RIDING RAILWAYS
NEWSLETTER

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Your submissions are always welcome, both for this electronic newsletter and for our print publications. Please send information to the address above or to ***mainline@sunset.net***.

Hello everyone, and welcome to the February issue of the **Riding Railways Newsletter**. As I write this, it is a blustery day. Rain, dark clouds, lots of wind. Yet it won't be long before spring is here and we are all ready to play trains! I would like to hear how you prepare your railroad for the spring season. What sort of track work do you have to do? Engine upkeep? Have you built new equipment this winter that you're itching to get on the rails? Please share your stories and photos.

Regards,

Susan

FLUE SWAGING MADE EASY

by the late Rudy van Wingen
with thanks to Bill Divine and Lorin Brown

Copper flues can be installed in steel boilers by silver soldering or swaging. Swaging has several advantages, however, not the least of which is easy installation and easy removal if they needed to be replaced.

Chuck up the steel bar and center drill, drill and tap one end 1/4-28 or 1/4-32 at least 1" deep. If bar is not square or hex, mill the other end to fit nearest available-size socket from your set.

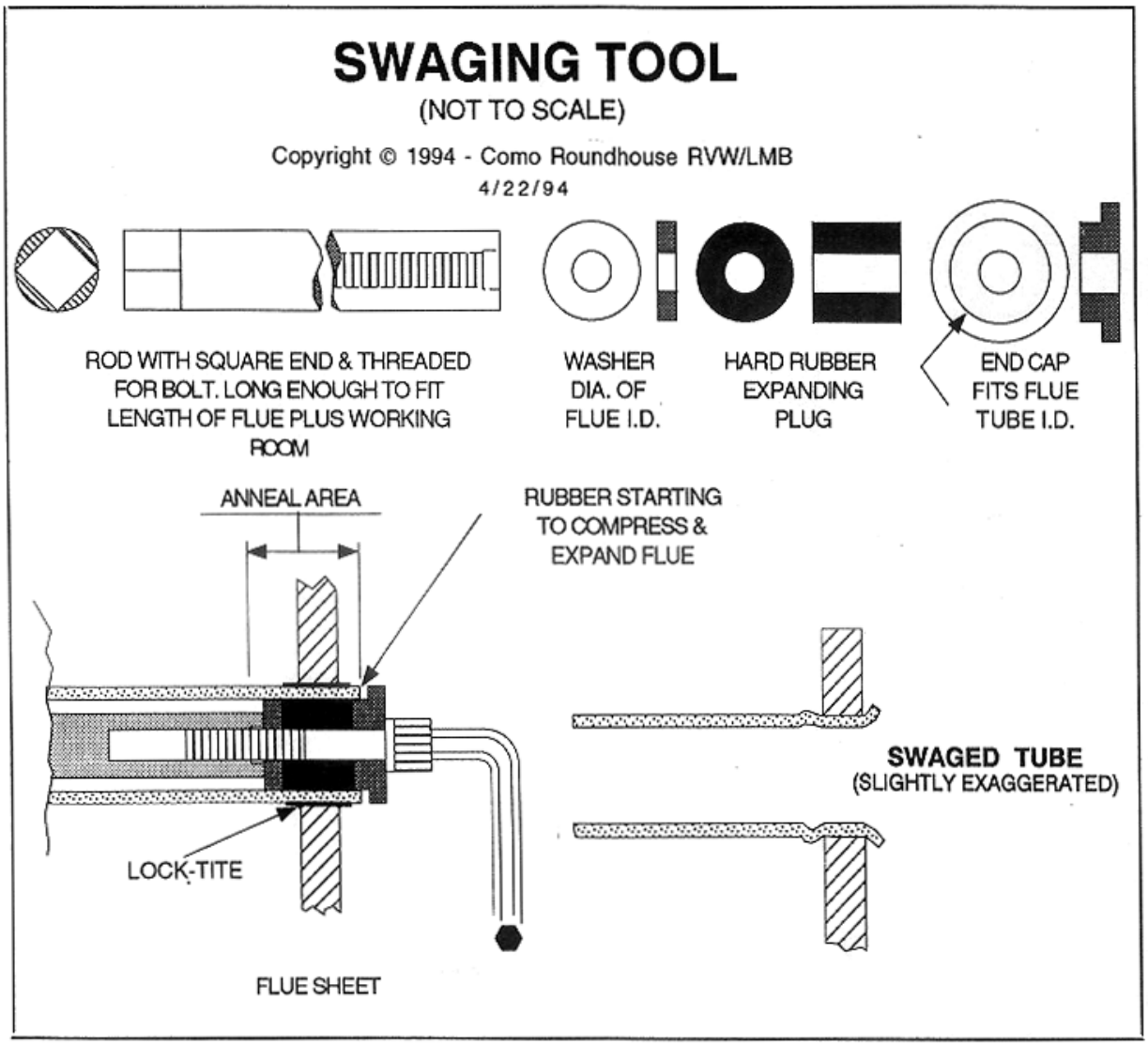
Machine rubber OD to fit flue ID and cut to length. (Length = flue sheet thickness + 25%)

