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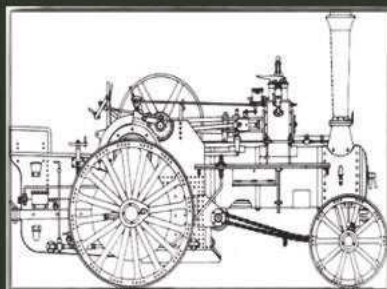


ON THE COVER...

Adam Farrance and Peter Pearson make the most of Bristol's New Year 'Steam Up' behind Rob Speare's Ajax (photo Richard Lunn).

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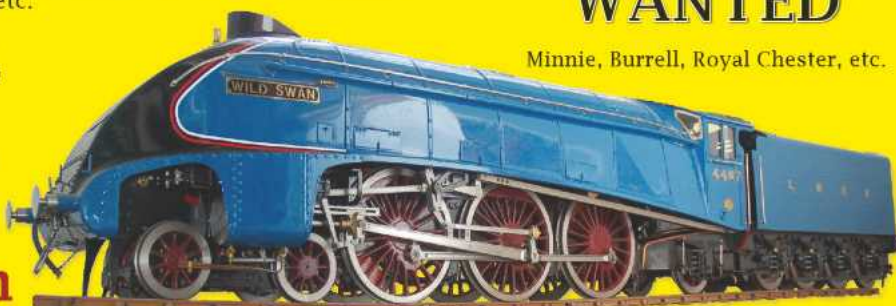
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Life After Lockdown

So – how has it been for you so far? I think, for many, lockdown must have been a rather dreary and lonely business, compounded perhaps by the fear of losing one's livelihood and worries about the future. For others it has no doubt been a time of discovery, or even renewal, finding fresh interests or the time to revive old ones. It may even have presented an opportunity to rediscover oneself and realise what things matter most in life.

With the end of lockdown now in sight, how will life be once we are free to carry on (almost) as before? Will we revert to our old ways or might we keep some of the new habits we have been forced to acquire during the last several weeks? Might we have found that we actually prefer some aspects of our changed way of life? Conversely, we may be surprised by what we find we have missed the most.

I suspect that for most of us the two biggest changes to our lives have been far less travelling and far less contact with family and friends.

Travelling. Did we really miss it? Modern technology makes working from home a realistic prospect for many of us and has many obvious advantages. How long for instance do we spend just getting to and from work? Couldn't that time be far more profitably spent? Do we really need to fly halfway round the world to enjoy our summer holidays? Of course, exploring the world is a fine thing to do but does a fortnight in Ibiza really fall into that category, or a seven-night bargain break in Barbados? Perhaps, with all the global warming we are promised, Bournemouth can



Marine Engine

Reader Anthony Cliff has sent me this photo of a marine engine and wonders if anyone recognises it. Some parts are missing and, after investigating a little further, he doesn't think it has ever run and was abandoned. Anthony would very much like to get hold of a set of drawings for this engine so that he can complete it and get it running.

become as balmy as Benidorm, or Torquay as tempting as Tenerife. Riviera, sir? French or Cornish? Is the sea any sexier because it is called 'la mer'? And remember, you can't get pasties in Cannes.

Surely, what is of real value to us is what we *did* miss during the time we were locked down. Family? Friends? Track days down at the club? These are perhaps the things to focus on as we emerge from this temporary, and perhaps illuminating, reshaping of our lives.

Wahya

I must apologise to readers following *Luker's Wahya* series for the very poor reproduction of the frames drawing on pages 754 and 755. The proofs were crystal clear but that clarity unfortunately did not make it to the printed page. We are investigating to find out what went wrong and will reprint the drawing in the next issue.

Podge

As we are in 'lost and found' mode perhaps someone has come across a 5 inch gauge 0-4-0 locomotive named *Podge*. A reader is currently restoring this engine and is keen to track down the articles in *Model Engineer* (many years ago – 1930s, 40s or 50s) which described it. Unfortunately, I have been unable to identify it so I wonder if anyone out there remembers it! It was bought from Cherry Models in 1960 but appears to be older than that. It has a soft soldered boiler and has what appears to be Baker valve gear. It is painted in Great Eastern colours and is similar to a Great Eastern B74. Any information on the provenance of *Podge* and which issues of *Model Engineer* feature the engine would be gratefully received.

LittleLEC

Unfortunately, this competition, due to be held at Birmingham on the 13th-14th June has, like IMLEC, had to be cancelled because of the current coronavirus crisis. The next LittleLEC will take place next year at Reading, on a date yet to be decided.

Martin Evans can be contacted on the mobile number or email below and would be delighted to receive your contributions, in the form of items of correspondence, comment or articles.
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Confessions of a Model Maker

Maximising the Chances of Success in a Making Project

John Moorhouse looks at the factors which lead to the successful planning and execution of a project.

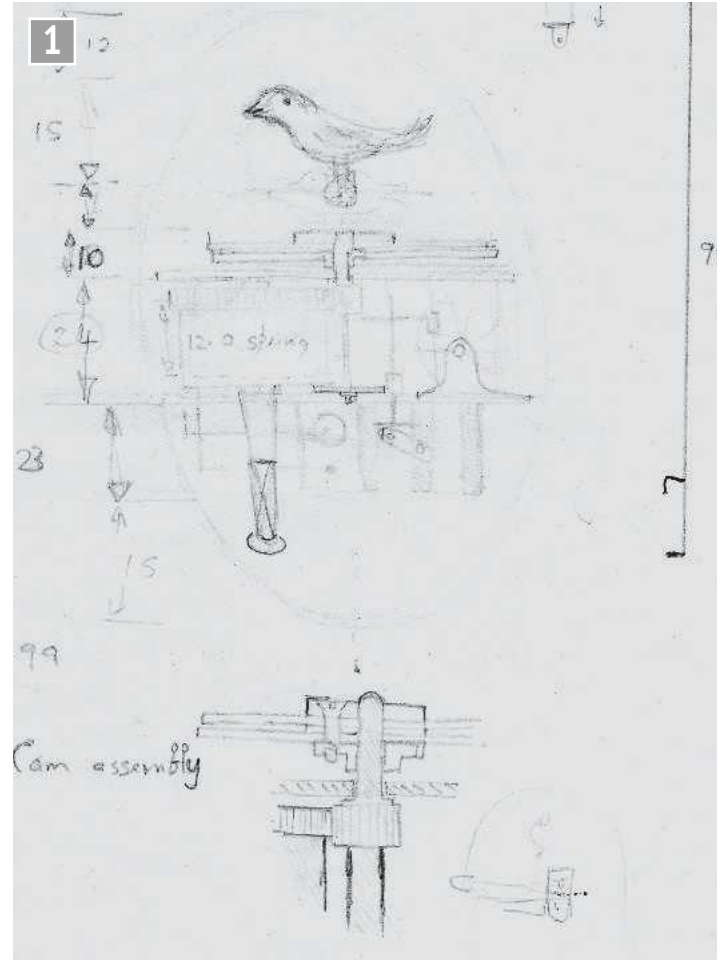


Introduction

There are regular articles in modelling journals about the design and making of models such as steam locomotives, clocks and tools. Some may well be 'one-off' ventures and cover aspects of design, making processes, assembly, testing and use. Rarely do these articles mention aspects which are common to all of these, such as the personal and psychological issues which arise at the various stages of the project, from the initial euphoria of starting out, through various crises along the way to the considerable satisfaction of bringing a project to a conclusion. They clearly have an important impact on the efficiency of the work, on some safety issues and on the likely outcome. I do not think I have ever seen such an article in a journal such as ours on this topic yet it is an integral and essential part of each and every one of these projects.

How many items have you bought with the intention of repairing them but have never started? Worse, how many repairs have you started and are still awaiting completion? Have you also started a 'making' project or two which have come to a stand-still. If you can answer 'none' to each of these questions, then this article is not for you. If the answer is 'yes' then you are not alone since a failure to complete existing projects before starting a new one is very common amongst people of a practical disposition and I am no exception.

It is very easy to fail in a making project, for a myriad of reasons, but we often do not class it as a failure, just a project put aside for a while but which may never re-surface. This article delves into some of the reasons why



An overall outline provides a good start to setting some of the basic design parameters of layout, dimensions, complexity, controls and power requirements.

we can all come close to a complete stoppage in this way and includes strategies which have been very helpful to me. It is with trepidation that I write on this topic since I realise that there are many others with more experience of making than I have. I also recognise that many modellers and horologists have a previous engineering related background and often come equipped with well proven project management skills. However, commercial projects generally focus on imposed finance and timing issues which are generally not too relevant to us modellers.

Over the last four years I have been involved in making what I

hope will be a special piece. It has been a long, interesting and enjoyable voyage of technical and personal discovery and many lessons have been learnt. It is from my experience, particularly with this big project, that the contents of this article have been drawn, as well as from discussing these issues with others actively involved with practical projects.

It is my hope that those who are going through some of the inevitable agonies of a making project, or those about to begin one, may be able to recognise something of themselves in the following and that by bringing the various issues out into the open they will find it easier

➤



Research is essential prior to design, such as into this nightingale box (in which song cams are selected in a pre-set varied sequence, for teaching a caged bird to sing), and can provide a good guide to many of the proven design principles in a singing bird mechanism. Only by fully understanding the principles is it possible to adapt them to the actual design.

to manage the issues as they arise. I suspect that my thoughts and suggestions will have a wider relevance and not just to making and repairing activities.

This article is in 3 parts:

Part 1 (this part) considers issues such as the complexity of the project, research to produce the final design and a review of the various stages common to all projects.

Part 2 looks into the workshop environment and how it can influence progress and efficient working.

Part 3 proposes strategies to tackle problems including issues of confidence and reward, with suggestions for maximising the chances of a successful outcome.

Complexity

The nature and level of complexity of a project are very important keys to success and an ascending progression is summarised as follows:

- 1 Making an individual component to a design.
- 2 Making an individual component to fit with other finished components.
- 3 Making a complete assembly to a proven design.
- 4 Making a complete assembly to a proven design and then

modifying or adding to it.

- 5 Designing and making a complete assembly.
- 6 Inventing and making an entirely new feature, such as a horological escapement, and demonstrating that it will work.
- 7 Making the invention as an integral part of a finished piece.

My training as a watchmaker provided the skills for 1 and 2. Experience on commercial repairs provided confidence to progress to more advanced work such as 3. Commercial designs for models bring with them the knowledge of a proven design often with available components such as castings. When modifying or creating a new feature the ability to visualise three-dimensional mechanical mechanisms is necessary but fortunately it is an inherent skill which practically oriented makers like ourselves generally possess. However, it is essential to understand in detail how and why things work to use this skill to full advantage. Handling, measuring up and restoring finished pieces can provide a full understanding which can be applied to designs up to level 5.

Each of these projects increases in difficulty and with it the sense of achievement. It is clearly sensible for most of us to start at the easy end before we attempt to progress to more demanding projects. Each of the first eight watches made by George Daniels (ref 1) was essentially a copy of horological work done many years before. The only 'complications' were a retrograde hour hand or 'up and down' (state of winding) work. Nevertheless, they provided a considerable wealth of experience and confidence on which to build, probably including several re-makes of key components. It is by proving ourselves at the easier end of this range that we have the confidence to progress to more advanced work. In this way we may aspire to invent or develop something new which is not just a near copy of something already there. Unfortunately, we do not always recognise the level we are currently at and the best guide may be when we fail to achieve something.

The stages of a project

A project usually splits itself into a series of stages:

- 1 Initial concept and objective
- 2 Design
- 3 Making
- 4 Assembly and testing
- 5 Finishing

We will take a look at the first three of these.

Initial concept and objective

Makers and repairer/restorers usually lack nothing in enthusiasm to start a new project. This initial burst of euphoria about making and then possessing a finished item (such as the one they have just seen!) is sufficient to galvanise activity for a significant time. It does not usually last for more than a quarter of the time and effort required to completion. One common failing is the lack of any realistic initial estimate of how much effort it will require to

bring it to completion. This is particularly true when purchasing items for repair or restoration. The only consideration seems to be whether we are actually capable of carrying out the work with their current facilities. It is easy therefore to have a workshop with a number of items all awaiting work since the effort required to do the necessary work is just too large. It is a good idea before starting any project or purchase to make a basic assessment of the amount of work required, with a generous margin of error, and also decide how important we see it in relation to our other projects. Will it help or hinder them? These are matters I still need to get better at!

Design

I suspect that there are a few amongst us who can conceive and prepare a full design which they are confident will lead to a successfully finished project. Those with these skills are at a clear advantage since many problems can be identified and avoided before any metal is cut; the extra effort can be well rewarded in reducing trial and error, and speeding production. Some may have confidence in their ability to achieve the desired results by just following a trial and error approach to design and construction. For the rest of us, writers such as John Wilding have been a great asset. They have produced designs which are well thought out and any problems in design or making have already been largely resolved. They provide confidence to the maker that the project is do-able and that for any tricky aspects there is a sensible solution. It provides an attractive outcome with little risk. It also allows a realistic estimate to be made of the cost of components etc and will also provide a guide to the time required to carry out the project.

Whatever the level of the project it is most advantageous to fully understand the design.

There is a danger when conceiving a design to make it too complicated. This arises from the personal test which the maker seeks to set themselves, since it is the challenge of doing something new and beyond our comfort zone that inspires us to undertake a project. There are two design routes; one is to create the full design with all the complexity built in. This is the most efficient for the maker provided that the design is perfect. The other route is to design and make the basic model and when successful to then add on the extra aspects of complexity. In this way there is good sense of achievement along the project to maintain enthusiasm. The danger is that the initial design may not allow the layers of complexity to be added either at all, or without major modifications. However, it is easier to retrace these steps when the maker has proven that the basic design is within their competence and works well.

Table 1. Gear train details collected for 19th and 20th century going barrel type singing bird box movements based on the original 1885 Bontems' design.

Bird box maker	Barrel, number of teeth	Speed control	Drive wheel teeth for endless	Endless screw pitch	Endless screw diameter	Turns of fly for one turn of barrel and cams
Bontems Type 1	98	8 blade fan	25	1.0mm		1960
Bontems Type 4	98	8 blade fan	18	1.0mm		812
Flajoulot	104	Centrifugal, 2 arms	20	0.9mm		915
Griesbaum (Mayson)	104	8 blade fan	20	1.0mm	1.9mm	1040
Griesbaum	100	8 blade fan	20	1.0 mm	1.1mm	1200
Rochat (double bird)	98	8 blade fan	20	0.7mm		1372

Making

At the extreme end of the spectrum is a making project without a fully developed design but which evolves stage by stage. This is a very different matter from working to a well proven design but can be a very satisfying and at times exhilarating experience. I admit to having these delusions of grandeur. Any part of the design which is not acceptable not only necessitates a redesign of that element but probably some

other aspects with which it interacts. During my current long running 'design and make' project a significant part of the time has been spent thinking about how to design one or more parts so that it will fit in properly with the existing and future components within a confined space. This has required a considerable knowledge of the principles by which the mechanism operates and necessitated research into similar mechanisms: spring sizes, operating lever ratios, gear train calculations, running time, cam dimensions etc. I have studied photographs and taken apart actual examples and compared dimensions and functions. Sketches have been produced, with design calculations. The outcome needs to be fit for purpose, robust and preferably elegant. The better my understanding the more refined, and more rewarding has been my work.

