Modelling in Gauge 1

Book 5 : Coal Firing

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The Gauge 1 Model Railway Association’s principle objectives are to promote railway modelling in any scale which will involve a rail gauge of approximately 1.75 inches or 45 millimetres, and to bring together persons interested in the construction of Gauge One models, tools and apparatus of all kinds.

Information on G1MRA can be obtained from their web site at www.g1mra.com
or by writing to the Membership Secretary at PO Box 1356, Buxton, Norwich, Norfolk, NR10 5WR

Other books available from G1MRA in the MODELLING IN GAUGE 1 series are:-

Modelling in Gauge 1 - Book 1 - Electric Propulsion

The first book in the Modelling in Gauge 1 series. Draws on articles from 200 Newsletters to bring you the collective experience and wisdom of G1MRA members on the subject of Electric Propulsion. Motors, gears, locos, bogies, controllers, batteries, tracks and much more.

Modelling in Gauge 1 - Book 2 - JVR’s Contribution to Gauge 1

This book draws on the many articles and letters written by John van Riemsdijk that have been published in more than 200 Newsletters over a 50 year period. John’s work is legendary. Many of us will know of his input into the design of the many Aster locomotives running throughout the world. His work is published in this volume of over one hundred pages including photographs and drawings.

Modelling in Gauge 1 - Book 3 - Freight Stock

A compilation of articles on Freight Stock that have appeared in Newsletters since 1963.

Modelling in Gauge 1 - Book 4 - Coaching Stock

A compilation of articles on Coaching Stock that have appeared in Newsletters since 1963.

Also available from G1MRA are: a number of books on th econstruction of G1 locomotives:-

The Project Book edition 5 created in 2013

This brand new version will offer improved help to beginners who want to build from scratch. This latest edition of a book which has stood the test of time over 40 years contains almost 100 pages, more colour, up-to-date drawings and more accurate descriptions based on feedback from users of the original editions. Those who want to build this meths fired single cylinder LMS 4F 0-6-0 tender engine will be able to buy parts from G1MRA suppliers if they wish.

The Dee Book

Members who already possess loco constructional skills could move on to the Dee book. This Book contains 96 pages including full drawings and constructional descriptions to build a live steam SR D class twin inside cylinder tender engine. The loco design can run on meths or gas. A separate book of metric drawings can be purchased, but you will still need the Dee book.

The ARM1G Book

Those who may not have the time to work from scratch may wish to choose the new gas fired ARM1G, for which most parts are available off the shelf. It is a scale live steam working model that involves very little engineering skill from the builder and is simple to run. The book contains 70 pages including full drawings and constructional descriptions to build a twin cylinder 0-4-4 Twin Tank.

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Introduction to Modelling in Gauge 1

The Modelling in Gauge 1 series started with a collection of the best articles in the first 83 issues of the Gauge 1 Model Railway Association (G1MRA) Newsletter & Journal (NL&J), published in 1972 as a small booklet.

There were attempts to revise the concept in later years which started with the creation of an index of NL&J articles by Geoff Hammond. The index for issues 1 to 163 showed that the number of articles which might be worth reprinting was large, and that a system of dividing them into topic groups was needed.

When I was Editor of the G1MRA Newsletter & Journal (NL&J) I realised that there was a wealth of knowledge in the old NL&J issues. I started a 25 years ago feature to remind G1MRA members of the earlier wisdom, and also reprinted some important articles so that newer members were able to enjoy them today.

After I stopped editing the NL&J in 2002 I decided to see if I could revive the Modelling in Gauge 1 idea. Using Geoff's work as a starting point I added the articles up to issue 197 to the index and started looking for help to select articles for specific topics. The result was been the four books in the current Modelling in Gauge 1 series, as described on the previous page.

