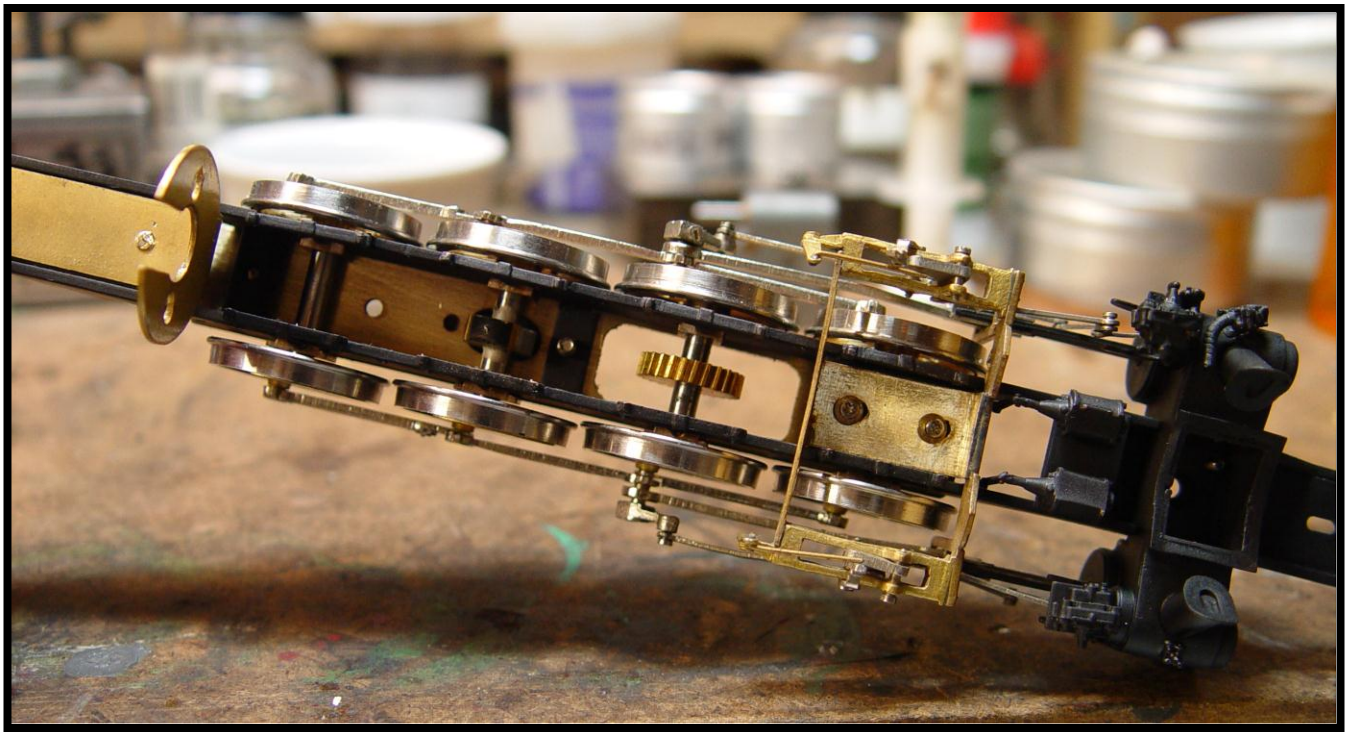
This portion of the Y-2 rebuild blog will describe some enhancements to the mechanism of the model. Once refined and all assembled, on a level bench surface or test track the "bare" chassis should roll with virtually a "flick" of the finger. Anything less is predictor of possible troubles later.

One this particular model there was a slight "rocking" fore and aft, with very little pressure, when tested on my granite surface plate. One "truth" of the so-called "sprung" mechanisms of brass locomotive models is that the springs, and springing, have absolutely no effect when running over uneven surfaces or tracks. The springs serve only to force the axle journals firmly down on the bottom retainer plate. Accordingly, the bottom of the frame must be absolutely dead straight. In complete disassembly I dress the bottom of the frame first by running it over a 14" mill file, and then with a rub on 220 grit wet-dry (used dry) paper either on the surface plate or the surface ground feed table on my bandsaw.