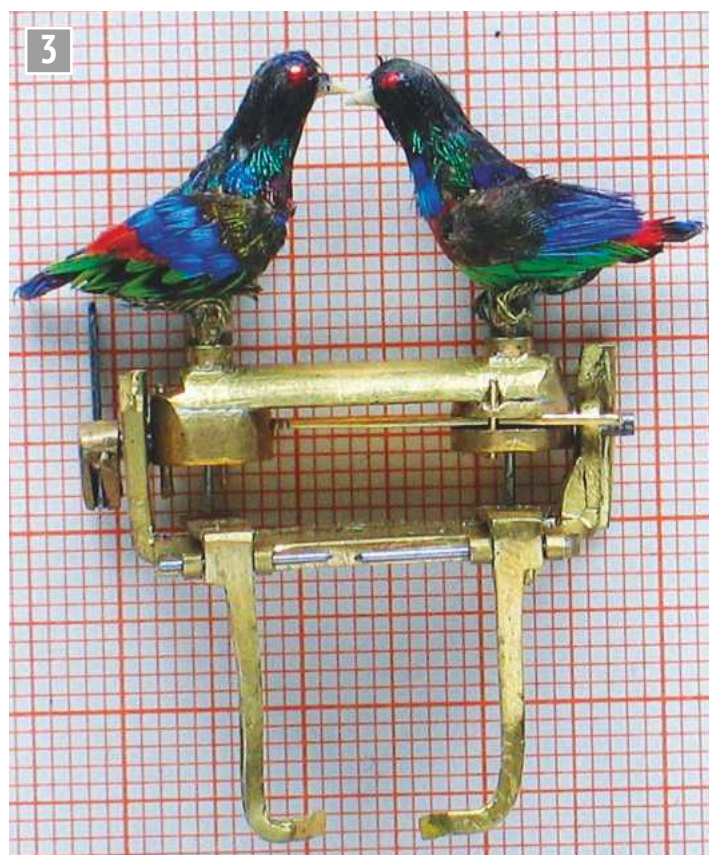
Could my project have been achieved more efficiently by making a fully worked out design? In theory, yes, but in practice I think not; many of the matters arising would not have become obvious at the design stage.

There is however a danger of going around in circles trying various solutions when a fundamental understanding would have ensured a single-shot solution. A past student of horology in Birmingham designed and made a clock with the module correctly decreasing along the train from spring barrel to

escapement. Sadly, he used the same module for the wheel and pinion on each axle and therefore mating wheels and pinions were of different modules. He had a fairly good grasp of theory and practical work but lacked one key element of understanding to achieve success.

One important aspect in a design is the power required to drive a mechanism. I suspect that many makers usually base this on similar pieces and fit a stronger or weaker spring or weight. In his tourbillon watch designs George Daniels ([ref 2](#)) chose a mainspring barrel which could house a large variety of available springs, both in terms of strength and length. In this way it provided the maximum scope to make the final choice; a very wise and safe approach which I have chosen to follow and I strongly recommend.

● To be continued.



An important part of the challenge and satisfaction in a making project is incorporating novel or extra features, such as twin birds, which are rarely encountered in other pieces, to make it a special and unique item (1mm small squares).

NEXT TIME

We will focus on the workshop environment and the part it can play in the work progress and the success of a project.

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2. George Daniels 'Watchmaking' (London: Philip Wilson Publishers) 1985 pp 371-404.

The Barclay Well Tanks of the Great War

PART 62

Terence Holland describes and constructs two appealing, century old locomotives.



Continued from p.705
M.E. 4638, 8 May 2020

This constructional series addresses Andrew Barclay 0-4-0 and 0-6-0 narrow gauge locomotives supplied for use in the First World War. Built without the use of castings, the 0-4-0 design is described as two versions; as-built for the British Admiralty in 1918 and as rebuilt and currently running on the Tallylyn Railway as their locomotive No.6, *Douglas*. The 0-6-0 engines described were built in 1917 and operated on 60 centimetre gauge track at the Western Front in France. These were small, spartan machines of which only 25 were supplied and none have survived into preservation.

The water tank and superstructure

The driving tender carries ten litres (for the 'imperialist' approximately two gallons) of water, which supplies feed to the fireman's injector and the crosshead feed pump. The top of the tank, fitted with a suitable foam cushion, provides the seat for the driver, whose feet fit into the footwell above the pony truck.

The tank needs to have some degree of corrosion resistance and, therefore, should be made from copper, brass or galvanized steel sheet – see **fig 202**. The tank lid is screwed in place with 6BA brass screws – no gasket is necessary here.

In front of the water tank is an enclosed space for the storage of coal, oilcan, various spanners and firing tools etc.

for the driver, along with the ubiquitous oily rag. Hence the name 'driving tender'.

Note that the storage space takes a 'standard', one gallon ice-cream tub, which holds a kilo or so of coal, i.e. enough to boil two gallons of water (roughly equivalent to the quantity of water carried in the tank). These quantities allow the engine to operate for over an hour. In the base of this space is the water isolation valve, which can be fitted to either side.

Plumbing

Fairly simple this, as only one pipe is concerned, apart from the standpipe at the rear of the tank, which needs no elaboration. The commercially-available valve for isolating the water from the tank is connected to $\frac{3}{8}$ inch diameter



Douglas with driving tender.

copper feed pipework, which provides an unrestricted water flow to the fireman's injector and the crosshead feed pump; the excess water from the by-pass valve returns to the side tank (the driver's bunker) from where it feeds the driver's injector. See fig 176 (M.E. 4626, 22 November 2019). Increasing this pipe diameter to $\frac{1}{2}$ inch would be acceptable,

as there is plenty of room for the increased size. Note that the isolation valve should be provided with a filter to prevent particulates entering the injector.

Photograph 294 is a view of Douglas complete with tender and, with cab access panels removed, ready to steam from the head shunt onto the main line.

The Norfolk Douglas

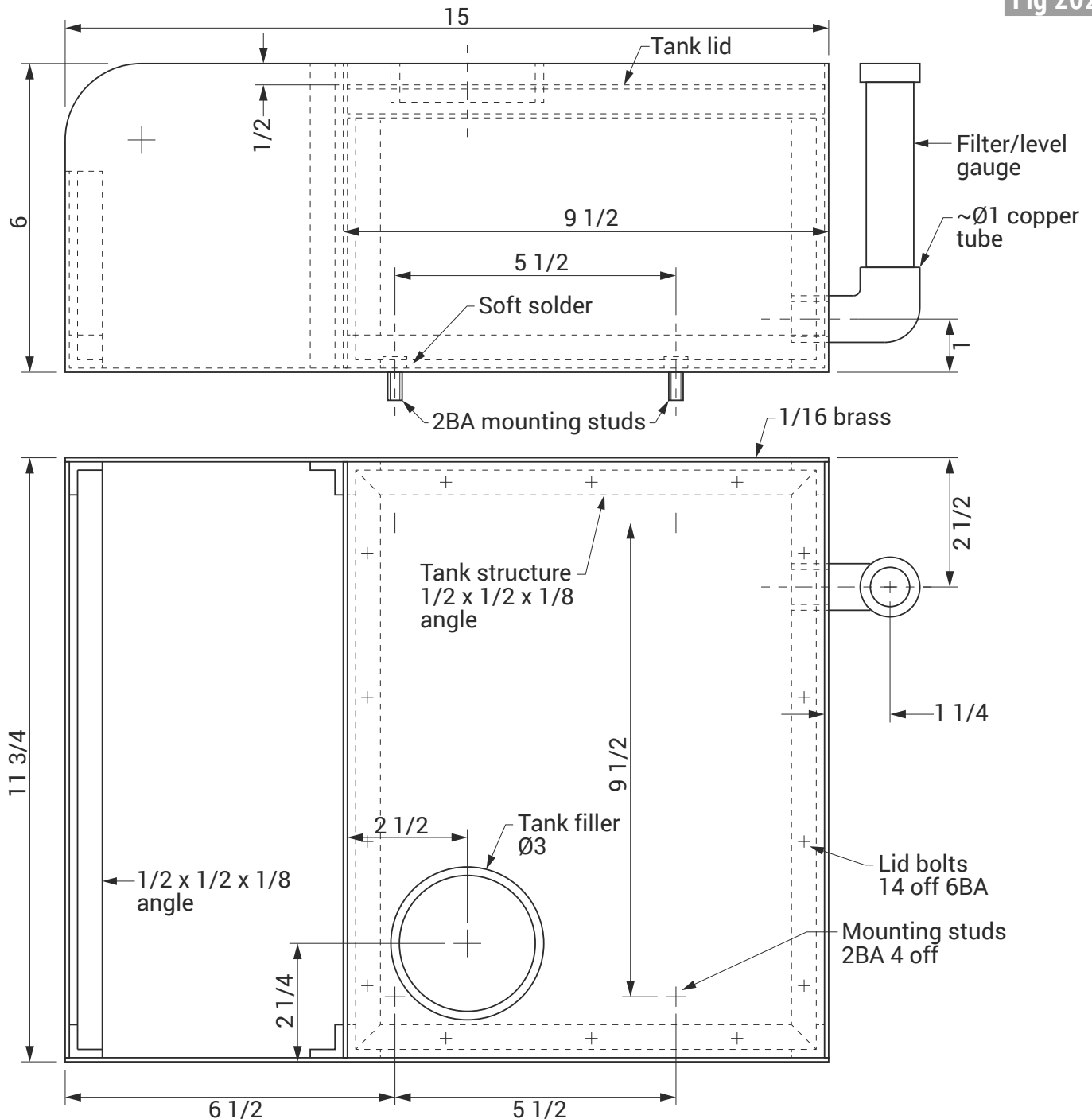
More photographs are available detailing progress on Mr Simmons' locomotive in Norfolk. **Photograph 295** shows the chassis on a raised railway (- if you go down to the woods today...). Was this its first outing from the workshop to the track?

Photograph 296 shows another view of the rear axle

assembly and the inside of the rear frame and cross stay – a view that is almost impossible to see once the boiler is fitted.

Photograph 297 shows the left-hand cylinder in place and gives a first class view of the centre (steam chest) drain arrangements. This fairly complicated pipework will eventually be hidden by the cylinder lagging plates. The

Fig 202



Water Tank

Water tank and superstructure.

Note that the storage space takes a 'standard', one gallon ice-cream tub.

photograph also shows the drain cock linkage, the front coupling rod fixing and the crosshead arrangement.

Another view of the crosshead and its cylinder connection is shown in **photo 298**, along with an etched nameplate.

●To be continued.

NEXT TIME

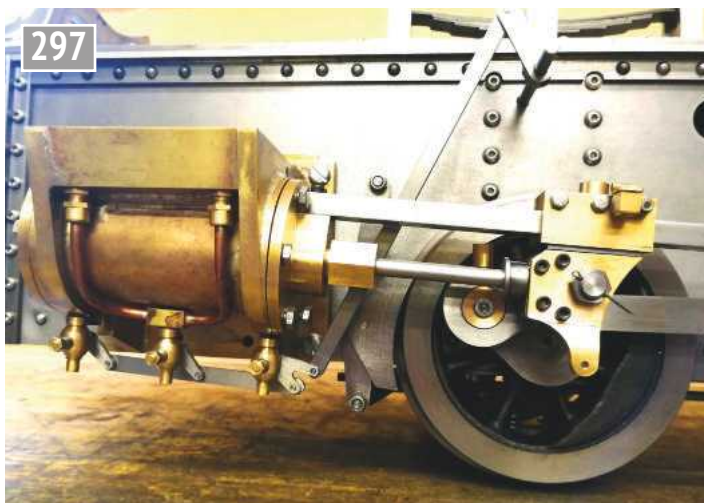
We'll look at the rôle of the Barclay tanks on the Western Front in the First World War.



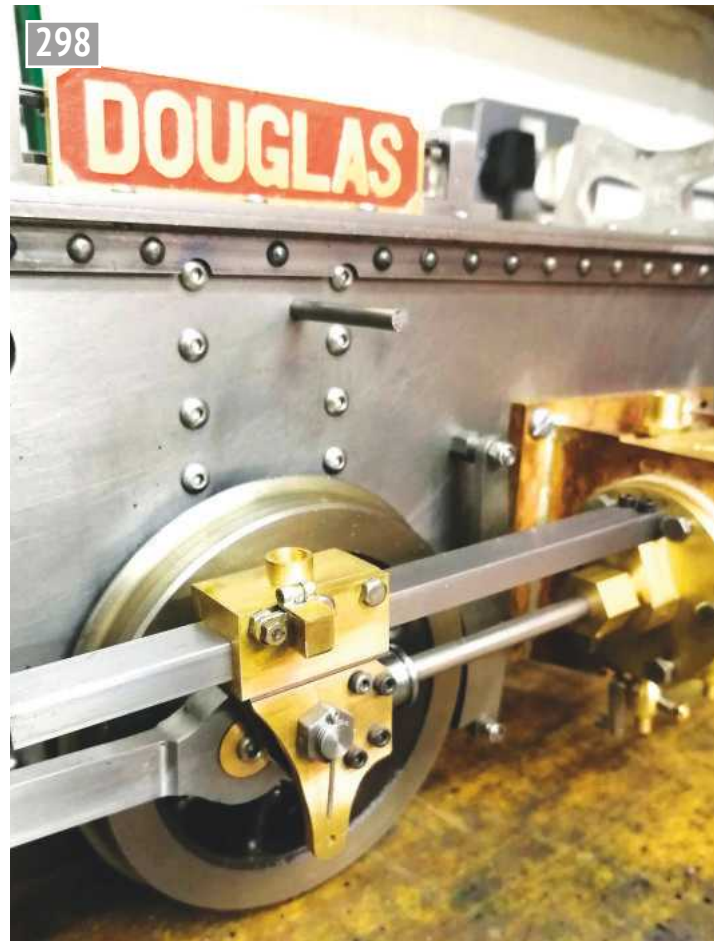
First visit to the track?



Rear axle assembly.



Centre drain arrangements.



An embryo engine that already has a name.

An Engineer's Day Out

Milestones at Basingstoke PART 1

Roger Backhouse

takes a trip into the past at Basingstoke's living history museum.



Aspects of Hampshire's living history museum at Basingstoke, known as Milestones, have previously featured in *Model Engineer* articles (**ref 1**) but it is well worth a re-visit. The museum was created by Hampshire County Council as a purpose designed building set into a chalk hillside. Whilst relatively new, the museum concept of recreating street scenes and shops to display objects goes back to the pioneering Kirkgate of York's Castle Museum (**photo 1**). An impulse decision to go on a very wet September day turned into an unexpectedly interesting trip.

