Relaxing with Emily

BRIAN WILSON describes coal firing the easy way with his loco, equipped with a Riverdale boiler..

Some people have said, (and many more have probably thought), that I am a bit weird. I love exploring bookshops, and when I pick out a book, the first thing I do is open and sniff it. The smell varies tremendously from book to book, but it is nearly always pleasant and it adds so much to the whole experience of examining the book. Many other activities in life are enhanced by smells, such as walking through bush land, especially after rain; visiting gardens in bloom; being by the seaside. So many of the things we do are associated with aromas which form an integral part of our enjoyment of the activity.

Coal smoke

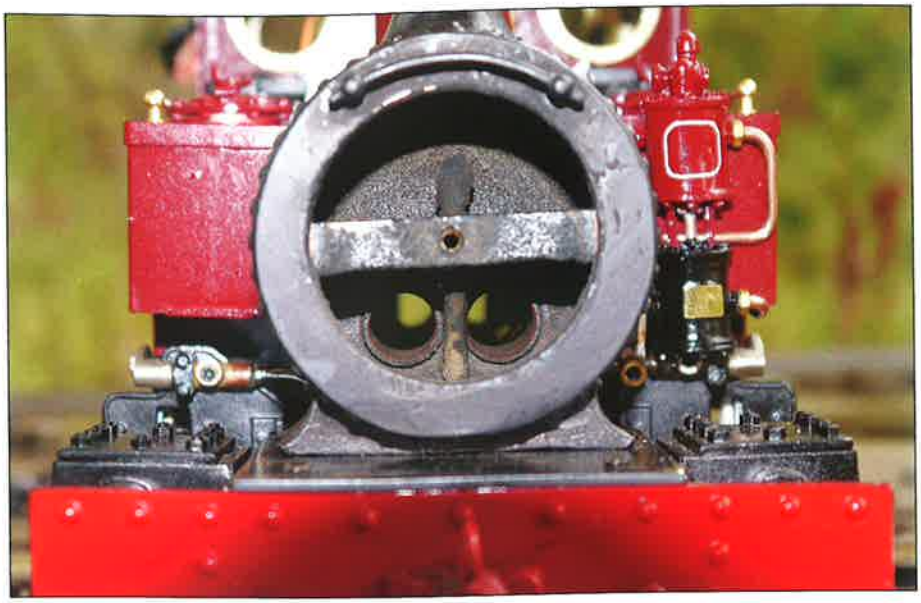
Now close your eyes and imagine standing on a railway station platform. A huffing, wheezing, clanking locomotive is just pulling in. You move as close as safely possible to the edge of the platform, and as the engine glides past you are enveloped in the most evocative swirl of hot steam, coal smoke and hot oily smells. The locomotive stops a little way down the platform and you follow it down, taking deep breaths to enjoy as much of the smell as possible, catching extra whiffs as the breeze swirls the mixture towards you. It is an unforgettable and wonderful experience wrapping you in the sights, sounds and smells unique to a steam locomotive.

If you are reading this, you are of course interested in trains. You hardly needed me to remind you of a train pulling into a station, you have experienced it often. Not only that, no doubt you have your own railway in your garden. Even if you don't, you regularly visit steam ups and train meets with like-minded people. You have some beautiful little scale models. Like the prototypes, some are highly polished and shiny, and some are weathered and all grimy, just like the workhorses of yesteryear. They will be fired with gas or maybe spirits, both of which are wonderfully reliable and easy to use fuels, and as they pass by, you get a lovely whiff of steam as it puffs out of the chimney. However you can't help thinking occasionally, that something is missing... and it is… the smell of the burning coal! Not only the smell, but the whole process of driving a coal-fired locomotive; shovelling coal; tending the fire; checking the water… just like the real thing.

Ah! that's all very well you say. Coal firing has been around for ages in the garden and I would love to have a coal-fired engine, but it isn't for me. Too difficult to get it working. The fire keeps going out. Keeping a safe water level with a bypass valve is too tricky, it could be dangerous if the water gets low. The safety valve blows off all the time. I would be too busy concentrating to enjoy the company... and so on.