Cut one aluminum washer to fit flue ID. It should be about 3/16" thick with 1/4" clearance hole. Then cut another washer about 1/4" thick with an OD equal to or larger than the flue tube OD. Turn a step in the washer that will just slip inside the flue tubes.

Anneal the test flue tube pieces. (To anneal copper,

Materials that will be needed:

- Dentist's angled mirror or equivalent.
- Small penlight or equivalent.
- Steel bar about 2" longer than flue length and smaller than flue ID. Hex or square bar would be great.
- 0.34 oz. (10 m1.) bottle of Loctite #515 sealant/gasket eliminator or equivalent high-temperature sealer.
- Can of good-quality spray carburetor cleaner and/or 6 oz. spray can of Loctite.
- #2556 "Klean 'n Prime's Supply of soft rags or paper towels.
- Steel wool.
- 6" bar of aluminum slightly larger in diameter than the flues.
- 1/4-28 or 1/4-32 x 2" socket head Allen screw.
- Black, hard-rubber cylinder same OD as flue ID with 1/4" hole in center, at least 1" long. Chemical company bottle stopper can be machined to fit or you can use a rubber "spring". [These are hard rubber cylinders sold for use in certain applications in place of compression springs.)
- 1 can STP.
- Test piece of scrap flue sheet with several flue holes cut in it.
- Several test pieces of scrap flue tubes about 3" long.
- Piece of blackboard chalk.
- A minimum of one helper whose skill you trust.



heat to red heat then plunge in cool water.)

Place some STP on bolt, on both washers, on rubber slug and assemble to steal shaft with the large end of the stepped washer under the head of Allen screw and the small end facing the shaft. Tighten up the Allen screw and note how the rubber expands. Now insert a flue tube test piece into the test flue sheet scrap with the ends of the test flue extending 1/8" beyond the test sheet (you'll probably need to prop up the long end to hold it square to the flue sheets

Now put the steel shaft through the test piece until the stepped washer seats into the short end of the test piece. Tighten the tool using socket and Allen wrenches, and observe the swaging action. Count the number of turns that are required to get a good swage. (Don't worry, you'll recognize it when it's right) record this number of turns and you are ready to start on the real boiler.

Make sure the boiler is as clean as possible before you start to install flues. Most towns have a boiler servicing facility that cleans, repairs and provides for commercial boilers in hotels, motels, cleaners and bakeries. They usually have acid tanks big enough to take even the largest of our model boilers, and will clean your flueless shell for a very few dollars or a promise of a train ride. Often they can provide you with water treatment chemicals tailored to local conditions, too.

Cut the flue tubes to the proper length. (The proper length is the distance from the outside of one sheet to the outside of the other flue sheet plus 1/8" on each end or 1/4" for both ends). Anneal about 2" at the ends of all the flue tubes.

Clean the outside ends of the flue tubes and flue holes with carburetor cleaner or Loctite "Klean n' Prime" and a soft cloth or paper towels. Carburetor cleaner is cheap and easy to obtain. The Loctite product is both expensive and hard to find (except in big cities) but it is highly recommended.

Using a small diameter guide rod, insert flue tube in top row hole and align. Check fit and length. Leaving the guide rod in place, slip flue flue back slightly into boiler one end at a time and "dope" hole with sealant. Push flue tube through so that

1/4" or so sticks out and dope end of flue tube and repeat the process on the other end, then center the tube between the sheets. A gauge would help here.