Although Basingstoke is in a farming area, the neighbourhood also developed significant engineering firms and the museum claims that most exhibits were made within forty miles of Basingstoke. Much the same happened in Lincolnshire where nineteenth century farm mechanisation gave rise to many engineering companies including Rustons, Marshalls, and Clayton and Shuttleworth.

Taskers of Andover is a case study of how an engineering business developed. This began with



Milestones museum is housed in a purpose designed building containing re-created streets.

Robert Tasker working with Thomas Maslen in his forge ironworks at Abbotts Ann nearby, eventually taking over the business. As a devout non-conformist he found it difficult to get work from the local Anglican landowners and so moved to Andover where with his brother William he set up the famous Waterloo Ironworks near the canal in 1813, developing a foundry (**photo 2**). There Taskers made a range of items including ploughshares, finding that chilled cast iron was far superior to wrought iron. By 1865 they had made their first

steam engine, specialising in individually produced designs. This did not change until 1891 when, under the influence of another family member, they started their standard 'Economic' range. Like many other makers their first moveable unit was a portable engine, much used on farms to power threshing machines (**photo 3**).

The museum has recreated a workshop and a foundry with an example of Taskers' classic 'Little Giant' light traction engine, a type made from 1902 onwards (**photo 4**). They also made road



Taskers of Andover became a well known name for their agricultural machinery, steam engines and later semi-trailers.



A Tasker portable engine, of a type much used on farms to power threshing machines. Contractors would move these engines from farm to farm.

rollers, farm machinery and stationary engines including one displayed that was used in a Mottisfont paint factory (photos 5 and 6). Despite the

business suffering difficult times, it was reformed in the 1930s making semi-trailers using their specially designed coupling. Examples

included the Queen Mary aircraft transporters (a full size example of which is displayed at the RAF Museum in Hendon) (photo 7).

Another noted firm was Wallis and Stevens of Basingstoke (photo 8) which developed a range of agricultural machinery, later



Classic Tasker 'Little Giant' traction engine built from 1902 onwards.

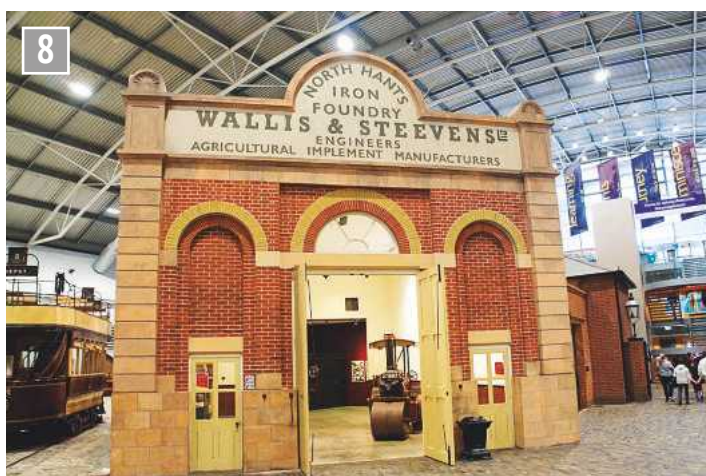


Tasker and Sons Type B steamroller made in 1923 and believed to have been used in Northamptonshire. The firm made their last steam roller in 1926 and that is also in Milestones.



Demonstration model for Taskers patent automatic coupling, much used on semi-trailers like the Queen Mary aircraft transporter.

10 hp horizontal steam engine made by Taskers and used in a Mottisfont paint works.



Wallis and Stevens had a noted engineering works in Basingstoke, partially re-created in Milestones.

With a sloping boiler the Simplicity roller was a radical attempt by Wallis and Stevens to rethink conventional steam roller designs.



adding traction engines and steamrollers. As the market for steam road rollers began to fall into decline they rethought the concept and came up with their small Simplicity roller which was a complete redesign with a sloping boiler. The firebox crown was covered by boiler water and was therefore claimed to be safer in less skilled hands (**photo 9**). Their Advance steam roller was designed to help cope with cambered tarmac roads (**ref 2**). As demand for steam engines declined the firm then produced diesel road rollers (**photo 10**). When a Wallis family member met a representative of the de Beers group it led to Wallis and Steevens supplying most of the machinery for the rapidly developing South African diamond mining industry. One

of the displays is the collection of woodworking tools used by the late Harry Bone and Stephen Spicer who worked at Wallis & Steevens as pattern makers. Theirs was a highly skilled craft (**photo 11**).

Re-created transport displays include a bicycle shop and garage (**photo 12**) plus a Great Western station with the ex Longmoor Military Railway locomotive Woolmer on loan from the National Railway Museum (**photo 13**). There are models of Southern locomotives too, and an open top tram and bus feature, both from Portsmouth (**photo 14**).

Motorcycles are displayed in the re-created streets and aviation is not neglected, with a fuselage and wings of a Seafire, the Royal Navy equivalent of a Spitfire with folding wings (**photo 15**).



With the market for steam rollers in decline, Wallis and Steevens developed a range of diesel rollers like this one.



Harry Bone was a skilled pattern maker in Wallis and Steevens' works. Here are some of his tools.



Milestones has several recreated shops. Here is the cycle dealer; at one time every small town had at least one.



Woolmer worked on the Longmoor Military Railway and is on loan from the National Railway Museum. The figures remind us that every station had a coal yard and coalmen were a regular sight in every street. Theirs was a hard and dirty job.



Portsmouth had its own fleet of tramcars like this one.



The Seafire was the Royal Navy version of the Spitfire with folding wings.



Dennis made many fire engines in Guildford, Surrey. This model dates from the 1930s.

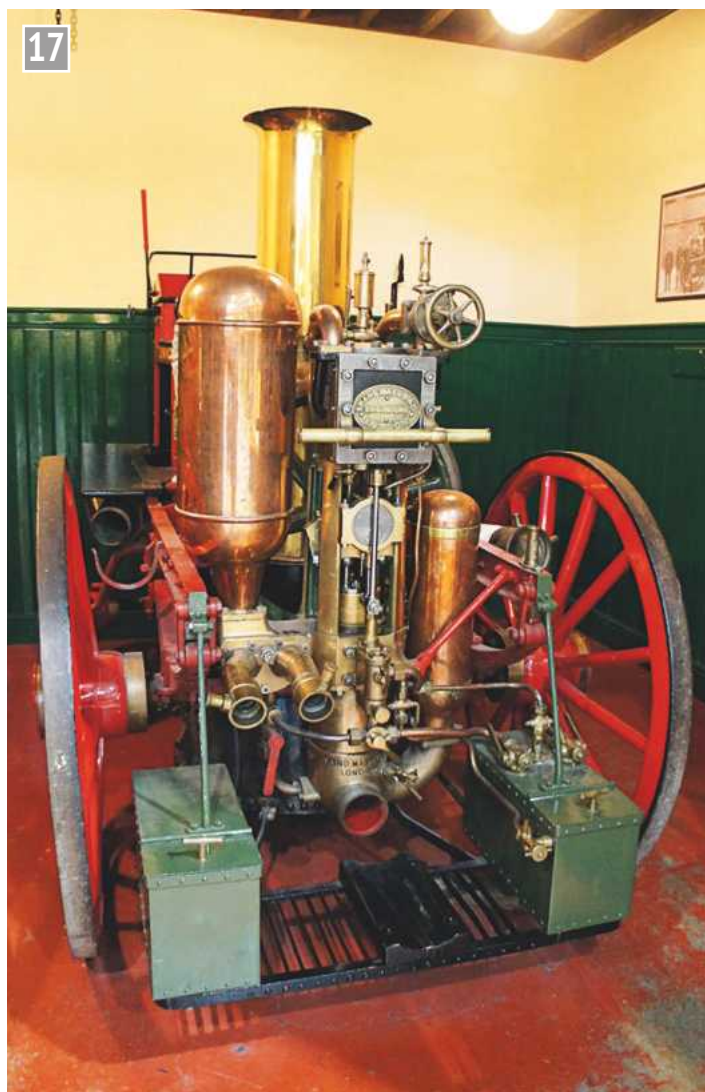
The fire service display is good with the earliest exhibits probably the hand pumps from Crondall and Andover (**photo 16**). Many towns and parishes had such pumps made to standard designs by London makers. Many Councils progressed to employing steam powered appliances,

such as the Shand Mason engine displayed (**photo 17**), and then later to internal combustion with fire engines such as the Dennis made at Guildford and a later airfield fire tender (**photo 18**).

●To be continued.



Town and parish councils bought hand pumped fire engines from London makers. This one is from Andover with another from Crondall.



London makers like Shand Mason later produced horse drawn steam fire engines like this one. The museum has a good fire service display.

REFERENCES

1. Vol. 198 issue 4294, 4295 2007 and Vol. 199 4305, 4308 2007.
2. See Wallis Advance Road Roller by Alan Barnes: *Model Engineer* Vol. 224, issue 4630, page 151-153, January 2020).



Turning the boss of the crank.



The finished crank.



The secondary connecting rod.



Squaring up before machining the top end.



The secondary connecting rod top end – after and before.

the tapped hole. Centre drill and ream the $\frac{3}{8}$ inch hole so the two holes are at $\frac{3}{4}$ inch centres. Saw and file the outline shape, drill and tap for a grub screw (**photo 61**). (I have no means of slotting the bore, so when it is all built up and in place on the main shaft I drill and tap the grub screw $\frac{1}{8}$ inch into the shaft.)

Secondary connecting rod – top end

Photograph 62 shows this and for the drawing please refer to fig 13, which was included in part 6 (M.E. 4637, 24th April).

Because I drilled and tapped a blind hole into the bottom, I turned the shaft down and threaded it 5BA x $\frac{1}{4}$ inch top and bottom leaving a 2 inch long blank centre. Then with a piece of $\frac{1}{2}$ inch brass bar I centred, I drilled and tapped

5BA and parted off a strong 1 inch (I used stainless steel so I had to insert a brass bush). Next, I screwed and Loctited all three pieces together. Then it is placed in the miller and machined down $\frac{1}{4}$ inch. Make sure that your bottom piece is square as in **photo 63**. Machine down $\frac{1}{4}$ inch so that you are left with $\frac{1}{4}$ inch flange. Mark out the 4 inch centre. Centre, drill and ream keeping all square, then file off the top profile as in **photo 64**.

The Crank Pin

Machine down as shown in the drawing but whilst it is still held in the chuck place the secondary connecting rod on, then screw the crank up tight and keep adjusting the thread until it is a good swinging fit. File two flats for a spanner to fit on (**photo 65**) before



Putting the flats on the crank pin.

parting off, turn a round dome and polish.

Main Shaft

To get the main shaft length screw all the secondary connecting rods back onto the base plate and put the crank onto the shaft. Swing the connecting rods up to the crank and fasten with the crank pin. Next machine down a distance piece out of brass to fit between the bearing and the crank. Then with the shaft protruding about $\frac{1}{32}$ inch with a good chamfer on, tighten the grub screw up - this will mark the shaft. Strip the shaft out and centre pop the mark, then drill the grub screw diameter hole $\frac{1}{8}$ inch deep into the shaft. Build it all up complete with the eccentrics (**photo 66**).

Do the same to the other side *not forgetting the 90° difference*.

Eccentric Strap Unit

Please refer back to fig 17, which was included in part 8 (M.E. 4639, 22nd May).

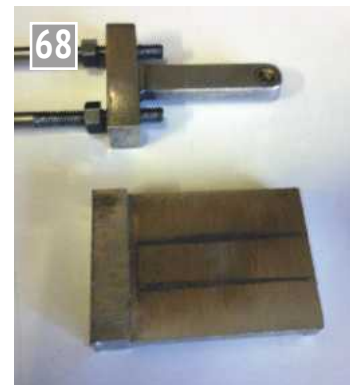
Using some 1 inch wide and $\frac{3}{8}$ inch thick material, approximately 3 inches long, fasten in the milling vice so you can mill $\frac{1}{8}$ inch off the top. Knock down onto parallels and square the end off leaving a $\frac{1}{4}$ inch strip for the base and mill down $\frac{1}{8}$ inch deep for $1\frac{1}{4}$ inch up the strap. Leave $\frac{1}{4}$ inch and repeat. Turn the job over, tap down onto the parallels and cut the other side as in **photo 67**. Mark out a $\frac{1}{4}$ inch strip in the middle for the strap as in **photo 68**. Saw it to shape leaving it flat on the top. Next drill the two $\frac{1}{8}$ inch holes at $\frac{5}{8}$ inch centres and then clamp onto the base of the eccentric strap (**photo 69**). Spot through, drill and tap for 5BA. Finish the profile of the end unit and



The crank and connecting rod assembled.



Roughing out for a pair of eccentric strap units.



Marked out for cutting to shape.

polish (because mine was made out of stainless steel I brass bushed it). Next cut four $\frac{1}{8}$ inch eccentric strap rods and thread them 5BA (I just screwed my rods straight into the eccentric - no nuts). Do not be afraid to bend them if they do not line up so that the end unit slips on easily (**photo 70**).

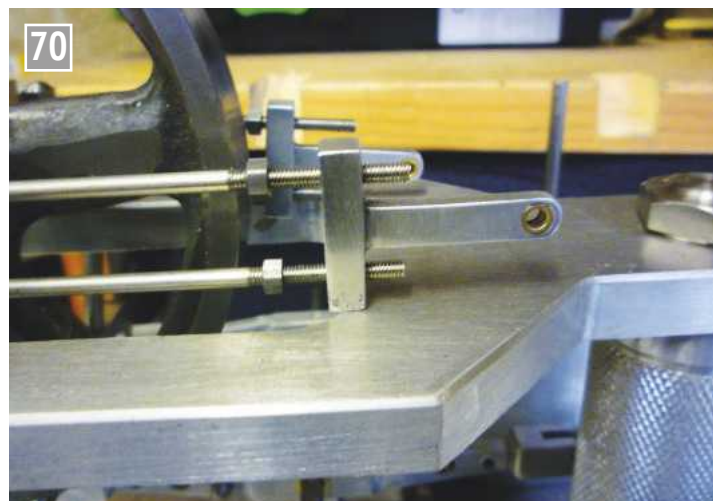
NEXT TIME

We make the crosshead guides.

● To be continued.



Spotting through for the fixing holes.



Unit fitted to the eccentric rods.

The Watt Governor

PART 3

A BLUFFER'S GUIDE TO HOW IT WORKS

Mitch Barnes gives a short potted history of the 'Watt' Governor which bursts a few myths before outlining how it works.



Continued from p.765
M.E. 4639, 22 May 2020

I outlined a potted history in the last episode but what exactly does a 'Watt Governor' consist of and how does it work?

Perhaps reflecting the age in which it was invented, the governor consists of a selection of simple components acting in concert to perform the important function that is speed regulation.

The genius of what is generally known as the 'Watt' Governor is that it has so few parts; while this may seem counter-intuitive, those of us who have had to devise mechanisms know that it is in perfecting and tweaking the mechanism that the parts count reduces. At the end of the process, one often thinks 'Wasn't it *obvious* that this is how it should be?'