It isn't too many years ago when I might have agreed with you. In fact a few more years back still, and it was considered to be almost impossible to make a reliable coal-fired steamer in 16mm. Coal firing was fine for ride-on gauges down to 3½in and for 2½in gauge garden railways, but far too difficult for smaller than these. Okay for the experts, but not for ordinary folk.

Now we all know that this is no longer ▶

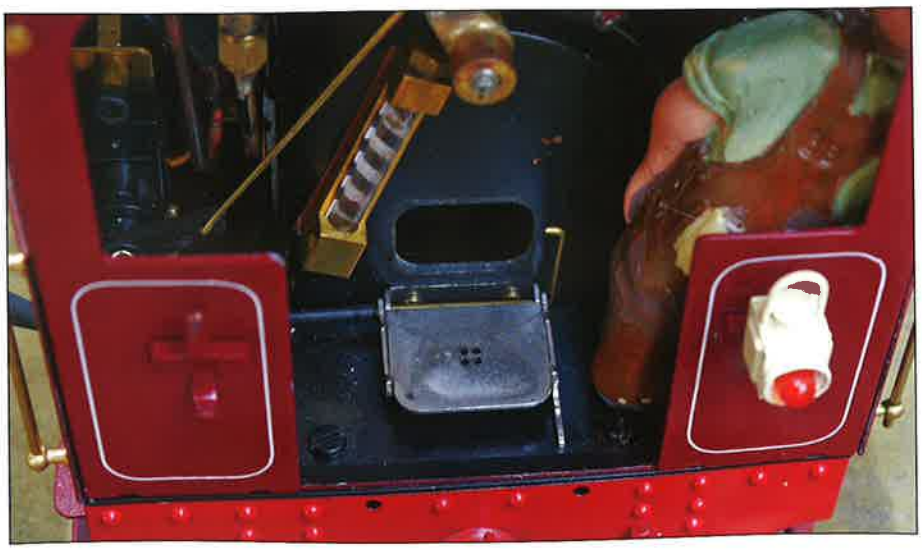


Previous page, main photo: Coal smoke – a magnificent smell!

Previous page, inset: The Roundhouse Lady Anne 'Emily' showing the alternative valve gear.

Above: A view into the smokebox showing the two flue tubes and the position of the exhaust and blower.

Above right, right and below: Three views of the fire door showing it shut, open with the damper and fully open for feeding.




The tee to the pressure sensor runs from under the standard pressure gauge connection – the gauge can be seen showing 50psi.

true, and several manufacturers have been offering reliable coal-fired locomotives for some years now. Some are built from scratch, some using commercially available cylinders and valve gear and some making conversions of complete locomotives from well-known manufacturers such as Roundhouse and Accucraft. These, almost without exception have been very well made and reliable, and provide their operators with hours of enjoyment with plenty to fiddle with and lots of the evocative aroma of burning coal. But they do demand quite a bit of understanding and concentration to run successfully.

Boiler design

It could be said that most of these locomotives have been designed and constructed with concepts which have filtered down from the previously mentioned ride-on and larger gauges. That is to say that the fireboxes probably have at least three wet sides; water is supplied whilst running from on-board tanks by means of an axle-driven pump; and the boiler is multi-tubular, in other words it has several fire tubes. The length of run which can be achieved varies, but seems to be an average of about 10 minutes before the fire needs topping up, and if the load varies or there are stops and starts, almost constant adjustment of the water level by means of the bypass valve from the axle pump is necessary. Often, if the locomotive hasn't been run for a while, the non-return ball valves in the pump and clack valve stick and the run has to be interrupted while they are freed up.

This formula has worked quite reliably however. The boilers are reasonably straightforward to construct, they are safe, and a dedicated operator can learn the art of firing relatively easily and have all the benefits of coal firing. However, there a quite a few things to think about and do while operating these little steamers, and it is easy to see where difficulties can creep in to spoil a smooth run, and lead to many of the sentiments expressed earlier about how difficult coal firing is.

No doubt many people over the last few years have thought long and hard about how the coal firing process might be made easier, but apart from some changes which simplify construction such as a fully dry-sided firebox and the use of unflanged plates, nothing much has changed for the operator. That is until Riverdale boilers were developed.