As well as producing these first four books I started experimenting with ways to digitise the complete set of NL&J. The software to do this had been available for some time, but the effort involved in physically separating what was now over 200 paper NL&J issues into individual pages and then scanning them always appeared to me to be an insurmountable barrier. Luckily I met two G1MRA members local to me - Adrian Johnstone & Elizabeth Scott - who had access to technology that could reduce the task to one of manageable proportions, though still requiring a lot of effort. The result is that nowadays G1MRA members have all the NL&J issues on-line via the G1MRA website at www.g1mra.com, together with a spreadsheet view of the article index. So I decided that there was no need for further books in the Modelling in Gauge 1 series because all the wealth of knowledge from the old NL&Js was available on-line.

But then Charles Simon sent me his work on Coal Firing, and I realised we can combine old NL&J knowledge with new articles from current G1MRA members to create this book on Coal Firing in G1.

Please understand that each of the authors is writing from their own experiences, using product names that are local to them. Which may mean that you need to do a little research in your own location to find equivalent products. What we call paraffin in UK might be called lamp oil or kerosene in other countries. Anthracite is a description for a the coal that seems to work in many G1 coal fired locomotives, but its quality and properties vary widely across Europe, so experiments are needed to find out what suits a particular engine. The modern smokeless fuels, made from powdered coal formed into briquettes, have different names from different suppliers so you can find lots of them to explore in one country such as the UK in your search for your perfect G1 coal fuel.

I hope you enjoy this book and it encourages you to explore the world of G1 coal firing. Personally I find my coal fired Britannia is both the most challenging and most enjoyable of my engines.

Martin Hulse (584)
G1MRA Vice President

In this book:-

INTRODUCTION

Charles firing up Adam's Brighton Atlantic photo Adam Houghton

My first electric train appeared under the Christmas tree when I was seven years old. After happy years with Märklin & Co., my interest in larger gauges grew. So, 1978 saw my first gas-fired, gauge 1 live steam locomotive running on LGB rails in the garden (a Beck "Anna", which was a 0-4-0 narrow gauge model in scale 1:22.5; 16mm NG) and a major attraction for children and adults. As a result, I became acquainted with like-minded colleagues from the gauge 1 scene (1:32), too. I was particularly impressed by the coal-fired locomotives. However, I only dared to try out this form of firing many years later. I received my first coal lesson from the late Robert Houghton in July 2010 at his track at Vert House, Whitesmith, on his locomotive "Dorothy H.", a Pacific with a large firebox and a wide, spacious grate. I received more training under expert guidance at Adam Houghton's with his LBSC Atlantic (see photos above & on next page). This is also a locomotive with a wide, spacious grate and a deep firebed.

With his newly acquired and brilliantly constructed "4F" 0-6-0, (images in Adams Lecture page 35 & page 36) Adam was also the person who introduced us Swiss in September 2007 to HomeLight coal ("smokeless coal" based on anthracite dust, which we know as, for example, "Extrazit", see also page 8). Despite its narrow grate, this small locomotive can be kept in steam for a long time by an experienced fireman.

This made a great impression on Swiss G1MRA members and some began to experiment with different types of coal. One result of this was the booklet "Firing gauge 1 locomotives with real coal" by Peter Krattiger and Heinrich Schartner in the summer of 2012 in German, which is a compilation of important basic information on the subject. This brochure was well received in German-speaking countries, which was an indication that coal-firing - although it had been the focus of interest to some enthusiasts for a long time – was of major interest again. So we wondered if it might make sense to address the broader platform of G1MRA. This brochure is the chapter 2 of this book on coal-firing, page 7and following. In response to our request, G1MRA's committee gave us the green light for our concept in the spring of 2014!

It is clear to us in Switzerland that there are many experts and luminaries on "coal" among English G1MRA members

and we wanted to include a few of these. Therefore, with the assistance of Martin Hulse and Martin Slater, we set to digging out older articles and, in parallel, to generate new contributions from different countries. This book is a colourful bouquet that shows how much knowledge, experience and intuition is necessary to design and build coal-fired boilers and that coal-firing is a fine art. In his article (page 24), Bob Hines goes so far as to say that coal-firing is similar to golf: there are many obstacles, but the trick is to get through. Some days are more successful than others and that is when the pleasure is all the greater!