Over the years, a lot has been written about the mathematics of governors and being unfortunately one of the world's most useless mathematicians, I'll leave such explanations to others who might be able to understand it. Maybe one of them can even write it up with lots of formulae for readers of this magazine in terms I can be made to understand. But for all you hopeless mathematicians like me out there who want to know how it works, the following is for you.

It'll help you a lot if you picture a governor in front of you while I describe what the bits are, how they are attached to each other and what they do. To help you, here's a convenient photo for you to gawp at (**photo 15**). I hope that looking at this image will help you understand what I am about to burble on about.

Deep breath, okay, here goes...

15



This is a typical Watt governor of the later type as used towards the end of their career in the mid-19th century - in fact this one is now nailed to a Major Beam.

The parts are the two upper arms, two lower arms, a pair of spherical weights and upper and lower brackets supporting the arms and riding upon a central shaft which rotates. There are variations on this theme but basically the principle is as follows and takes longer to describe than see in operation.

The upper arms are pivoted at their upper ends, to lugs located in a vertical plane on opposing sides of a bracket

attached at the top of a vertical rotating shaft, the lower ends of these upper arms carrying (usually) spherical weights.

The upper bracket is pegged to the central shaft and the shaft's rotation, driven often by bevel gears from the crankshaft, drives the upper bracket with the arms attached, around. The lower bracket also rotates with the shaft but it is able to slide up and down - within a small defined length of the central shaft.

The lower arms are pivoted on the lower bracket at their bottom ends, directly below the upper arms and bracket. The upper end of each lower arm is attached to the upper arms by pivots placed partway along the upper arms. The upper and lower arms are pivoted in one vertical plane from the upper and lower brackets and where the lower arm pivots on the upper.

The action of the governor while rotating about its central shaft is such that because the upper bracket is fixed at the top of the governor shaft and the lower bracket slides on it, centrifugal force generated by the spherical weights while the governor turns, acts on those jointed arms to pull the weights outwards and thus pull the lower bracket upwards. There are variations on this but generally this is the movement one sees. This movement of the balls flying further and further out in proportion to the rotational speed of the central shaft is the principle that Huygens patented (for regulating his clocks) and that Watt was later to utilise.

It is also the origin of the phrase 'balls out' which Americans are wont to exclaim when working at maximum effort.

This outward and upward movement of the arms, pulling the lower bracket upwards, moves a semi-balanced pivoted arm with a yoke at one end, which rides in a radial slot that is usually cut in the lower bracket. You can see this happening in **photo 16**. The upward or downward movement of the lower bracket pivots that yoke and the balanced arm, via a simple linkage, alters the position of the valve within the throttle, regulating the amount of steam that can pass into the cylinder and therefore varying the engine's speed as desired.

Simples!

Actually, it is far simpler in operation than the description suggests.

In fact, why not think about adding a governor to your favourite stationary engine of whatever type – by far the majority of full-sized engines had them in one form or another. Furthermore, it adds interest for the average member of the public when they peer at your handiwork and becomes a talking point, for you to engage in conversation with them.

There you have it: the 'Watt' Governor - no stationary engine should be without one...



ME *Balls out!*

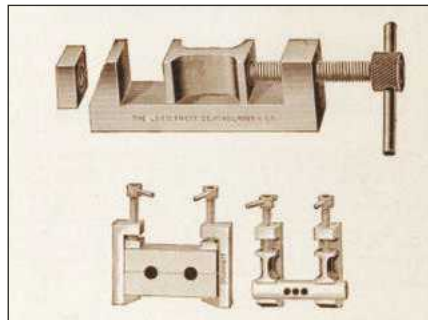
No.294

Look out for the June issue, number 294

MODEL ENGINEERS'
WORKSHOP



Martin Berry makes a set of pulley blocks.



Stew Hart makes some 19th century-style clamps.



Duncan Webster makes an Arduino Tachometer.

Pick up your copy Today!

Mastering Non-Ferrous Metal Casting

PART 5

Gerald Martyn has a go at making his own non-ferrous castings.



Continued from p.736
M.E. 4639, 22 May 2020

BOOKS LIST

Foundry Work for the Amateur, by B. Terry Aspin. Pub. Special Interest Books.

How to Cast Small Metal and Rubber Parts, by William A. Cannon. Pub. Tab Books.
The Complete Handbook of Sand Casting, by C. W. Ammen. Pub. Tab Books.

SUPPLIERS LIST

I have no link with any of these suppliers except as a satisfied customer:

John Winter

All the essentials such as sand, flux, core binder, bricks, safety kit, metal etc. Occasional advertiser in *Model Engineer*.
www.johnwinter.co.uk/foundry/model-engineering

Artisan Foundry

On-line shop for the essentials, and particularly Superwool, furnace building and metal casting courses.
www.artisanfoundry.co.uk/product_info.php?cPath=28&products_id=81

Vaughans (Hope Works)

Foundry and blacksmith tools and equipment
www.anvils.co.uk

Shrinkage is frequently talked of and it can be a problem. The one most commonly understood is the reduction in size as the solidified item cools down. However, in the sizes encountered in my work this has hardly mattered and I've made little allowance for it in the pattern making for small parts.

For brass and bronze the shrinkage is around $\frac{5}{32}$ inch per foot, so a part 2 inches long, like the buffer stock, will shrink by $\frac{1}{32}$ inch or so. Rapping the pattern in the mould will provide a fair bit of clearance, near enough to look after this for small parts anyway. Of course, if the part is to be machined then an extra metal allowance must be made for it in the pattern and the shrinkage allowance can be contained in that.

The shrinkage that causes a hard to predict but very real problem is that which happens on transition from liquid to solid. In a large block of metal this can cause a depression of the sides and, in the worst-case, large voids and tears inside the body of the part. It is made worse when a thick section is adjacent to a thin one as metal can be drawn from the still liquid thick portion to feed into the solidifying thin section, causing extra-large voids when the thick section subsequently solidifies.

Photograph 36 is a half section of my first cylinder casting, showing surface depression and some voids in the valve port block. By the time I came to do this casting I was experienced enough to know there would be a problem but I wanted

to find out how bad it would be, so I count this casting as an experiment rather than a failure. Also, by this point I was well versed in melting down and having another go so not unduly concerned to 'waste' one like this.

The solution to the problem is to provide a reservoir of molten metal to feed into the moulded part as it solidifies. This can be in the form of a large riser to contain metal somewhere near or above the casting, or perhaps a large feeder in the entry gate area. It is important to provide an ample feed hole from the reservoir to the part otherwise the part can be cut off from the feed too soon as the entranceway solidifies. A bit of trial and error is often needed.

In the case of the cylinder I provided a riser above the casting to hold a kilo or so of metal and transferred the pouring to this as soon as metal appeared in it rising up from the mould. This ensured that it was as hot as possible and I then immediately covered it with some insulating fire brick to retain the heat. To get my 2.1 kg cylinder casting I actually poured over 3.5 kg of metal. This is why I have two crucibles. Before starting the project I thought an A2 size would be big enough, but soon learned that I needed to 'upsized'.

For the wagon parts in my previously described casting sequence I am putting a reservoir cavity at the base of the sprue and feeding the mould through a large cross section gate. This defies the advice that the gate should be small and choke the flow a bit but my gate would be small for an industrial size casting;

it's all relative. With only a small crucible it simply can't be upended fast enough to achieve choked flow through any sensible gate, and it's not clear why this needs to be done anyway.

A couple of problems which made the safety clothing worthwhile were volcanoes and explosions. When the metal enters the mould the water in the sand immediately vaporises and has to escape somewhere. If it can't escape any other way then it will come back up the sprue hole as you are pouring metal in, driving the metal back out like a mini-volcano and ruining the whole job. The escape is not explosive but can throw blobs of metal around a bit.

The most common causes, singly or in combination, are poor or no venting and/or the sand being rammed too hard and/or the sand being too wet. The first two can be corrected next time. The only solution for wet sand is to lay it out to dry but not in the garden in case of rain or the local cats finding it useful. I laid my overly-wet sand out on the mixing tray in the greenhouse for a couple of days.

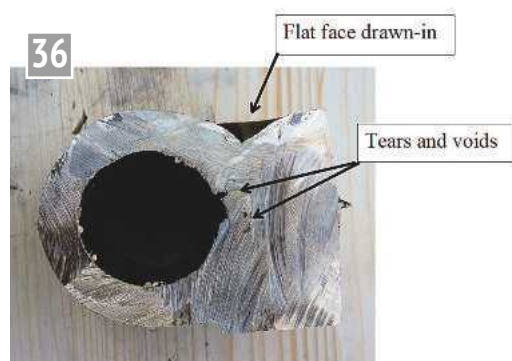
This problem highlights again the need to have somewhere prepared to pour spare metal because in this situation there is no way that what is left in the crucible will go into the mould. The other and more dangerous experience came about when I forgot to thoroughly dry the metal I was adding to a melt. The result of plunging even an unnoticed and probably tiny amount of moisture into a pot of molten metal was a loud fizz-pop and a spray of red-hot droplets. Fortunately, most of

the metal was fired into the side of the furnace, which still shows the pock-marks to this day, but it was an unnerving experience. So, dry the metal well in the furnace exhaust before putting it into the crucible!

For the cylinder casting a harder, baked sand core was required to form the bore. There are proprietary mixers to go with special silica sand to make these. A whole bag of sand to make a handful of cores seemed extravagant so I experimented successfully with the sand that's used between block paving and of which I had half a bag of left over. The sand is mixed with the mixer according to the instruction sheet and cores moulded in a female pattern, then carefully removed and baked in the oven.

Cores need to be vented through (skewer whilst still held in the pattern) and the main sand mould freely vented at each end of the core. Failure to do this will result in another volcano (oops!). After casting, the previously hard core simply crumbles away. The cylinder and core patterns and a spare core are shown in **photo 37**. For interest the finished cylinder sets are shown slave-bolted into the frames in **photo 38**. All the bronze bits you can see were cast at home using the methods described in this article. The counterbore in the flange for the centre attachment bolt head and the adjacent little nick in the cylinder cover are both prototypically correct, not a mistake.

I have mentioned the use of scrap and I now need to say that this comes with its own little problems. If the exact nature of the scrap is unknown then the best way to melt it and which flux or degasser to use are also unknown. Copper will alloy well with all sorts of other metals and some of these have been defined by custom, usage and specification, like gunmetal (copper with 5% tin and 5% lead).



Section of the first cylinder casting.

Countless other alloys will work perfectly well and give acceptable properties for home casting so, in a way, any old mix is worth a try but results may be varied. I melted what was given to me as gunmetal but looked more yellow, like brass. It melted well and I topped it up with a bit of (probably) phosphor bronze and added the degasser grains as usual. The mix produced a very interesting heavy green vapour but poured well. The resulting castings, though, had the roughest surface finish I've ever seen anywhere and with long whiskers of metal attached where it had run deeply into vent holes. Clearly the metal was so very fluid that it had penetrated between the sand grains.

On fettling and cleaning-up, and a trial machining, perfectly good results were obtained and it seemed to be a rather nice low-friction alloy well suited to the use intended. What was it? Probably mostly brass as the addition of phosphorus (also in the degasser) is supposed to make it very fluid. I termed this metal 'bross' and put it to good use, though will try to steer clear of such a mix in the future because of the extra work cleaning it up.

The lesson here may be that if in doubt then treat the mix as brass and use a cover flux, rather than as bronze with a degasser. Another and more recent mix of gunmetal and possibly silicon bronze produced nice castings but with a lead-plated surface. Possibly this was caused by opening the moulds too soon as (I have read) something

called 'lead sweat' can occur if the casting is still above the melting point for this metal. Deep in one of the books, also, is a note saying not to mix leaded bronze and silicon bronze but without saying why not, so the jury is still out on the cause of this oddity but the underlying metal was just fine and machined well. As mentioned in an earlier section, for important parts and for use on a boiler I melt (purchased) known quality metal.

Now for a final little tip, if the safety elves will allow. I use the small size propane bottles and, as many will know, as the gas runs out and the bottle temperature falls it becomes hard to maintain a high-power flame. The solution to this problem is to put the bottle into a bowl of warm (not hot!) water. Every last puff of gas will then come out at a good rate. Naturally, the spare bottle is there and ready for a quick changeover because a crucible full of half-melted metal is about as much use as a chocolate teapot. If, like me in the past, you are into all-season camping then this is a technique you can adapt for use in France where the only gas available seems to be those wretched little blue cans of butane which are completely useless when they get cold.

So how successful am I? I have now finished the latest



TOP RIGHT: Cylinder patterns and core. RIGHT: The finished Metro tank cylinders.

batch for the wagons; a dozen of each casting plus spares. One of the first buffer stocks failed to fill because I had not fully cleared the entry gate, one of the axle boxes shows signs of shrinkage and one has a part-line mismatch but is probably useable. So out of attempting to make 28 I have 27, two of which may be a problem on machining (or could just be the left-over spares), so at best 96% success, worst 89%. Whichever is right, the leftovers, along with all the offcuts and catchable swarf, will go in the 'mixed metal' tub for re-melting next time.

A question I'm often asked is whether I can melt cast iron. The answer is no. The flame is not hot enough without some extra oxygen, and the 'superwool' is not really up to it either.

So, there you have it - my experiences to date. I hope this will encourage some of you to have a go. As I've mentioned more than once, the mis-casts and mistakes can simply be considered a learning experience and melted down again for another go. I have yet to meet another model engineer who has done any home casting so am looking forward to comparing experiences, so get to it.

Fantastic Materials and Where to Find Them

PART 1: FERROUS METALS

Luker says you don't have to rely on suppliers to find the materials you need.



After the enjoyment I got from writing the articles on the Stirling locomotive build I thought it might be a good idea to have a series of articles concentrating a little more on the technical side of workshop practice. The best place to start would no doubt be the common materials used in a workshop and where they can be cheaply found and repurposed. This series will not be bogged down by technical jargon and material designations, but will be more of a general approach to materials, how to change their characteristics and how or where to use them. So, Prof. Meticulous, this series might be a little slow for you, but if I've piqued your interest, please read on.

Unfortunately, there will be no suppliers mentioned because they tend to come and go in these tumultuous times. I've also found the quality and service are variable so I would rather not recommend specific suppliers. Besides, most of the materials in these articles are rather common; I've stayed away from the Adamantiums or the Unobtainiums typically specified by Mr. Wiki Engineer. For the more specific materials it's worthwhile to download the supplier's catalogue where they normally have a common use section that will generally point you in the right direction.

This series will be a two-part series, with this part concentrating on the ferrous materials, i.e. the carbon steels. The second part will be the non-ferrous materials, including the aluminiums, copper alloys and stainless



Low carbon steel machined examples.

steels and a short section on how to differentiate between the materials.