Put a small (1/4" diameter) guide rod through matching front and rear holes the flue sheet. (I prefer to do the top row first. Some people feel that it is better to start with the bottom row of flues. I prefer the alternate, but I don't think it makes a lot of difference.) With the guide rod in place, insert a flue tube in the hole and align it, checking fit and length. With the guide rod still in place, slide the tube back and "dope" the hole with sealant. Repeat the process at the other end. Center the tube in the flues. A simple aluminum gauging fixture will help center it.

Disassemble the aluminum washer / rubber slug stack for the swaging tool's steel shaft, remove the guide rod carefully, and carefully insert the steel shaft into the tube, working from the front end of the boiler, with the tapped hole going in to the rear flue sheet. You or your assistant will need to steady the flue tube from the other end while you do this. Lightly recoat the OD of the stack of slugs with STP and reassemble the shaft. Then gently push it into place so that the stepped washer seats into the end of the flue.

After slightly tightening the expander so that it grips the ID of the flue tube, use it to rotate the flue about 180 degrees to distribute the Loctite. Your assistant can help from the other end.

Don't feel rushed! The sealant works by anaerobic action, and will not begin to set until the joint is squeezed tight and air is expelled.

Recheck the centering / overlap of the flue ends. Tighten like you did the test pieces, until you have turned the same number of turns. Remove the swage and inspect the results; reinsert and retighten if you feel it needs it. Now do the other end. Repeat the process one row at a time. It is also a good idea to make up a chalkboard or paper sketch of both flue sheets, labeled front and rear and "X" off each end of the flue as it is completed. This can save embarrassing squirts in the face later.

After all the flues are in place and swaged, let the assembled boiler rest for at least 24 hours before sealing the boiler and hydro testing.

Hydro a new boiler to at least 2x working pressure; I prefer 3x. Check the flues for weeps or squirts. Mark any leaks with the chalk. Don't worry about weld weeps at this time. They can be handled later unless they obscure the flue test. Some squirts of compressed air can help here.

If you have flue weeps, don't despair. Some people like to make a "drift pin" that can be inserted into the flue about 2" and then has a step of about 1/4" that will flatten the exposed end of the flue when struck with a hammer. If you use such a device, you can reinsert the swaging tool a little deeper the and thus get a slightly larger "bulge".

If you elect to try using a drift pin, try it first on one of the test pieces. If it splits the ends of the flue don't use it! Usually a second swaging with the first tool is sufficient. You do not have to drain the boiler to do this.

You probably did not expect a leaky weld, and with a really professional welder, you probably will not have any. However, if you have a problem with a leaky weld it is not a disaster.

If the leak is a simple weep (a damp or wet spot) the leak will probably seal itself within 24 to 48 hours after the initial hydro. They simply rust shut. Drips usually do the same thing. Even squirts, where there is a tiny stream of water may seal themselves.

If the leaks are not "self-healing" try sealing them with a drift pin or a blunt punch. This is best done while the boiler is under hydro test, so that the results are immediately apparent.

More serious leaks will require more serious measures. Mark the area with chalk and make notes on the problem. Drain the boiler. If the boiler was professionally built, such a leak is a legitimate reason for rejecting the boiler, and the manufacturer should fix it. Otherwise, clean up the area and grind the defective weld. A little light surgery with a cutting torch may even be required, followed by a light grinding to clean up the area. Reweld carefully.

Incidentally if you contract to have the boiler built, but you are installing the flues yourself, you should include a clause in the contract that says the manufacturer is responsible for such repairs after the flues are installed and the boiler can be hydroed.

Even though the boiler may still exhibit some weeps and flue sweats during its final hydro, if it will hold 2x or 3x operating pressure for 10 minutes without losing more than 10%, you can rest assured that you have a sound vessel. It is now time for the steam test.

I prefer to steam test new boilers with propane or natural gas. The best procedure is to mount the boiler on the locomotive frame and the smokebox and install a temporary burner (unless the finished engine will be propane fired). Set up the blower using temporary tubing at this point. If you are prepared to run the engine on steam, of course, the throttle and attendant piping must be connected.