Many people have definite theories and ideas about how a boiler should be made, and this is a good thing. But as long as we adhere to sound engineering practice, it is always good to try new ideas and deviate from established practice, and this is exactly what Joep Janssen of Riverdale Locomotives has done. Riverdale boilers have made running a coal-fired locomotive virtually as easy as running a gas-fired one.

On the Riverdale website under the section on 'Special design features' it states: "From the start our goal has been to build a coal-fired locomotive with the ease of a gas-fired locomotive but with the fun of building a real coal fire." I am sure that this is exactly what has been achieved.

Many accounts have been written describing coal-firing in some detail, but bear with me while I briefly describe a typical firing up of my modified Roundhouse Lady Anne 'Emily' with her Riverdale boiler, and talk about the differences between it and a 'conventional' boiler.

The run

To start the run, water is topped up in the boiler to about half a glass. About six shovelfuls of charcoal soaked in spirits or kerosene (paraffin) is added to the firebox, the door closed and the blower valve closed. A fan is placed onto the chimney and the fire is lit and the fan started. In a short while, a few lumps of coal can be added and after the fire starts to build up, the pressure will start to rise.

At about 20psi the fan can be removed and the blower cracked open. As the pressure builds, more coal can be added to build a good fire and gradually replace the charcoal. It is good practice when first lighting any locomotive to test the safety valve, so the pressure is allowed to build until the safety valve blows at around 60psi. More water can be added to the boiler through the Goodall valve until there is almost a full glass, and the pressure drops back almost to around 35 to 40psi.

At this point, one makes sure that the water glass is full and the firebox is full of coal. (Just before the first run a couple of extra shovelfuls of coal need to be added to replace the charcoal which by now will have burnt away). We can now close the blower valve and move off, firstly clearing condensate in the normal way. We now have a locomotive which is in a similar configuration to a gas-fired one when it starts a run. The boiler is full of water to working level, and there is a fire or source of heat which can last as long as the gas in a gas-fired engine – about 20 mins or more.

From here, Emily can be run without topping up the water or adding coal to the fire, for the same duration and in much the same way as a gas-fired locomotive, except we have the fun and smells of a real coal fire, and we can relax and enjoy ourselves! After some practice we can even talk to our fellow train enthusiasts without losing the fire. We only have to adjust the 'damper' on a regular basis, but more of that later.

At the end of the run, it is a simple matter to prepare for the next one by raking over the remains of the fire, and systematically restoring the fire and water level for another run. And although the engine gives long run times without attention, if we feel like feeding coal into the fire more regularly, there is nothing to prevent topping both coal and water up more often during a run. This way the engine can be run almost continuously for as

long as required. The lubricator is oversize, so provides plenty of oil for a long run.

What's the difference?

How can this be so? Why can we get a longer run time? What are the differences from running a conventionally built coal-fired engine which seems to need more attention? Why don't we need on-board water tanks?

There are just a few simple concepts which together ensure the boiler's success. Probably the single most important thing is that it does away with the axle pump. In some ways an axle pump is self defeating. It requires a lot of power to run an axle pump and therefore it is necessary to increase the boiler pressure to allow it to run smoothly and effectively. Instead of a working pressure of 35 to 40psi as in the gas-fired locomotive the pressure is bumped up to 60psi. A bypass valve is required to control the water into the boiler and this whole arrangement constantly upsets the balance in the locomotive as more or less water is required and the pressure fluctuates. Also more fuel and water usage is required to run the pump; it uses energy which isn't being used to drive the train. (It is a little bit like when one's other half goes out to work to bolster the family income. By the time they pay for a second car and appropriate clothing and childcare, there is hardly any money left over!)

The safety valve

Next, even though the engine runs at 35 to 40psi working pressure, the safety valve can safely be set to 58psi (the maximum working pressure of a Riverdale boiler is 4bar or 58psi). By doing this, it gives us a 'working margin' and we can avoid losing water through the safety valve blowing off constantly. To do this, we have the next clever innovation and that is a controllable fire door, or 'damper' with which we can control the pressure. As the boiler pressure rises above 40psi, the damper is opened which stops the rise in pressure by allowing cold air to flow in over the fire. As it takes effect, the door can be closed again, or even cracked slightly to give finer control.