Low carbon steels (mild steel)

Carbon is the most common alloying element in steel production. By increasing the carbon content of the steel it generally becomes stronger (increases tensile strength) at the expense of ductility. Other alloying elements give the steel's specific characteristics, for example, if you add small amounts of lead it increases the machinability of the steel, making free machining steel. Typically when adding carbon and other alloying elements it does decrease the weldability of the steel.

The low carbon steels are the workhorses for the home workshop and are used in a number of applications. With the carbon content typically below 0.25% it's not readily heat treated without carburising. The low carbon steels are easy to weld so they're good for fabrications. They're also ductile, making forming easy. If it's a thicker section, then making it red hot

and bending won't make the steel harder, so subsequent machining and fabrication is not an issue. Sometimes you get steel with the mill scale still on. This helps prevent rust with the steel in storage but it's not kind to your tools so it's worthwhile removing before machining. A 50/50 pool acid (hydrochloric acid) and water (**NB! add the acid to water**) makes a good pickling solution to remove any unwanted scale.

Some home workshops battle to get a good surface finish with the low carbon steels. To get a nice looking surface finish your final cut should be done using HSS with a sharp edge and some cutting fluid (**photo 1**).

Some parts need additional surface hardness to prevent wear and cold welding in service. This is where case hardening works well. The basic principle is as follows: the component is heated red hot and surrounded by carbon allowing the carbon to diffuse into the steel. This diffusion is temperature dependent and even at red hot temperatures it's a slow process. If you are looking for a very hard,

strong part you need to encase the part in carbon (crushed anthracite and 1% soda ash works well) and place it in the fires of Mount Doom (**photo 2**). Typically, I work on an hour per inch thickness at red hot temperature and that seems to work.

A quicker and easier case hardening method is to heat the component to red hot and dunk it in some used car oil. The diffusion time is greatly diminished and the depth is rather limited but a small amount of case hardening does take place. The item can be heated and dunked a few times to increase the amount of hardening. This also works well to blacken small items that are not worth painting or to prevent corrosion to homemade tools (**photos 3 and 4**).

Other than steel merchants, a convenient source of smaller shafts can be found in items like printers and computers. The roller shafts are free machining steel and are accurately ground to size.



Carburising steel.

High tensile steels

High tensile steels are typically low to medium carbon steels with alloying elements added to increase the tensile strength. They can be heat treated depending on the grade obtained. I normally heat a test piece to red hot and quench it in water. I test the hardness with a file; if the file bites in and removes metal easily it hasn't been hardened; if it glazes over the material it has been hardened. If the steel has become very hard you might need to temper it by reheating to a golden brown and quenching. This will increase

the ductile strength and prevent brittle failures. This can also be done in a commercial oven at around 200°C. For smaller items, old bolts (grade 8.8 or higher) are a good source of high tensile steel or, if you need hex pieces, Allen keys work (the black ones). You may need to soften the metal by heating it to red hot and covering it in some dry sand until cool.

Generally, I stick to EN8; it's easily obtainable in a wide range of sizes and machines well. I use it for crankshafts, wheel shafts and any shaft that requires a higher strength than mild steel (**photo 5**).

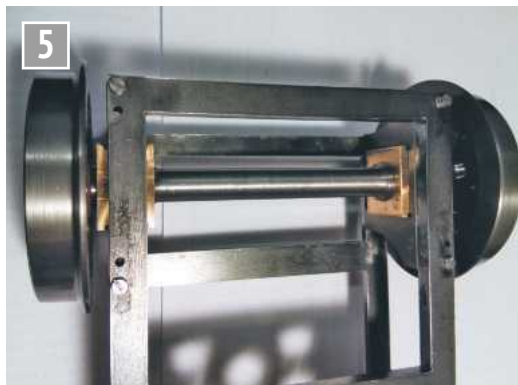


Oil blackening steel.

High carbon steels and tool steels

High carbon steels and tool steels can be readily heat treated to increase the material hardness. Silver steel is a common tool steel used to make taps, cutting tools, etc. in the home workshop. The steel is heated in the same fashion and tested for hardness as with the high tensile steels. Typically I temper tool steels in our oven. This gives a little more control and depending on the material the tool needs to cut, different temper temperatures are selected. The accompanying list (**photo 6**) gives a guideline for temper temperatures (**ref 1**).

Old files, broken taps and drills are a good source of tool steel that can be ground to the shape needed for machining. This saves buying expensive HSS rod. The back end of broken taps, ground flat, makes good square drifts for that odd square hole (**photo 7**). I also use taps for small taper reamers by grinding them on the lathe using a fitted micro grinder (**photo 8**).



Typical shaft from EN8.

Blackened homemade tools.

6 TEMPERING TEMPERATURES FOR VARIOUS TOOLS					
	Degrees C		Degrees C		Degrees C
Arbors	200	Dies (Drawing)	200	Pickaxe	255-275
Axe, Cutting edge	255	Drill (Very small)	210	Planer Tools	215-225
Brass-turning tools	170-190	Drill (Small)	220-240	Reamers	230-240
Chasers (Thread)	230	Drill (Large)	245	Scrapers	200
Chilled iron-turning	150	Engraver's tools	230-250	Taps	210-220
Cold Chisel	260-280	Gauges	220	Screwdrivers	280-290
Counterbore	220-240	Hammer-head	230-250	Shaper Tools	215-225
Centres (Lathe)	215	Lathe Tools	200-220	Springs	300-310
Dies (Screwing)	215-225	Milling Cutters	210-230	Wood Chisels	215-225

Temper temperatures list.

Cast iron

Cast iron is one of my favourite materials but I'm uniquely biased in that I mix my own cast irons based on the material characteristics I'm looking for. Cast iron can be made ductile, incredibly hard or easy to machine by changing how the carbon graphitises during solidification. All this is typically done by adjusting the additives before pouring. I've used cast iron in a number of steam engine applications and the general perception that rust is an issue is misleading. I personally haven't had any issues with cylinders rusting or seizing, although I do keep them properly oiled. Cast iron on cast iron as a bearing surface is as good as, if not better than, the bronzes on mild steel and I have had very good results with eccentrics and eccentric straps made from cast iron (**photo 9**).

There are hundreds of different grades and post-casting heat treatments for industrial applications using cast iron, but most of the casting additives fade when it is re-melted so you need to start afresh with mixing and additives (that's an article and a half on its own!). Cast iron is also one of those materials that are easy to come by and used in numerous everyday applications. You should have seen the looks I got from the mechanic when I told him I wanted the disc brakes from my wife's car for melting!

Spring materials

Materials for springs can sometimes be an issue to get, especially in small amounts. Flat springs or leaf spring material can be made from band saw blades or, at a push, hacksaw blades. I've also made leaf springs from high tensile strapping, typically found on crates (**photo 10**) and the flat coil springs from any appliance with a retractable cord. Our vacuum cleaner suddenly stopped retracting the electrical cord about the time I made the coil springs for my locomotive. Funny that...



7 Square hole cut with the back end of broken tap.



9 Cast iron eccentric.



11 A simple put-put boat.

For normal coil springs music wire will work and certain sizes are available from music shops. Just ask for the steel guitar wire. For a wider range of gauge sizes, tracer wire used for fishing will work and it doesn't rust. All of my steam valves and clacks requiring a spring have tracer wire in and they're all still going strong. For larger gauges (e.g. safety valve springs) SS316 TIG welding wire will do the job.

Biscuit tins

For all those granddads that want to make little toys for their grandkids I've saved the best for last! Tin plated steel

is a convenient source of plate to make toy models. It's easy to bend, cut with tin snips and easy to join using normal electronic or plumbing solder. Food grade tins, like biscuit tins, etc. are normally coated with a thin plastic coating on the silver side and branding paint on the outside that needs to be removed before the solder will take. This can be done with a thinners-soaked rag. Just make sure you fold the ends over or go over the ends with fine sandpaper to stop the little ones from cutting their hands.

The simplest is of course a little putt-putt boat and there are a number of designs on the



8 HSS taper tool and square drift.



10 Leaf spring system.



12 Simple wobbler steam car.

web. The one shown in **photo 11** (that Picasso got hold of) is a very simple one a friend's young son helped me build; an engineer in the making!

If you want a slightly more complex project a simple steam car might be the way to go. This green one I made for my nephew (**photo 12**).

● To be continued.

REFERENCE

1. *Hardening, Tempering and Heat Treatment*. Cain, T. 1984. Argus Books: ISBN 0 85242 837 5

A New GWR Pannier

PART 19

Doug Hewson decides that LBSC's well-known GWR pannier tank design needs a make-over.



Continued from p.713
M.E.4638, 8 May 2020

Now, I think that the time has come to do a bit more work on the boiler. The first thing I want to describe is the fire grate, ash pan and a damper. I think you might turn your nose up at the thought of fitting a damper but I can assure you that if you haven't had one before then you don't know what you are missing!

I did have a bit of a problem with my ash pan in the first place as I just blindly copied the Ron Bray design but it was nowhere near deep enough. I altered it to make it one inch deeper as there was plenty of room to do that.

We used the Y4 for building my own railway in my garden and after I dropped the fire after it had been in use for eight hours one day there was a large hole in the grate. I had made the fire grate out of $\frac{3}{8}$ x $\frac{1}{8}$ inch mild steel bars and it only lasted 50 hours because it just became blocked with ash. I know that because we always keep a log book for all our engines and note every detail of the steaming and this tells us how the engines have run, and any maintenance done on them. We went on shed to clean the fires in the two locomotives (and closed



Digging out the cutting at Ais Gill.

the dampers!) at about one pm while we had our lunch and then by about 8pm the grate was blocked again. The fires stayed in over lunch time (on both engines) as we had banked the fires up with a bit of slack and filled the boiler up to the top of the glass, so all we had to do was to give them a bit of a rake through, empty the ash pans again and then we were off shed.

Photograph 150 shows Howard Hill and John Love digging out the cutting at Ais Gill at the top of the garden and loading the wagons with the muck. A very young Matt Baker is attending to the fire on my new Y4. I followed it up with

my stone walling as we went along. **Photograph 151** is Phil Bootland returning with another load behind 780, with the steam brake on coming down the 1 in 60 bank to where we were tipping the spoil and there was no paddling about on the lawn. All really good fun!

Anyway, since then I made a new fire grate out of $\frac{1}{2}$ x $\frac{1}{8}$ inch stainless steel fire bars. It was looking a little down in the mouth after about 1,500 hours but all I had to do then was to replace the centre four bars and it has lasted now about 2,500 hours.

For the record, the fire grate I made for my new Y4 was to all intents and purposes the

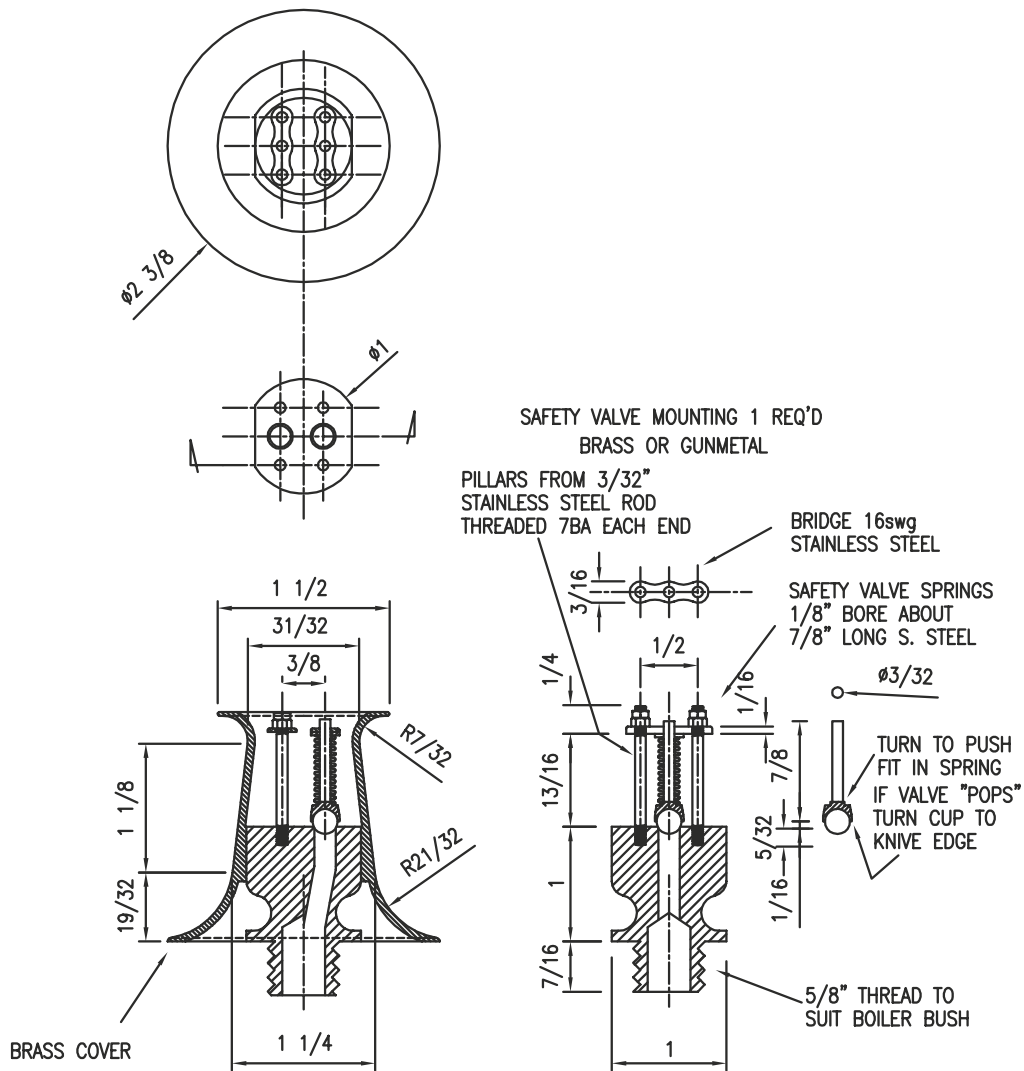


Carting away the spoil.