When compiling the contributions to this coal-firing book, we took care not only to allow a wide range of voices to have their say, but also to incorporate both the theoretical aspects, people's experience in boiler construction as well as the practical experience gained when running coal-fired locomotives. All of this against a backdrop of attractive illustrations. We do not claim to cover the topic in its entirety. Building on theoretical principles relating to coal, our aim is to pass on the special aspects and people's experience in boiler construction and, in particular, in practical coal-firing. For both beginners and for advanced gauge 1 adherents. We are aware that this book does NOT provide any detailed instructions on boiler construction. There are standard works on this subject (see Further reading page 80).

I have enjoyed the assistance of a variety of authors and have also written reports myself. My special thanks go to G1MRA's committee, who responded to our desire to create a comprehensive G1MRA book on coal. I would also like to thank the authors for their interesting contributions, Martin Slater for the accurate translations from German and French into English and Martin Hulse both for the contact with English members as well as for turning our text and images into a professional layout and, finally, into this coal-firing book. It only leaves me to wish readers a lot of pleasure and edification in reading: it should encourage everyone to try coal-firing themselves! And if you have any questions on the individual articles in this book, please contact the authors concerned directly: every author is a G1MRA member.

Charles Simon, (1663), Binningen, Switzerland

Charles pushing the coal bed on Adam's Atlantic photo Adam Houghton

FIRING GAUGE 1 LOCOMOTIVES WITH REAL COAL

Co-authored by Peter Krattiger (3209) and Heinrich (Heiri) Schartner (2323)

The co-authors are members of G1MRA CH (Gauge One Model Railway Association Switzerland)
Original German title "Der Betrieb von Spur 1 Dampflokomotiven mit richtiger Kohle"
2nd revised edition dated 25 October 2013
Translated into English by G1MRA member Martin Slater (1045)

Foreword

This documentation is aimed primarily at all gauge 1 live steamers interested in firing a model locomotive with real coal.

It has been compiled as a guide and introduction to the firing of gauge 1 locomotives using real coal since a basic level of knowledge of this type of fuel is a prerequisite to. successful coal firing. It provides both general as well as specific pointers and information relating to the use of coal and its context, which is why the major focus is on practical aspects. While the documentation describes a proven and practical approach for beginners with coal, it does not claim to be complete. The authors of this document are aware that there are a variety of other methods that will also lead to success since "many roads lead to Rome".

As stated above, the aim is to acquaint the reader with the exciting world of coal firing since a steam locomotive running on real coal, is undoubtedly just that little bit closer to the original.

1. General considerations

1.1 The allure of running a coal-fired locomotive

Live-steam gauge 1 locomotives give steam locomotive enthusiasts an enormous amount of pleasure where seeing and hearing are concerned. However, if their sense of smell is also to be addressed and satisfied, this is only feasible if their locomotives are coal-fired. The pervasive and unmistakable smell of burning hard coal is irreplaceable for true steam locomotive enthusiasts.

The real challenge is not just in running a locomotive safely, but also in being able to fire it correctly. An experienced fireman is familiar with his locomotive and knows how to maintain his locomotive's fire if it is to provide the required boiler performance over a lengthy period of time.

Having a coal-fired boiler gets your locomotive just that little bit closer to its big brothers.

1.2 The right locomotive

Certain basic conditions must be in place if you are to fire your locomotives with hard coal. The first thing to do is to ensure that the locomotive's boiler really has been designed to take coal and that it therefore has a grate.

It must also be said that it is easier to operate a larger locomotive with a correspondingly larger grate than a smaller locomotive with a small grate.

On this basis, it is clear that beginners should start off with a larger G1 coal fired locomotive for preference.

1.3 Coal-fire emissions

During combustion, coal not only produces a respectable amount of heat but also releases a variety of different gases. Alongside sulphur and other components, there are also the volatile components as they are called. Added together, they make up the smoke that locomotive enthusiasts love so much.