Controlling the pressure in this way is the only 'extra' thing we have to do while running compared to the gas-fired boiler. Having said that, we usually have to adjust the gas valve on a gas-fired locomotive anyway, as the run progresses and the gas tank heats up and increases the gas pressure.

Water space

Finally, the design of the boiler shell allows a larger water space. Firstly there are only two half-inch flue tubes rather than, say, five or seven smaller tubes. This gives a free flow of gas from the fire and also increases the available water space. More space for water is also provided with the firebox design which has a low crown or top, leaving more room above it. In addition, the lower half of the firebox is dry on all four sides and deep, which allows a larger fire.

Something to further give a deep firebox is the clever design of the ashpan and grate which is made up from laser-cut stainless steel and is extremely thin and compact. At the same time it provides plenty of draught, and the ability to scrape out any ash accumulated during the run. The fire can be dropped instantly if necessary by simply pulling out one pin. It's probably quicker than shutting off a gas valve, so safety is not compromised.

The transmitter for sending back information to the driver sits neatly in a coal truck.

Put together, these features provide sufficient water for a long run, a large enough fire, and the means to control it so that water is not wasted by the safety valve blowing off. It is as simple as that.

As with a lot of things, often when something different is tried and it works, then in hindsight it seems so straightforward and you might ask yourself: "Why didn't I think of that?". Also, often new ideas are not tried because of entrenched attitudes. I suspect there are those who may still be dubious about not having an axle pump, or any fully wet walls to the firebox. Also some people like the idea of making a boiler as close to the prototype as possible, with multi-tubular arrangements and wet firebox walls. As long as the design is safe, there is no right or wrong with boiler design. A builder can make any type of boiler and enjoy it and it all leads to variation within and enjoyment of a great hobby, but I think the new approach from Riverdale provides an improvement to boiler design producing a boiler which is safe and above all easy to control.

The only issue that I can see with a Riverdale boiler is that they have so many orders, there is a long wait if you want one! Other than for that, we have a boiler design which has incorporated some very clever features, all of which go together to make a locomotive which any garden railway enthusiast can enjoy. I recommend it to anyone who wants to have a coal-fired locomotive but thinks that coal-firing is too complicated for them.

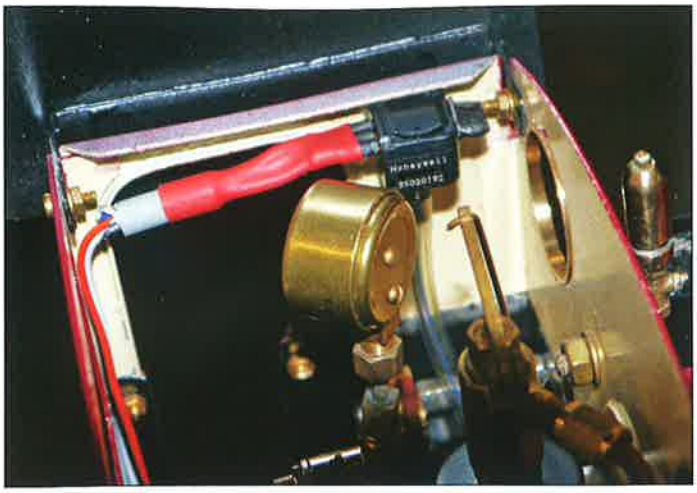
Emily – Some details

The other partner in the success of a Riverdale boiler kit is a Roundhouse locomotive. Although Emily is a Lady Anne design, boilers are also available for a Roundhouse Billy and now the saddle tank Katie.

Emily is basically a standard Roundhouse chassis and body, but I made a few changes and additions to personalise her – the biggest change being that my own valve gear has been incorporated. Whilst the standard Roundhouse expansion link is a pleasure to watch in motion, it is rather large and distinctive, so to replace it is a big step towards personalising a locomotive.