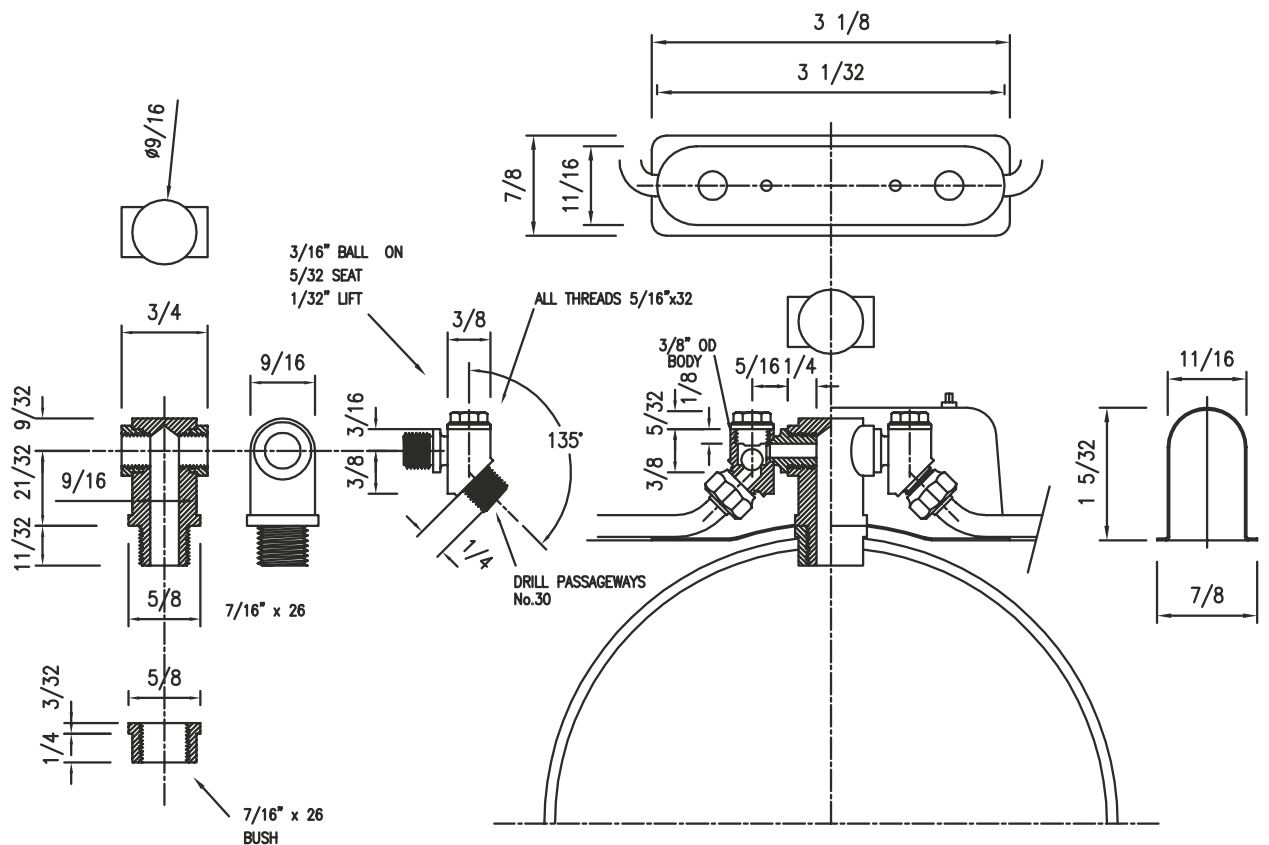


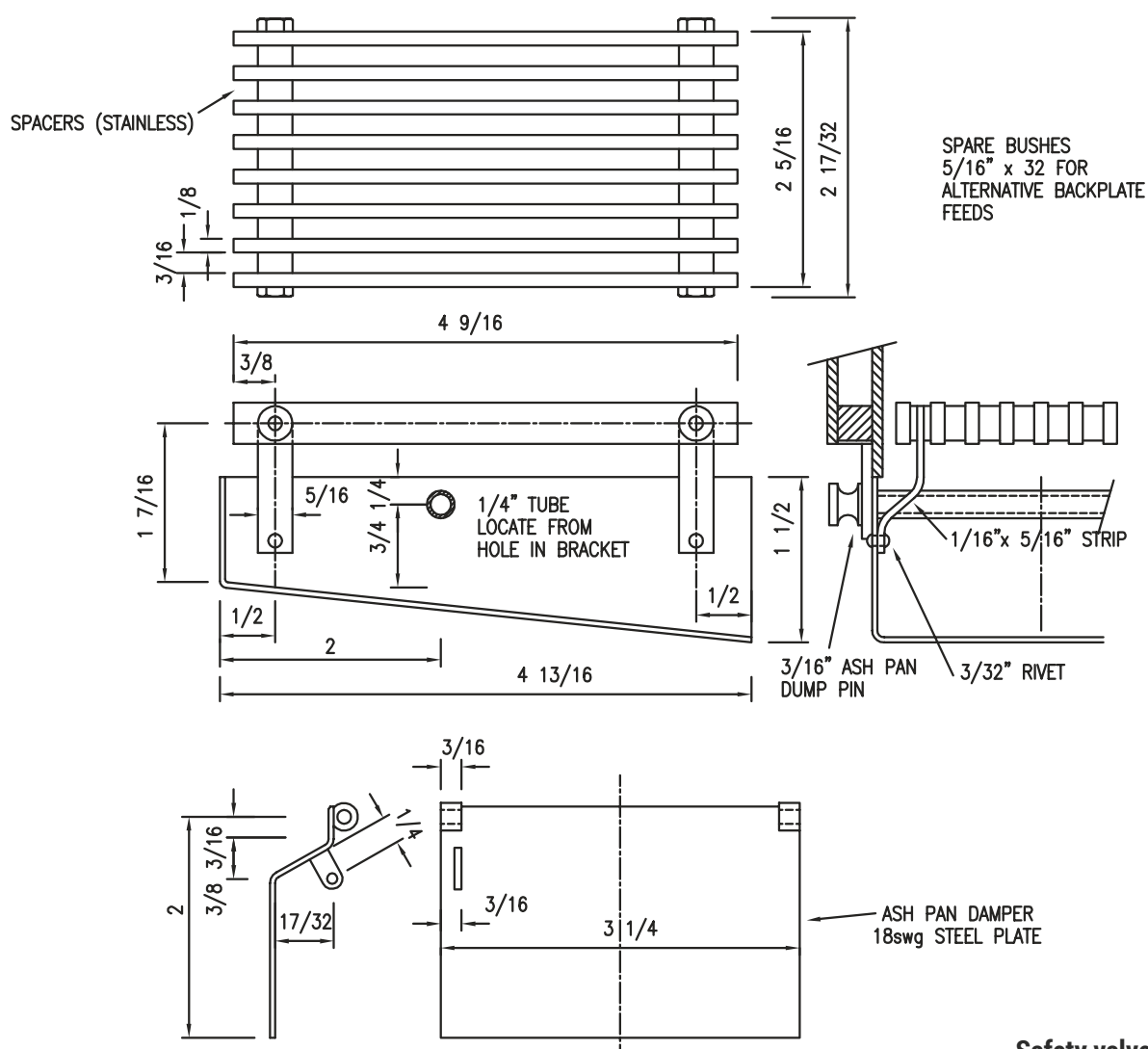
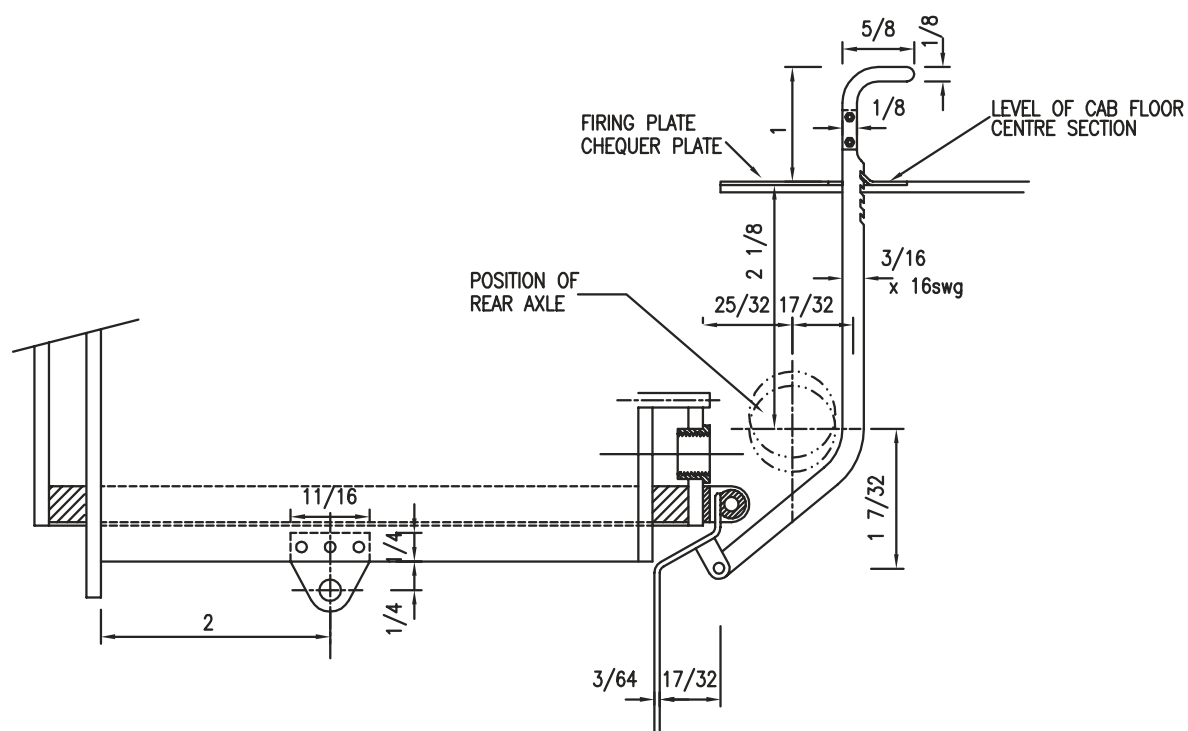
Folding up the ash pan.

Fig 33



SAFETY VALVE ARRANGEMENT





Safety valve, top feed and grate.



Bars and spacers for the grate.



Fabricating the dump pin tube.



Dump pin tube attached to ash pan.



Completed grate and ash pan.



The dump pin is accessible through an aperture in the frame.



Damper levers (just by the firehole door).

same as the Pannier Tank, so at least I can illustrate that. **Photograph 152** is the ash pan, part made, but ignore the cutaways as they were to fit around my Y4 horn blocks. **Photograph 153** shows the stainless fire bars with all of the bobbins to go between them. The rods to join everything together were also made from $\frac{1}{8}$ inch stainless rod. **Photograph 154** shows the beginnings of the bar through which the dump pin

passes and **photo 155** shows the rod fitted into the ash pan. **Photograph 156** obviously shows the ash pan finished off and **photo 157** shows the dump pin on the Y4 with the fire grate and ash pan in place.

The ash pan needs making out of a piece of 16swg steel plate which I am sure that you will be pretty good at by now. It hangs from two brackets attached to the boiler so that the underside of it is level

with the underside of the foundation ring. The dumping arrangement is made from a piece of $\frac{1}{4}$ inch diameter steel tube just as a guide for the pin and drilled through No. 29 just to give it a bit of clearance. This tube can be silver soldered or riveted straight inside the ash pan and if you take heed of the dimensions it should sit nice and tightly up to the foundation ring.

Now I am sure you will all love a damper to play with

and people will ask you what the little gadget is when they see it on the footplate. They will be most impressed! It will be something to make conversation about anyway - very useful they are too, especially if you need to leave the engine for any length of time. The only thing is that the engine does not make steam very well if you leave it shut when you get back, which I have done on several occasions!



Blanked off clack pad.

First of all, you need a piece of 18swg steel plate shaped as shown on the drawing and then a couple of pieces of $\frac{1}{4}$ inch rod drilled through No. 30 to form the two hinges. They are silver soldered on to the damper plate. Whilst you are silver soldering you can also fix the little strip on to it to form the attachment for the operating rod. This is also the next thing to make and it just pokes up through the cab floor. I would also fix the little handle on to it to make it look neat, and like the real thing. These two can be made of brass or steel.

The damper can be hinged across the bottom of the boiler, either by a strip across the whole of the boiler with the ends turned up, or by a couple of trunnions either side. You will also need to make a little catch plate to screw down to the firing plate, which should be a piece of chequer plate let into the wooden cab floor plate.

However, I have just been making a further study of **photo 158** and it shows a little piece of rod which fits across the opening and the damper rod just latches on to that. At this point the planks go from side to side. Where the step occurs on the left-hand side there is a small piece of timber which runs from front to back, at least that is apart from where there is a piece of chequer plate which surrounds the opening for the front sanding lever. See photo 158. This is also a good photograph

showing the front and rear damper levers, except I have only shown a rear damper. You can always do the job properly and fit both dampers! Whilst taking about the cab floor you can also see the bunker shovelling plate on the floor in front of the opening to the bunker, which is a piece of plain plate.

I also want to talk about the top feeds. On all the Pannier boilers there are two pads for fixing the clacks to the back plate. **Photograph 159** shows one of these pads, which is on the boiler of 9681 on the Dean Forest Railway. It has the rusty plate on it to blank it off, as the locomotive has now been fitted with top feeds, as seen in **photo 160**. It is to the left of the gauge frame. Also, on this photograph is the 'Mason' valve which is for the train steam heating, which we will eventually come to when I describe the boiler fittings proper. The top feeds are pictured in photo 160. **Photograph 161** is a good photograph of Frank's locomotive with the naked top feed, which shows the pipework which Frank has fitted to his Pannier.

Frank has made an excellent job of his top feeds and the pipework to them. Also, on the right-hand platform is the rodding to the cylinder drains and a very nice little quadruple oil box to the horns for which I made a pattern to have them lost wax cast. These



Top feed cover.

should be available from G & S Supplies and others all being well. There is also a very nice little GWR standard No. 5 toolbox on the platform!

As you will see from the photograph, the body of the top feed is made from a piece of $\frac{5}{8}$ inch diameter good quality brass or gunmetal and it has a couple of bushes silver soldered in there which are tapped $\frac{3}{16}$ x 32 and so are the rest of the threads.

Also, if you had not noticed, you will need to make some special thin union nuts. As long as they have about four threads to hang on to, they will be fine. You will also need to make some sharper bends than what you may be used to, to fit them on to the top feeds. Anyway, you can see that Frank managed it with his.

The cover for the top feed was made from three pieces of copper sheet which were formed over (a former, what else!) and silver soldered together. For the caps you will need to tap them 10BA and screw in a couple of lengths of $\frac{1}{16}$ rod to fix the top cover on.

Now, there are other things which you need to look at on photo 161. One thing is the twin safety valves, which I will come to very shortly, and the route of the blower pipe. He couldn't fit the blower pipe quite where it should go as the boiler is too large by $\frac{1}{2}$ inch, but it should come from the tapping on the turret and then emerge from that little hood on the cab front sheet to the left of the whistles and run underneath the cleading. It then comes straight to that



Uncovered top feed on Frank's pannier.

little elbow on the top of the smokebox. It should just run beneath the top plate which fits across the tanks.

One thing I never have liked about the LBSC version of the Pannier Tank is that it only has one safety valve. Yes, I know that a lot have been built but I can't see that that makes it right, so I have designed a new one. All being well G & S Supplies will be making a pattern for the cover to go with it so that it can be cast in brass. If it is machined properly it should just be a snug fit over the safety valve mounting. It should screw into any bush as long as you furnish it with the correct thread in the boiler. **Photograph 162** shows the twin safety valves off very nicely.