However, for a test steam-up, as long as a working blower is available, you will only need safety valves, a pressure gauge, water glass or try cocks, and blowdowns are all you really need. Injectors (see note below) and/or a hand pump will lengthen your test and allow a more thorough test run, but are not absolutely necessary.

Fill the boiler to it's normal operating level and be sure all accessories are closed. If you have a dome auxiliary steam valve, leave it open. Use compressed air to pressurize your blower line downstream from the boil-

er (don't ever pressurize your boiler with compressed air--the CO2 in the air will make the water acid). As an alternative, you can mount a tube to expel air from the stack or use an elector blower to induce a draft.

Establish a very mild draft , open your gas line slightly, and light the fire. Coordinate the with the blower, but don't force it. Forcing a fire from steamup is a gross violation of the rules. I know a lot of fellows boast about how fast they can steam up from a cold start, but do they realize how hard that is on their boilers? Another common way to shock a boiler is to open the firebox door while pulling a heavy load, or even running with the door open. Either practice can allow cold air to dart right over the fire and hit the flues; that can warp them causing leakage. I always recommend an arch for this reason: it deflects the air just enough that it has time to preheat

Now is decision time. Your natural reaction would be to take the boiler up to pop off, and let the safety valves do their thing. That is what you should do once and prior to every time you are ready to start running on the track, BUT NOT NOW!

Personal experience has taught me never to allow a boiler to pop off' on the first steam up or two. Twas never able to repair one $150 Lukenheimer pop off that was factory set and sealed. Also, never, NEVER slowdown so that the products go into your neighbor's swimming pool! (Another story for another day.)

No matter how well you think you cleaned your boiler, it is still full of junk. If you let it pop off now, a lot of that junk is going to go into your pops, and, at best, you'll have to shut down, pull them off and clean 'em.

It is far better at this point to use your accessories. Use the auxiliary steam valve on the dome to clean the top water, which will probably be quite foamy from suspended oil. It is a good idea to attach a hose fitting to the valve and attach six feet or more of hose. Do not use cheap plastic garden hose, which could melt, and anchor the exhaust end.

Stand back in case the hose splits. Let 'er rip.

Alternate this with the bottom blowdowns. Blow one side, then the other, then go back to the auxiliary valve on top.

Refill the boiler with the hand pump. Foam will shut down an injector really fast. Be careful not to cool the boiler too quickly by pumping in too much cold water. A slow, even pumping is better. Balance the fire against water input. Don't force the boiler hard.

On this initial steam, there should be enough light from the fire to see the firebox flue sheet through the fire door. With the blower turned down and just enough fire to keep things warm, open the door and look at the flue sheet. You may see some "fizzes" around a flue or two. Unless there is enough water leaking out to run down to the mudring and drip off the engine, don't worry about it. The copper/steel interface (between the flue and the sheet) is electrolytic, so corrosion products tend to form here, creating a natural seal.

If you see a fairly large leak, shut down and let everything cool slowly.

When it's cool, you can reswage. If some small leaks bother you after several steamings, you can use a trick from the "full-sized" boys: put a tablespoon of ginger in the boiler before the next filling and enjoy the smell. The ginger will migrate to the void, expand and plug it tight--and it works for boiler shell weeps, too.

When it comes time to get your boiler approved by your local club, it is best to let them see it the first time without the jacket. While most clubs have good, competent inspectors once in a while they will err on the side of caution.

Be sure to tell the inspector that your flues are expanded in, not silver soldered, and that there is a possibility that he may see some "weeps". Take a.copy of this article along as a backup in case you get an argument.

Chances are, even if everything is tight at the start, your flues will develop a few weeps later. This is due to the different coefficient of expansion between copper and steel, Every time you fire up and every time you shut down, the flues flex at the joints. The club boiler inspector should know this before he inspects your boiler. He should not pressurize it more than 1.5x operating pressure.

If he sees weeps he doesn't like, invite him to withhold approval until he can inspect it under steam. Fire up, (without the arch), and let him see the flue sheets under steam. Voila! No weeps! Dick Bagley taught me -- and several other boiler inspectors--this trick years ago.