In Emily's case, the expansion link is smaller than the standard Roundhouse one, and is also pivoted in a casting which forms a more prototypical full link bracket. To give ▶

A dummy coal load sits neatly over the top and hides the transmitter equipment.



Left: The pressure sensor for the readout is located on the top of the cab side.

Below: Emily eases into Euphoria Central Station with the first light mixed working of the day.

the correct valve travel, a slightly smaller return crank is used. A small problem occurred in that the front of the side tanks doesn't come far enough forward to be able to hide the reverse lever on the weighshaft. You will notice a Westinghouse pump on the left side, which has been strategically placed to take your mind off the fact that the reverse lever shows through.

The cylinder covers also add some interest. These are covers which were developed to go over the cylinders on a Roundhouse Innisfail Fowler locomotive, and are made up from a combination of etchings and castings to try and more closely resemble those on the prototype.

Reading the pressure gauge

One of the essential requirements when running a locomotive, and particularly one with a Riverdale boiler is to be able to constantly monitor the pressure, or put simply, read the pressure gauge. On some of our garden railways, through no fault of the locomotive, this can be extremely difficult, particularly on a ground-level track, and particularly if your knees and hips are as old and worn out as mine are becoming.

Joep's own garden railway is a ground-level track and he sits (old knees!) while running his coal-fired locomotives. This allows him to read out the pressure gauge easily as the loco passes during each round. After a while it is easy to know in what position the regulator and damper should be to keep the pressure between the optimal 40 and 50psi if there is any pressure variation due to an alteration in loco speed or its position on the track. In this respect it is just like the real thing and it isn't necessary to look at the pressure gauge all the time. But of course it remains important to read out the pressure gauge on a regular basis.

Coming back to our more difficult ground tracks: if we cannot constantly monitor the pressure, then we cannot adjust the damper correctly with the radio control. The fire can be lost very quickly, or a lot of water wasted if the damper isn't adjusted properly as needed and the safety blows off unnecessarily.

Remote pressure readout

For me, the solution to make reading the pressure gauge easier was arrived at through a passing interest in model aircraft. There have been leaps forward recently in radio control equipment and batteries for model aircraft and model cars. Most of us are familiar with the huge improvement which 2.4GHz provides to the reliability of our own RC gear. As part of a need to monitor the battery voltage of batteries in aircraft, 'telemetry' systems have been developed. These consist of an on-board transmitter which sends back signals to a receiver held by the operator which can give readouts for battery cell voltage, temperature, altitude and so on.

I had been wondering whether this system could be used to give a readout of boiler pressure, but as there is no need for a pressure reading with model aircraft other than a tiny pressure variation for altitude, it seemed that it couldn't be easily done. I was considering trying to use an on-board video camera with a wi-fi connection, as these sorts of cameras are also going ahead in leaps and bounds, but it was very difficult to fit everything in and at the same time not be too obtrusive. But when it looked as though there wasn't much hope, a clever electrical-minded friend was able to adapt one of the existing current readout devices for aircraft to indicate boiler pressure exactly as required. Now I can have the pressure readout screen clamped to the transmitter antenna where it can be constantly monitored. The readout still says 'A' for amps, but that is not a problem. 'A' just means 'psi'.

All that is needed is a commercial miniature pressure sensor placed onto the cab side with double-sided tape, a tube coming from a tee off the pressure gauge line, and the wiring from the sensor fed to the on-board transmitter. The system is quite compact, but even so there is not sufficient room to fit everything onto the locomotive as it is, so a coal truck has been set up behind the locomotive with a dummy coal load hiding the electrics. The wiring is connected with a plug, so the locomotive can still be run without the remote readout if required. If I want to provide a pressure readout from one of my 7/8ths scale locomotives, then all that is required is to remove the gear out of Emily's coal truck and place it in one scaled to 7/8ths. The only extra pieces of equipment needed to provide for multi locomotive readouts is the miniature sensor.

Conclusions

Having had experience with building and running quite a few coal-fired locomotives over the last few years, it has been a constant learning curve that has finally allowed me to now have a locomotive which is truly easy to operate, and gives all the enjoyment of playing with, watching and sniffing a real coal-fired locomotive. ●