I then make a completely new bottom plate from 1/8" thick Schedule 360 brass plate. The thick brass adds some additional weight to the model, over and above the stock weight . . . and, optimally, it's down low!



Reassembled after painting the frame and cylinders this view is of the new bottom plate. It has been milled with a relief at the rear for the new trailer truck (replacing the pitiful original NPP offering). It is further milled to create an opening for the gearbox. Lastly, it is milled down the center to remove some of the excessive thickness of the 1/8" material from which it is made. The plate between the third driver set coves clearance relief in the bottom plate for a Grizzly Mountain Engineering sound cam; -- installed with epoxy per GME instructions and then painted with conductive paint. The tapered hole to the rear of the cam cover is for a nylon 0-80 screw which holds down the bit of PC board to which the contact slider and conductor wire back to the DCC decoder are soldered.



This view "inside" the frame shows the clean burnished upside surface of the new bottom plate. The GME sound cam is clearly shown on the third axle; -- selected as a choice location given the room to fit the contact slider inside the frame and out of harm's way if installed beneath the bottom plate. Above the left cylinder is the lubricator left missing by NPP, and in the center of the cylinder saddle are the brake cylinders similarly omitted by NPP.

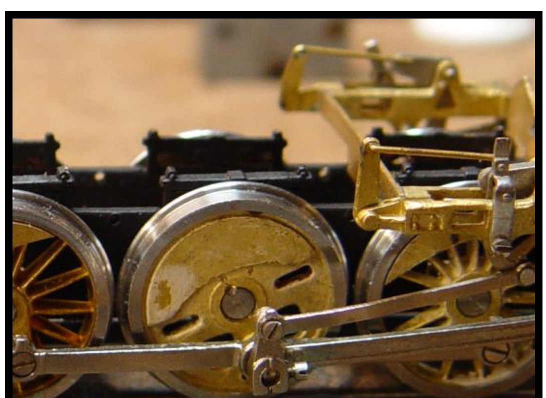
As a general procedure with brass locomotives I trim, true up and "tram" and square up the whole mechanism before any painting . . . as shown in some of the images in the first portion of this blog column. When all is to satisfaction I completely disassemble (again) the entire mechanism, and then grit blast the cylinders, the bare frame and bottom plate. The frame and cylinders are painted with [clear] Steelcote® primer and then painted with Scalecoat I paint and baked in an old Dry-Clave medical sterilizer oven that I use for the purpose. The driver set, with rods in place, is cleaned in a small ultra-sonic cleaner using one of the commercial citrus based cleaners for the auto parts stores.

When the frame and cylinder set have cooled the mechanism is re-assembled to the extent shown in the image above. Some narrations and articles covering the topic of brass engine painting suggest careful scraping the paint from the edges of the "slots" for the journals. My personal opinion is that this's a complete waste of time. The sintered bronze journals should slide easily in the frame slots, all to suggest possible intermittent contact, one journal to another. Making certain that the "top" of the bottom plate to be in contact with the journals is polished and clean I then put small drop of dielectric contact grease (also found as an auto parts store staple) on the bottom of each journal. This method both insures contact and good conductivity and it at least arrests the formation of a non-conductive oxidation of the bottom plate contact surface. I have used this method for decades, and even recent removal of a similar bottom plate, installed in the same way years ago, showed no evidence of any troublesome non-conductive oxidation.