Section 2.3 describes the proportion of these volatile components in the different types of coal. However, not every type of coal is suitable for use with gauge 1 models. More on this is given in section 2. At any rate, steam locomotives fired with real coal should mainly be run on outdoor tracks for preference.

COAL FIRING IN GAUGE ONE

By Adam Houghton (52) June 2013

Adam created these notes for a talk at the G1MRA Exposition

Adam with his Brighton Atlantic in his garden
photo Charles Simon

For many the ultimate challenge, sense of achievement and satisfaction in Gauge One is the successful steaming of a locomotive with coal firing. There is a skill and mystic in raising and sustaining steam in a boiler that requires careful preparation, patience, much practice and attention to detail. This activity engrosses the runner and is appreciated by the interested onlooker, that contrasts starkly with the push button mentality of the present age. Indeed there is a pride in belonging to an esprit de corps of Gauge One steamers, and for the reader I will endeavour to explain and guide on how best to achieve coal fired steaming and running based on a lifetimes experience (encouraged by our masters of the past) I have had the privilege to enjoy.

Before You Start

Acquire and prepare some charcoal (preferably burnt from hardwood) by breaking it into small pieces not larger than the end of your little finger to fill a medium sized tin or jar that can be sealed with a lid; I prefer the former container as the latter can break should it slip from the hand and fall. The charcoal must then be thoroughly soaked in paraffin oil (kerosene) or methylated spirit (alcohol); I prefer the former despite being greasy with a pervading pungent smell to the latter, which burns more cleanly with a familiar smell but does evaporate and burn off more quickly and thus is less enduring. I like to soak for about 12 hours to make sure the charcoal has fully absorbed the paraffin or alcohol.

Obtain some proprietary (man made) coals such as Phurnacite or Homefire that are either egg shaped or hexagonal lumps (made from crushed anthracite compressed together with tar), which break into pieces a bit smaller than charcoal and collect in a medium sized tin or jar.

Get some free burning anthracite (Welsh steam coal or Prussian anthracite) and there may be some British anthracite grain still around,which I find the best overall. There are many anthracites of different hardnesses and ignition points; basically the harder the anthracite the higher the ignition point and the greater the calorific value, and is a question of finding a fuel that suits the firebox and flue tubes of your locomotive; one loco I have has a deep narrow fire box that fires best on Homefire/Phurnacite. Welsh steam coal is available in the U.K and Prussian anthracite in N.W Europe (the former is pea sized and needs to be broken up to grain size for efficient burning in my view and the latter is already grain sized burns bright red but can ash up in my experience). Have a tin or jar prepared of either or both.

Adam firing his 4F at Charles Simon's
photo Charles Simon

Raising Steam From Cold

Before you light up put 4 or 5 shovels of duly soaked charcoal to well cover the grate area of the fire box. Then put your electric fan on the funnel of the locomotive and switch it on. I usually light a bit of charcoal on the shovel and pop it into the fire box which crackles into life.

Add a shovel of charcoal periodically (once a minute or so) with the fan on until 20 to 30lbs pressure builds up.

Then open the loco's blower fairly wide removing the fan at the same time which draws the fire harder and boiler pressure should soon starts to increase rapidly.

As soon as the loco is on its own blower I usually add a shovel or 2 of Homefire or Phurnacite which has a relatively low ignition point and burns with plenty of flame. As pressure builds up I add another shovel or 2 of Homefire or Phurnacite and cut back on the blower if roaring hard.

I then add slowly shovel by shovel the anthracite allowing each shovel full to start burning before adding the next. This is because anthracite has a relatively high ignition point and one must be careful not to overload the fire at this crucial stage and cause the temperature to drop. Add shovels of anthracite with one or two Homefire or Phurnacite until the fire box is 2/3rds full or so. The charcoal burns away underneath fairly quickly. When your safety valve lifts your loco is ready for the road.