A "Handy Hint" when you are about to shut down for the day, put a couple of capfuls of water soluble oil in the tender water before your last couple of laps. Run the boiler almost to the bottom of the glass, then, on the steaming bay, "fill it to the brim." (I just let the injector run until they prime.) The water glass may look a little milky, but that's OK. Let the boiler drop to 30 PSI or less (always), then blow down. The interior of the boiler will be coated with the oil for the storage period, as will the tender. On your next steam up, there will be just a smidgen of oil left that won't cause foaming,

Suggestion: blow this up to poster size (at least 11 x 17) and post on the wall before you start. It's easier to refer to that way.

Here are some other helpful suggestions: Use soft seats on all check valves. "O" rings can be installed in almost any available check.

Pumps need check valves with short travel (low lifts). The pump bounces the valve element off of the seat and allows it to "clack" fairly hard on the seat between strokes. With high lift valves, the result is too much velocity and both seat and valve get

hammered and distorted until the seal is ruined.

Injectors, on the other hand, need a valve with longer travel (higher lift). When an injector is running there is a constant flow, with no reciprocal motion. The less restriction to that flow, the better. Injectors work better with two checks: one on topside of the boiler and one just beyond the injector outlet. The latter is usually a horizontal check.

The boiler should follow prototype practice, with a shut off valve built in. Then if a check valve or the injector fails, you can shut it off.

Remember that an injector will not start if the checks fail and hot water is venting backward into the injector. Injectors must be cool in order to work.

One solution to the problem is to put a valve and fitting on the input line between the injector (or pump) and the boiler. This was a favorite of the logging roads and 'jerkwater" lines. The fitting allows the connection of a hose to the water supply, so you have a handy fire hose or a way to wash coal dust out of the cab. If a check valve fails, you can open this valve and allow the hot water to escape. When the injector is cool, again, it will probably work.

Did you ever wonder about that little tube (on prototype locomotives) that ran from the boiler side of the boiler check valve to the supply line? Did you notice the little globe valve on it? It allowed the crew to bleed a little bit of hot water into the feed line in really cold weather so the feed line wouldn't freeze. Look at photos of locomotives in snow plow service, and you'll almost always see wisps of steam coming from the injector overflow.

That reminds me. If you install injectors with the injector body above the water level of the boiler, it is a good idea to drill a small diameter hole (.015" approx.) in the overflow just below the valve body. This will prevent siphoning and allow you to leave the water valves set for its normal operating position instead of always having to remember to close it after each use. This is one of the advantages of lifting over non-lifting injectors.

This article is reprinted from the ***7+ Narrow Gauger*** *(an earlier name for the* ***7+RAILROADER****), Vol. 5, Number 1. While our friend Rudy is no longer with us, the information he shared is still of value. We hope you enjoyed it.*

In late January we were able to visit our friends at the **Riverside Live Steamers** (7.5", Riverside, CA). We would like to thank everyone for their kind hospitality!

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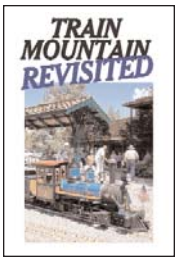

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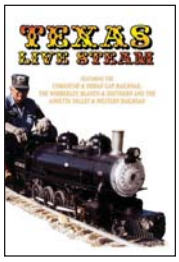

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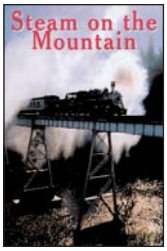

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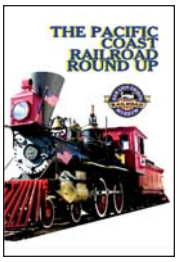

The Pacific Coast is a private railroad on the Central California coast. It is opened to the public only once each year, as a fund raiser for the San Luis Obispo Railway Museum. This DVD takes you aboard the charming narrow gauge train. It features vintage steam engines (including the one that was in the opening shots of Dr. Quinn, Medicine Woman TV show with Jane Seymour). The coaches are genuine Disney coaches - the first coaches to be used in service at Disneyland. Great for railfans, narrow gaugers, families, Disney enthusiasts and anyone else who would just enjoy a good show. Approx. 1 hour with bonus features. **$19.95**.

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