On a prototype steam locomotive the drivers are "quartered"; --that is they are phased ninety degrees in rotation across the axle set; -- the crankpins are 90 degrees "apart." Most roads preferred a "leading" quarter while some preferred a "trailing" quarter: -- but the choice is academic. The purpose of quartering was so that the locomotive would not get “stuck” without a usable impulse to commence any motion or movement. Another “truth” of model steam locomotive construction is that quartering is utterly meaningless insofar as power is supplied via the worm, worm gear and geared driver. The side rods serve the same purpose on a model as on the prototype: -- to transmit power to all driver sets, but there the similarity between model and prototype ends. The only requirement for drivers on a model is that they all be the SAME(!); -- accurately quartered at ninety degrees………or in any other phase as long as they are ALL the same! If all drivers are not in phase then the mechanism will have a hitch or bind. I have worked with model steam engines for over forty years and I have tried all of the gadgets sold as quartering jigs, and even beginning with a home-made jig. If a model exhibits a bind, then surely all of the drivers must be put through the exercise of being re-quartered, but if there is no such problem, and only the removal of a single driving wheel is needed in order to install a new worm gear, then there is another and simpler method at hand.

On this particular NPP Y-2 model the mechanism as originally set up (and after those refinements already described) rolled beautifully. However, the NPP gearbox simply had to be replaced. It was positively the sloppiest fit I have ever encountered on a brass engine . . . that is except for EVERY other NPP Y-2 model I have or have ever worked on! The worm shaft bearings fit poorly in the gearbox, even to the point of rotating with the worm shaft. The worm shaft wobbled in the bearings proper, and the entire gearbox sat poorly on the driver axle; -- essentially riding on the gears within. After wasting considerable time attempting to tune this gearbox up it was summarily discarded. The un-insulated driver was pressed off the axle along with the gear, which was discarded together with the bearings for the gearbox. Once the new gear for a KTM gearbox from Precision Scale was pressed in place then the driver had to be re-installed……and in proper phase with the OTHER three drivers.

The editor of the late hobby publication “Rail Model Journal” used to like to designate certain demonstrated techniques as “Modelers' Trick.” Well, here's a Modelers' Trick” I've developed when having to deal with only a single driver pressed off its axle and then re-installed;



Before removing the driver in question I make a small “witness” mark by drilling a shallow hole right at the end of the axle, as shown in the image above. Press off the driver, press off the old gear, press on the new gear, align the witness mark(s) on the driver and axle end and press the driver back firmly onto the axle, checking the gauge with an NMRA gauge plate. Always make sure to orient the bronze journal properly with its flanges to the outside of the frame, otherwise the driver removal and re-installation may have to be repeated to swap the journal around (don't ask how I know this . . . or how I learned this lesson (!)). A last treatment, while the drivers and mechanism are so largely apart is to check the other drivers for correct gauge. On the subject model here three of the four drivers were “tight” and thus explaining a propensity to derail while test running around my club layout. I checked an untouched NPP Y-2, yet to be rebuilt and found three of the four drivers to be similarly out of gauge.

Here the motor and new gearbox are installed. In this application a short piece of model airplane fuel line is used as shown; -- though not yet completely aligned. Notice that, in order to keep the very limber fuel line from "whipping" about, I insert a piece of rod into the tubing. The ends remain flexible enough to absorb some shock and serve in place(s) of universals….but then without the need to craft an additional torque arm device for the gearbox body.

If another "Modelers' Trick" there be for this column, it's pictured above. Very short slotted screws can be a headache to seat and screw in place…especially if the Paul Jansen designed screw "picker" has not enough room to fit or swing. A lesson learned in the restoration of antique Indian motorcycle Schebler and Linkert carburetors, which contain many small slotted screws and to keep screwdriver blades from slipping from or damaging the screw head slots, was to dip the screwdriver blade into some valve grinding compound; -- grease mixed with #220 silicon carbide abrasive. This's sold in automotive supply stores, and sometimes branded or labeled as "lapping compound." Well, that works well in modeling applications; -- especially with those short slotted head screws holding the bottom plates to gearboxes. The grease medium is sufficiently "sticky" to hold the screw while orienting placing it properly. The image above shows this incidental effect and use.