Onto The Road

However beware when you first leave the loco depot with a good head of steam that the bottom quarter of your incandescent fire could well still be charcoal, which burns away quickly. If you are delayed in hooking up to your train be sure to add another shovel or two of anthracite at every waiting moment. If you are held in the depot for some reason or may be got steam up too early there is no harm remaining in the depot and gently adding anthracite to the fire as you wait to allow time for the charcoal to burn through and have a full fire box of burning anthracite at the start of your run; however standing in the depot with the blower on and loco blowing off the water level in the boiler will be falling surprisingly quickly and you will need to regularly pump up with the hand pump while waiting.

If you get away from the depot quickly, stop after the first or second circuit of the track to shovel in more coal, since the loco pulling a load quickly burns through the remaining charcoal and only a small anthracite fire remains. Also as the loco rides the rails bright embers as well as unwanted ash shake through to the ash pan, and you need to keep to be the basis of building your next fire for hopefully a sustained non stop run.

Adam's 4F at full speed with Charles' freight train
photo Charles Simon

Re- Building The Fire

When after several circuits steam pressure starts to fall appreciably bring the loco with train to a halt turning the blower on gently as you shut off the regulator. On opening the fire door you should have a glowing red hot bed on which to build up a new fire shovel by shovel spreading the coal evenly over the grate increasing the blower as the coal is shovelled in. If the fire seems rather slack and slow to build up add a shovel of soaked charcoal or Homelight/ Phurnacite to brace it up. Unlikely you will need to poke the fire until after several firings when ash may have built up that has not shaken out due to the running motion of the loco. All being well pressure soon builds up since although the top of the fire looks black it is red hot underneath. As full pressure is nearly reached cut back the blower and the safety valve lifts as you start another run.

Sometimes boiler pressure will unexpectedly fall back early in a run when the fire box is still full of unburned coal. This is often due to a part of the box having what is called a "black fire" which means no fire at all causing a drop in temperature. This may be due to the embers of the last fire becoming too thin or non existent at the end of the last firing and some of the coal shovelled in fell directly on the grate with few or no embers underneath it and so will not ignite. Before the pressure gets too low shut the regulator and with the blower on patiently wait and hope the red fire spreads to all the box; however, the fire may require gentle mixing with the poker of the red hot embers with the coal with the risk of putting the fire out altogether. If the boiler pressure falls too low add some soaked charcoal which produces a nice roaring flame increasing the boiler pressure to increase the draught to assist the embers to transfer their heat to the unburned coal. If this fails then start your electric fan on the funnel of the loco and shut off the blower in the hope of getting the fire hotter to raise sufficient steam for the blower to bring up the fire, otherwise it is back to the depot and start again.

It is good practice to bring in the loco in good time for re-firing with a good hot bed with some depth to build your new fire if it is not your last fire of the running session. Keep water level well up to make full use of the heating surfaces to generate steam from radiant heat as well as flame in the fire box and fire tubes of the boiler. If you run the boiler dry and are unable to pump water in immediately open the fire box door and poke out the fire to avoid damage to the boiler.

Adam's Brighton Atlantic making a good fire
photo Charles Simon

Problems with Coal Firing

- Black Fire as mentioned above. The fire has become too small and cool under unburned coal and only burning in part of the fire box. There is not enough heat in the fire to ignite the coal you have shovelled in. One can sometimes recover the fire by adding soaked charcoal, but alas sometimes end up with a black fire on the grate underneath the burning charcoal. As mentioned with the poker you can mix up unburned coal with burning charcoal and get fire going again, but need patience and may be the electric fan to assist.
- Ash Up especially after several firings. Ash can hold heat but has no burning properties and can restrict air flow through the grate. Gently prick holes with your poker without poking out all the embers you are relying on to rebuild your new fire. Occasionally get clinker from poor coal that needs more rigorous poking to remove it.

Sometimes although the fire appears bright red the boiler will not steam up to full pressure. This may be because there are gaps in the fire bed which is allowing cold air to blow through the fire and fire tubes. With the flat back of your shovel spread the fire evenly over the fire bars moving the shovel from side to side especially with larger fire boxes.

For me coal firing offers that further dimension of bringing one closer to the real thing of the genius of the steam locomotive that is capable of operating from natural fuel dug from the ground and water that falls from the sky.