You need to make a suitable mounting for them of course and this will consist of a piece of 1 inch brass bar threaded to

suit your boiler bush and turned to the shape shown. There is no reason for this really but I have just copied the works drawing so that is why it is the shape it is. No excuse not to then really! There are four pillars which are made from stainless steel welding rod, threaded 7BA at both ends, and you need to make the little tops to go on them as the safety valve spindle guides.

The valves are made in two pieces with a spindle also made of the welding rod with a cup on the bottom to hold a $\frac{1}{8}$ inch ball. It should just wheeze before it blows off but if it doesn't then just make the lower edge into almost a knife edge and then it should. GWR locomotives are not designed to have Ross Pop safety valves, I don't think, but I am no expert on GWR locomotives so please correct



Proper twin GWR safety valve on Frank's pannier.

me if I haven't got that right! One thing you ought to know is that Frank has also fitted half nuts on the underside of the tops to hold them firmly in place.

NEXT TIME

We shall consider the regulator and the dome.

● To be continued.

The Suez Crisis

Our Man in a Shed, James Wells, recalls an era of domestic ingenuity.



As the first industrial power, the UK, by using mass fire power against spear waving natives, had gained an empire on the cheap. Post WW2 the remnants of empire had become expensive liabilities to an almost bankrupt UK but one of the few profitable sources of empire was the Suez Canal.

Despite the fulminations of such arch imperialists as Winston Churchill, the incoming new Labour government was steadily disposing of empire, beginning with India in 1947. Whatever nostalgia the middle classes might be feeling for the loss of empire, after the experiences of two world wars, the working classes had no such feelings.

The post WW2 reconstruction was well under way, with whole new housing estates being built and a network of new roads being planned and some under

construction. With the main trading rivals of Germany and Japan still rebuilding, the UK was without a trading rival.

By the mid 1950s, as the shortages of the aftermath of WW2 slowly began to recede, with even the last items of butter and petrol finally off ration, a modest degree of prosperity was indeed beginning to return. Consumer goods such as washing machines and TVs were also beginning to become available due to such schemes as 'hire purchase'. By agreeing to make regular payments it was possible to gradually furnish a reasonably good home and plan for the future.

This was also the great era of DIY, with demand being sufficient to support the publishing of several large colourful DIY magazines with the most famous of these under the editorship of

the legendary Fred Camm. Sculleries, wash houses and even tin baths were passing into folklore.

For the Men in Sheds, one main change was the increasing availability of personal transport. The pre-WW2 cars and vehicles were beginning to disappear and the UK manufacturers were beginning to grapple with the problems of producing suitable modern designs that were, above all, economical with fuel consumption. Petrol had never been cheap in the UK and fuel economy would always be a major factor affecting car sales.

In this period a whole range of bizarre vehicles, usually referred to as 'bubble cars', had made their appearance, sometimes in fairly substantial numbers. Almost from the start it was obvious that these vehicles were grossly underpowered and would

be unsuitable for the future motorways being planned. It is just possible that without the Suez Crisis such underpowered vehicles would have been gone from the roads much sooner than they were.

Against this background was the still existing legendary National Service, where a young man was expected to report for compulsory military service training and it was here that an unforeseen problem would reveal itself during the same Suez Crisis.

As the UK economy slowly improved this was increasingly based on oil fuel with coal increasingly and steadily being phased out. The post WW2 British investments in the Middle East oil producing nations had been a wise decision. At the same time the large bulk oil tankers which would use the Suez Canal route were being built to transport the increasing imports of oil.

In 1956 Colonel Gamal Nasser nationalised the British Suez Canal Company. In the political debacle that followed the Egyptians eventually sank block ships in the canal choking off the oil supply to the UK. The effects of the ensuing fuel shortage had considerable long-term effects on the Men in Sheds.

At this distance in time my main memory is how rapidly the fuel shortage took affect and that there was no level of chicanery, double dealing and outright theft that wouldn't be resorted to in trying to obtain petrol. A local military establishment lost 2,000 gallons of petrol. The official report read that the fuel must have 'evaporated' as no other explanation for the loss could be found.

A regular late-night visitor was the stranger banging on the front door offering black market petrol at about five times the official rate. My father even showed me how to siphon petrol from a vehicle fuel tank.

Official petrol coupons were issued and these rapidly became a harder currency than

bank notes. In the 1950s the Co-op Society used to issue stamped tinplate and plastic coins as dividend ('Divi') and even these could be included in petrol 'trading'.

For the Men in Sheds it became ever more difficult to get to their place of employment using the public services as these were also suffering fuel shortages and the reduced services were unable to cope with the numbers travelling to work in an industrial area.

At this stage the low and underpowered vehicles gained an extra lease of use but it was to be the motor scooter with a much better power to weight ratio and good fuel economy that was to prove a surprising winner. Unlike the British motor cycle dealers the scooter dealers also usually had stocks of spares available.

I still remain reasonably convinced that the rapidity with which National Service was later abandoned was due to any reluctant National Servicemen's likely debts. The day of the cheap Empire soldier was definitely over.

The local electricity company suppliers did their best to both eke out and share electrical supplies, again affecting the Men in Sheds. When the electrical supply was about to be shut off some warning was given by the power being briefly shut off to give advance warning of a longer shut down in a few minutes. Oddly enough, this brief warning certainly seems to have given the electricity suppliers a friendly reputation.

As this warning was given it was time for the Men in Sheds to move to the house where their wives would be removing the evening meal from the oven to the front of the fire to at least keep the food warm until the power came back on as the evening rush got fed and power demands eased. Lighting dimming but not actually going off became known as the 'brown out'.

Considering the experiences of the general population I can only definitely remember two possible methods of conserving fuel, one of these being the H₂O 'Bomb'. I still think that, being the size and shape of a standard Army hand grenade, it was meant to appeal to the ex-military man.

The second involved a witch's brew, mixing petrol with a certain amount of paraffin and adding moth balls! I still don't know how successful such a mixture would have been but moth balls rapidly became a black-market item.

The government almost panicked and tried to form up military forces to invade Egypt. Most of the Reservists though, including the Men in Sheds, having begun to enjoy the fruits of their WW2 and later efforts, weren't prepared

due to any reluctant National Servicemen's likely debts. The day of the cheap Empire soldier was definitely over.

Eventually American petrol began to arrive, the Royal Navy gradually cleared the Suez Canal and the situation began to ease, with things gradually becoming more normal, but several lessons had become obvious to the Men in Sheds.

It was to be the small car that would become the most practical form of travel and with the increasing production of fibre glass boats both these were becoming the outward symbols of returning prosperity. The underpowered 'gimmicks' were on their way out and would never again mount a serious challenge.

At about the time that this lesson had been absorbed the Germans and particularly the Japanese had rebuilt their economies and it would be the Japanese with their modern car and motor cycle designs who would be the real beneficiaries of the British Suez Crisis.

There was to be one domestic change as a result of the Suez Crisis which is still with us but now un-noticed. In SE London the bread was originally delivered to home addresses by horse and cart. Most people on the route had got to know the horse and frequently had a little titbit for him. The horse knew the route, which ended at the local pub, where the deliveryman had a pint and the horse had a bucket of beer.

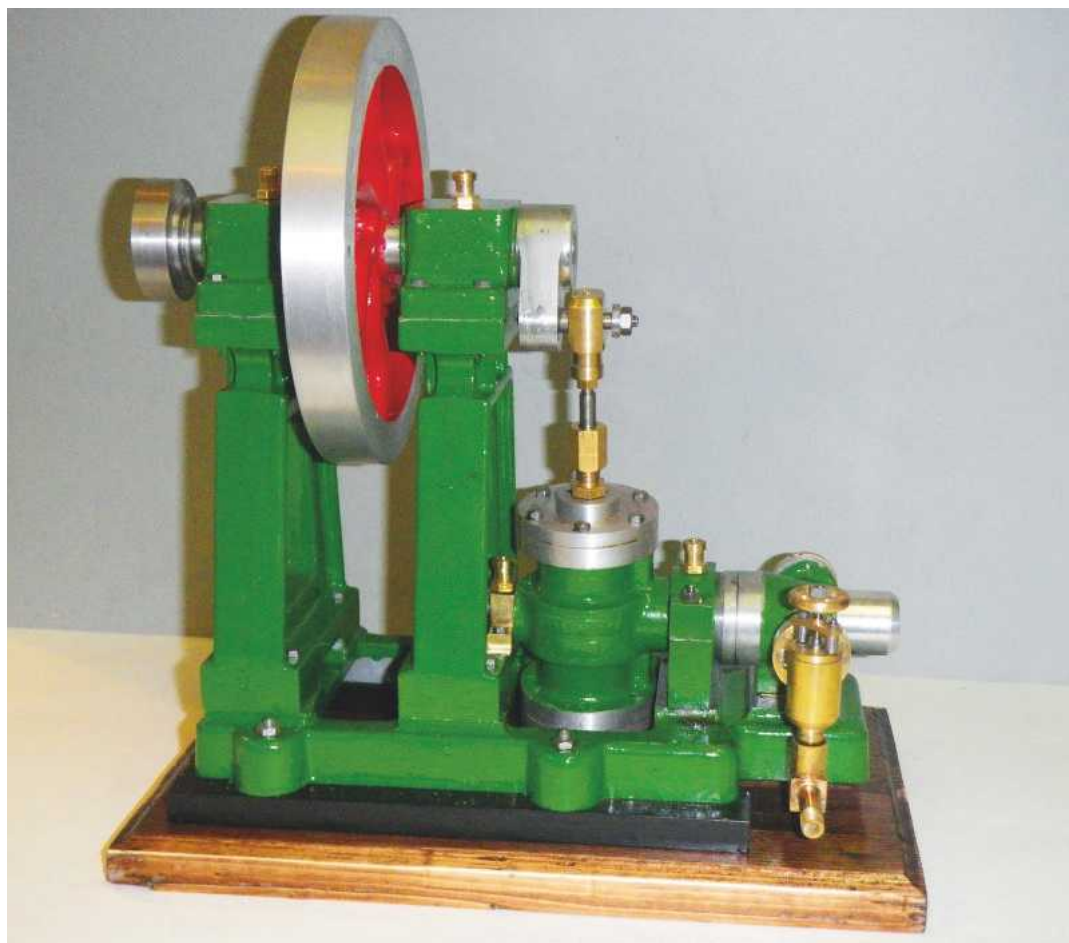
This service had just been phased out in favour of domestic delivery by small vans when the Suez Crisis erupted. Due to the fuel shortage, 'as a temporary measure', delivery could only be made to local shops. Enraged housewives went to the shops to collect their bread but insisted that it would be sliced first.

Sliced bread from shops and supermarkets is still with us but the domestic bread delivery was never resumed in SE London.

ME

Murdock Vertical Oscillating Engine PART 1

Geoff Spedding builds the Murdock oscillating engine from the Myers Engine Works.



Casting sets are available from:
Myers Engine Works
10200 Waterville/
Neapolis road
Waterville Ohio 43566 USA
+44(1)419-376-3206
www.myersengines.com



The kit of castings – other parts and fastenings are not supplied.

The Myers Engine works is located in Waterville, Ohio, USA and this engine is one of a number that the supplier stocks. A description of building another one of their models, the Rider-Ericsson Hot Air Engine by John Pace, is covered in *Model Engineer*, starting Vol. 211 No. 4459, 28 June – 11 July 2013 through to Vol. 212 No. 4472, 27 December – 9 January 2014. The Murdock Vertical Oscillating Engine has a 1.125 inch bore and 2.24 inch stroke and looks similar to the Hicks and Son Oscillating Engine supplied by

Hemingway Kits. However, its larger cylinder bore and stroke give the Myers Engine larger overall dimensions than the Hemingway Kits model.

The supplied kit consists of 13 aluminium castings as shown in **photo 1**. Three sheets of drawings are supplied giving the basic dimensions for machining along with a cross-sectional view of the model (**fig 1**) showing where most of the various components fit. The parts, as referenced in fig 1, are summarised in **table 1**, plus others I have added. For the other parts one has to supply the materials and fastenings.

The additional quantity of materials required is small, mainly consisting of steel and brass round and flat sections from $\frac{3}{8}$ inch up to 2 inch diameter. I am sure most of us have enough of these materials in our workshops or scrap boxes without having to purchase them. Drawing dimensions are in imperial units but there are no building or machining instructions. UNC threads are used on the drawings for fastenings. These can be changed by the builder to equivalent metric or BA screw sizes according to what one has in stock. Even though I live in Canada I have used BA screws as I have a good selection at hand.

Engine base (part 13)

I started off by machining the base. Taking a file, the flash was removed around the edges and run across the top surface to remove any irregularities. At

Cross sectional view showing component locations.

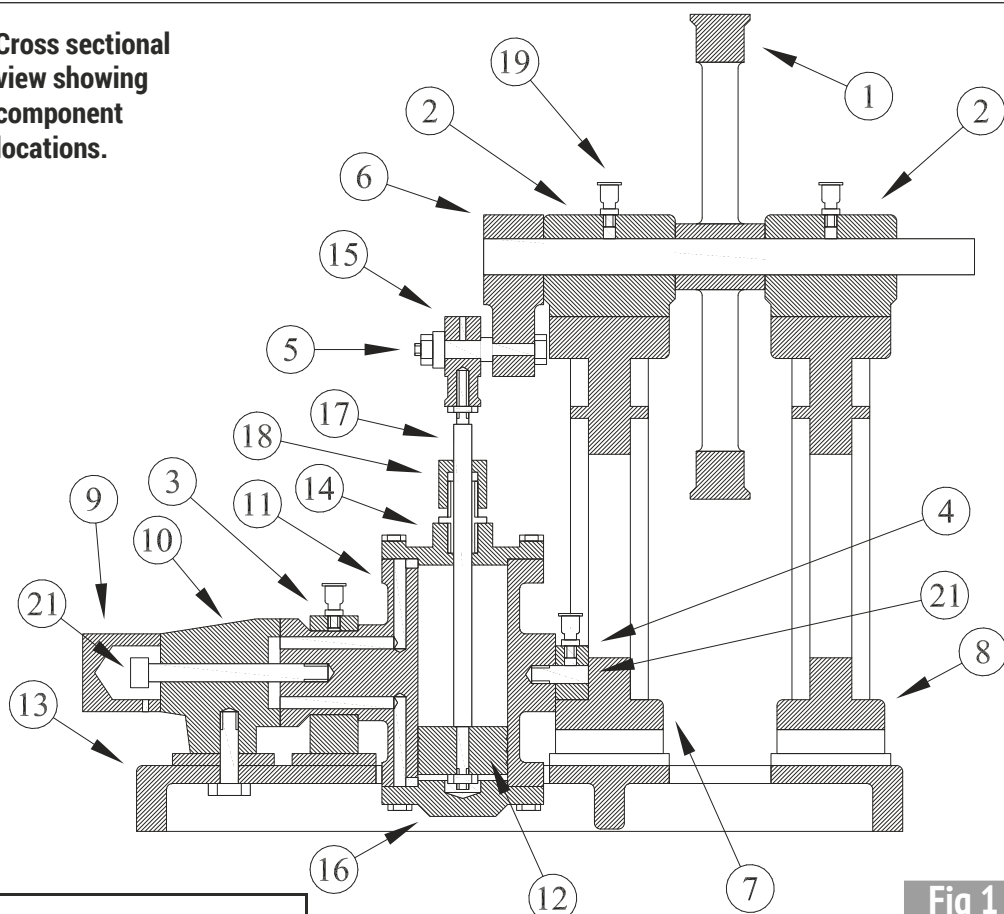


Fig 1

Table 1. Parts list

Part	Description	Material
1	Flywheel	Aluminium casting
2	Crankshaft bearing	Aluminium casting
3	Cylinder bearing	Aluminium casting
4	Bearing block cylinder	1" x $\frac{1}{2}$ " brass bar
5	Crankshaft assembly	$\frac{1}{2}$ " round steel $\frac{3}{8}$ " round steel
6	Crankshaft web	Aluminium casting
7	Front stand	Aluminium casting
8	Rear stand	Aluminium casting
9	Valve block cover	1" round aluminium
10	Valve block	Aluminium casting
11	Cylinder	Aluminium casting
12	Piston	1 $\frac{1}{4}$ " round brass
13	Base	Aluminium casting
14	Cylinder head (top)	Aluminium casting
15	Piston rod end	1" x $\frac{1}{2}$ " brass bar
16	Cylinder head (bottom)	Aluminium casting
17	Piston rod	$\frac{1}{4}$ " stainless steel
18	Piston packing gland	$\frac{1}{2}$ " hex brass
19	Oil cups	$\frac{3}{8}$ " hex brass
20	Engine base supports	$\frac{1}{2}$ " x 1" aluminium
21	Cylinder pivot dowel	$\frac{1}{4}$ " mild steel
	Cylinder pivot screw	2 $\frac{1}{4}$ " $\frac{1}{4}$ x 20 screw
22	Steam and exhaust flanges	$\frac{3}{8}$ " and 1" dia. brass
23	Steam control valve	Body $\frac{3}{4}$ " dia. brass Stem $\frac{1}{4}$ " dia. brass $\frac{1}{2}$ " square brass $\frac{1}{8}$ " x $\frac{1}{4}$ " brass
24	Driving pulley	2" dia. mild steel