Two other remarks are in order concerning the preceding images. First regarding the use of silicon carbide "lapping" compound; -- I find it useful in smoothing the operation of gearboxes. On this particular NPP Y-1 the gearbox was assembled from a KTM kit as mentioned, but upon the initial assembly it was more than just a little stiff! The bronze bearings for the worm shaft were very rough and the rotation of the worm shaft just with finger impulse felt.... in a word . . . "gritty." The holes in the sides of the gearbox casting had to be carefully reamed out with a #31 drill and the axle slot for the 3mm axle was very tight.

I first applied some lapping compound in the axle bearing slots and assembled the gearbox halves, with no internals, and then locked in a length of 3mm steel shaft stock with the bottom plate nicely tightened down. I then chucked the shaft end in a hobby lathe, and ran it in both directions for a very short time. The shaft stock slipped easily from the bearing slots.

I then applied tiny driblets of lapping compound to the worm shaft, the worm and worm ear and re-assembled the entire gearbox. Chucking the worm shaft in the lathe chuck and running, again, in both directions of rotation, successfully "ran in" the cranky gearbox. All parts were then cleaned in a heated ultra-sonic cleaner. A second re-assembly and run in with a much finer abrasive in the form of 5μ diamond paste refines any unevenness to the finish of rotating parts. Again, all gearbox parts were ultrasonically cleaned, lubricated, reassembled and installed on the locomotive frame.

While DCC control, with its BEMF feedback features can compensate for some minor running troubles and smooth, to a degree a less-than-silky-smooth mechanism, there's just no substitute for this sort of "pre run-in" I've described. Years back, before settling on the use of automotive lapping compound I can recall doing much the same sort of exercise using toothpaste as a mild abrasive.

To summarize, the careful frame set up (I roll test mine on the same track for roll testing passenger and freight trucks) to end with a flawless easy roll, without pauses or hitches, and then careful assembly and run in of the gearbox, will insure a locomotive with running characteristics as near flawless as can be expected . . . considering the starting point.

The second promised remark is: -- once having gone through all of the multiple assembly – disassembly – touch up – "tweaking" and a final assembly of the mechanism . . . I do NOT take it apart again for painting. I am of the "Spin 'n' Spray" school. I hook up the motor and run the mechanism while first spraying on a clear primer, and then an overall coat of my version of "Locomotive Black." After allowing the paint to flash off (while cleaning the airbrush) I then clean the driver tires using a pipe cleaner dipped in solvent. Driver cleaning is done, in the same way, at several other times during the final finish and preparation of any locomotive that I paint.

This last image is of the custom boiler weight made for this Y-1 model. The NPP weight included with the model was but a short piece of brass round adding next to nothing for additional weighting. In the past, when I had access to a set of cope and drag sand casting flasks, and a supply of molding sand, I cast any number of boiler weights from either lead or Hammer Metal®. I have even machined some boiler weights from solid brass rounds, but now prefer the method used for this model and of first preference.

I now first turn a round of PVC rod to a diameter that slips cleanly into the boiler shell. It is then bored out to about a 1/16" wall thickness, and then this new tube is poured full of melted low temperature bismuth alloy metal. Unlike lead which has a melting temperature around 590 degrees F., the bismuth alloy used here melts at a temperature somewhat below the boiling point of water. That low temperature melting point feature leaves the PVC unaffected.

As seen in the image I then machine it to "saddle" and fit over the gearbox, and machine shallow relief for the protrusion of the front boiler mount screw into the boiler shell. I drill a #31 hole in the center of the weight to line with the hole for the boiler weight screw in the bottom of the boiler. Whereas the weight material is so soft then turn a small brass round, bored and threaded for a 2.0mm screw, which is then knurled and pressed into the hole in the weight. The boiler weight can then be screwed down in place the use of an oversized and ugly self-tap sheet metal screw or wood screw; -- either of which will ultimately strip out of the soft weight material.

To shorten this blog, I will now end and promise a third part to describe detail changes to the engine superstructure and the modifications made to the tender body, tender frame and tender trucks for a reliable and comfortable installation of a DCC –sound decoder, TCS KA-2 "Stay Alive" and speaker.

More Later. . . . .Mal Houck