the same time flash was also removed from all the supplied castings. As the top surface of the base was relatively flat and smooth the base was bolted to the milling machine table, topside down (**photo 2**) to machine the underside of the base level. For this I used a $1\frac{1}{2}$ inch milling cutter but a fly cutter or end mill could be used depending what you have in your tool box.

The largest amounts of material to be removed were from where the risers joined the casting. Once this material was removed only a couple of light cuts were required to level the underside of the base. The base was then turned over and the top surface was machined (**photo 3**). Again, only a few light cuts were required to bring the base to the specified drawings thickness.

The centreline was then marked on the base casting. This was determined by measuring the overall width of the pedestals for the stands (parts 7 and 8) along with the width of the cylinder bearing

block section (parts 3 and 10). The locations of the bearing stand bolt hole positions along with positions, of the base hold-down bolts were also marked.

The base plate was again mounted on the milling machine and the bearing stand bolt holes were drilled and tapped for 4BA threads. At the same time the $\frac{3}{16}$ inch diameter base hold down bolt holes were started. These were not drilled all the way through at this time as the base was bolted directly to the milling machine table. The base was transferred to the drill press to complete the drilling of these holes.

It should be noted at this time, that when I came to assemble the engine I found the width of the opening for the cylinder in the base was less than the cylinder diameter. I should have checked the drawing dimensions more closely. So, it was back to the milling machine to open it up by $\frac{3}{16}$ inch to accommodate the cylinder. The material was

taken from the bearing side only, as the stand side is at the required width. No harm done - just a little more set-up time. I mention this so other potential builders can do all the machining in one operation.

Front and rear stands (parts 7 and 8)

Next, my attention was turned to machining the front and rear stands, which consists of machining them to the correct heights.

After examining the castings, the top surface was machined first as this was the roughest due to the presence of riser remains from the casting process. To machine the top surface the castings were bolted to a Myford swivelling vertical slide (**photo 4**). This was used as I do not possess a large angle plate. Measurements indicated the width of the top and bottom of the castings were within 5 thou. The castings were bolted to the vertical slide with packing pieces behind them and checked with a square to make sure they were vertical. The horizontal plane was checked by running a dial gauge along the top surface. Once the casting was level the hold down bolts were tightened and the top surface machined level with the 1 ½ inch cutter.

With the top surfaces machined the stands were turned over to machine the base. The stands were machined to within 15 thou of the specified drawing dimensions through use of the milling machine depth readout and a height gauge. At this stage the stands were removed from the angle plate and exact heights determined with digital callipers.

Once the heights of the stands were determined, one was re-bolted to the angle plate and machined to the drawing dimension of 4.88 inches. With the milling machine head locked in position the second stand was machined to the same height.

Next the centreline was determined and scribed on



Levelling the underside of the base.



Machining the topside of the base.



Truing up one of the stands.



Drilling the fixing holes for the stands.



Machining a flat to accommodate the bearing.



Machining the base of the bearing block.

both stands. This I took from measurements of the stand tops. With the centre of the stands marked they were again bolted to the angle plate and the 4BA bolt holes for affixing the stands to the base were drilled (**photo 5**).

The rear stand (part 7) was marked out for machining a flat to accommodate the bearing (part 4). Once marked, the stand was fastened to the milling machine table (**photo 6**) and milled out to the dimensions given in the drawing.

Crankshaft Bearings (part 2)

The drawing only gives a crankshaft centre height for these items along with width

but no overall height is given.

To obtain parallel top and bottom surfaces the bearing castings were mounted in the four jaw chuck in the lathe. As the top of the casting was relatively smooth it was mounted in the chuck so the rougher base could be machined first (**photo 7**). Once the riser remains (from the casting process) were removed only a few light cuts were required to face off the casting. The casting was then turned over and again a few light cuts taken off to level the top. With the top and bottom of the bearings machined parallel they were then machined to width.

The castings were again mounted in the four jaw chuck to machine the bearing faces,

Shimming of the jaws on the sides was required keep the casting square. Once everything was mounted squarely in the chuck only a few light skims were required to clean the bearing face. The bearing was then turned and the remaining face machined to the drawing width. The process was repeated for the second bearing.

The centres of the bearings were marked to determine the location of the centre bore and marked with a centre punch. The bearings were set up on the milling table and a centre drill was used to mark the bore centre. The drawings indicate a ½ inch diameter crankshaft hole is required in the aluminum bearing blocks.

If one is going to adhere to the drawings the $\frac{1}{2}$ inch diameter crankshaft hole can be drilled and reamed at this time. However, for my engine I decided to add brass bearing bushings, as I had some $\frac{1}{2}$ inch inside diameter brass tubing with a $\frac{5}{8}$ inch outside diameter. To bore these holes for the brass bushings the bearing blocks were returned to the four jaw chuck in the lathe and centred to drill the crankshaft bearing hole. Drills were used to open up the holes to $\frac{1}{2}$ inch diameter (**photo 8**) then a boring bar was used to obtain the finished $\frac{5}{8}$ inch diameter hole for the bushings. This finished diameter allowed for a push fit and then the bearings were held in place with Loctite adhesive. To obtain the finished bearing side profile the bearings were fitted on a $\frac{5}{8}$ inch mandrel (**photo 9**).

The next stage was to mark out the holes for fastening the bearing blocks to the stands and the oil cup hole. The fastening holes were then drilled out on the milling machine along with the oil cup holes. The latter were tapped with a 4BA thread to accommodate the oil cups.

Crankshaft web (part 6)

For a small part there is a surprising number of machining operations required. Firstly the crankshaft web was mounted in the lathe four jaw chuck and machined to the finished 0.78 inch thickness (**photo 10**). Next, the location of the $\frac{1}{2}$ inch crankshaft and $\frac{3}{16}$ inch crank pin holes were marked and drilled. At the same time, with the aid of the vice stop to maintain the location in



Drilling then boring the bearing block.



The bearing block mounted on a mandrel for facing off.



Machining one face of the crank web.



Drilling the holes for pinning the web to the shaft.



Rounding off the ends of the web.



Final finishing of the web.

the vice, the web was turned 90 degrees and $\frac{1}{16}$ inch holes were drilled to pin the web to the shafts (**photo 11**).

Then I used a small milling machine with a small rotary table to round off the ends (**photo 12**).



The complete crankshaft.



Aligning the shaft before fixing the stands to the base.

Over the years I have acquired a collection of mandrels of varying diameters for rounding off the ends of parts. Sorting through them, I had no trouble finding $\frac{3}{16}$ inch and $\frac{1}{2}$ inch mandrels to round the ends of the crank web to the correct radii. Once the radii were machined the web was transferred back to the milling machine and the surplus material on the sides between the two holes was removed.

Fitting of the web on a $\frac{1}{2}$ inch mandrel (**photo 13**) in the lathe allowed the web to be finish to its final profile and thickness. It should be noted that the two sides have different amounts of material removed (0.08 inch and 0.12 inch). The final finishing was done with a file and emery paper.

Crankshaft and crank pin

The crankshaft itself is made from a $6\frac{1}{4}$ inch length of $\frac{1}{2}$ inch diameter bright mild steel. I cut it slightly over size, with the ends faced off to the correct length.

The crank pin is made from a length of $\frac{3}{8}$ inch mild steel and is a simple turning job working to the drawing dimensions. It should be noted that no diameter is given on the drawings for the end of the crank pin that fits into the crank web. Looking at the drawings I estimated this diameter to be around $\frac{3}{16}$ inch, which is what I made it. Also, the drawings give no thread size for the piston rod end. Judging by the hole diameter given for the rod end washer, I estimated this thread to

be 10-32 UNF. As I have standardised on the use of BA threads for my model I made this thread 2BA.

The crank web and crank pin were then attached to the shaft with Loctite adhesive. After letting the adhesive cure for 24 hours, the pin holes were drilled through the shafts. $\frac{1}{16}$ inch diameter pins were inserted to hold everything together, with Loctite adhesive being used to secure the pins. The completed crankshaft is shown in **photo 14**.

Assembly of bearings on stands

With the completion of the bearings and crankshaft, the next undertaking was to drill and tap the bearing fastening

holes on the stands. The bearings were aligned with the crankshaft and the assembly held in place by clamps to the top of the stands (**photo 15**). The previously drilled fastening holes in the bearing bases were used to locate the holes on the stands. These were tapped with a 4BA thread and the bearing fastening holes opened up to the 4BA clearance size.

● To be continued.

NEXT TIME

I tackle the cylinder.

● Pumps

Ian Couchman explains the workings of the Weir pump.

● Materials

Luker discusses various kinds of non-ferrous metals and alloys and suggests some sometimes surprising sources for them.

● Beam Engine

David Haythornthwaite adds the throttle and steam shut-off valve to his 1 inch scale *Model Engineer* beam engine.

● Thread Dial Indicator

Jacques Maurel extols the virtues of the thread dial indicator and shows how you can make your own.

● Double Beam Engine

Rodney Oldfield makes the engine frame crossheads for his Middleton double beam engine.

● The Steam Engine

Ron Fitzgerald tells the story of the years of struggle for Watt to turn his ideas into reality.

● Wenford

Hotspur installs the three water tanks and associated pipework into the chassis of his $7\frac{1}{4}$ inch gauge 2-4-0 Beattie well tank.

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Gas Tanks

Dear Martin,
I thank Alex Weiss for his concern about gas tank testing (Postbag, *M.E.* 4636) but he does not need to worry about my current gas tank testing. Unfortunately, I have been slightly misquoted - my words were 'my tanks were always tested to 200 psi' i.e. past tense, not the words quoted i.e. 'I always test the gas tanks to 200 psi'. The letter implies present tense but my words were definitely past tense.

I am well aware of the modern pressure requirements as I mentioned the 377 psi in the next line. The required current pressure is 400 psi and no doubt it will continue to climb over the years.

I first built a steam engine boiler about 60 years back when I was 12 - mind you there was a lot of soft solder in it. *Tut, tut!* I think I built my first gas tank 25 or 30 years ago. I ended up building and testing my own tanks and also testing tanks for other people. We set up the testing for model steam boats with the rules and certificates as they were then. (Testing was carried out by any three of the six or seven people on the committee.)

I would like to point out that time keeps marching on and my first ideas for the two 'pepperpots' were grinding round my head back in 2016. I did send one of my tanks to be tested officially at 400 psi by the 16 mm narrow gauge railway people - it passed the test very happily and the test certificate was returned with the comment 'a well-built tank'.

From first starting to think about building an engine and then producing a project for a magazine article takes time. Actually seeing it in print is obviously not an instantaneous happening. It does usually span a few years so some information can easily be out of date.

Incidentally, try dismantling an empty commercial gas lighter, the ones bought very cheaply from any

Electronic Boiler Level

Dear Martin,
I was interested by James Wells's letter in Postbag (*M.E.* 4636) concerning electronic water levels and I have seen the particular circuit he was discussing, but I am sorry I cannot find it.

I did conduct some experiments in previous years and two of my circuits were published in *Model Engineer* in December 2011 and January 2012. Tim Greenwood also published a circuit in March 2013. My circuits would be considered as very old-fashioned nowadays. No doubt they could be very much miniaturised now.

All of my experiments were with DC circuits and physical probes inside the boiler. They were all fitted into various model steam boats. I managed to get some of the circuits to work very reliably. The only problem was the fact that they 'drifted' and needed resetting frequently. I assumed that the probe(s) was getting oxidised and needed cleaning occasionally. I did try lots of combinations of copper, stainless steel, brass, bronze etc. and found that the polarity of the probe(s) made a large difference to the resistance values.

There was also a method tried by several people which used a small float fitted inside the water gauge, which allowed an LED to shine light at a sensor as a yes-no switch. It was wonderful on calm water but if the unit was fitted in a boat which was bouncing up and down the float could give false readings to an electric water pump. This then cheerfully filled the boiler up to the eyebrows. Not good. My experiments stopped when I gave up trying to use DC because I realised there had to be a method which could just be switched on and it would work reliably for a long time. I did not know what that would be.

There is a company in America which uses an 'RF coupling circuit'. It is supposed to get rid of all the problems with dirty probes and plating of the probes. I assume 'RF' means radio frequency but whether it applies to actual radio signals inside the boiler or a PCB running at high frequency I do not know. The website is still there as of April 2020: www.wldssystem.weebly.com The unit cost 125 dollars in July 2012. It was also on the *Model Engineer* website at that time. Maybe this one is worth a look at, even if it is not the one you are hunting for.

Regards, Martin Ranson (Bridlington)

Write to us

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local supermarket. The gas container is thin, lightweight plastic. I am not sure it would survive a pressure test of 400 psi. There is quite a difference in construction methods.

**Regards, Martin Ranson
(Bridlington)**

Rack Locomotives

Dear Martin,
I would like to thank Jeremy Buck for bringing my attention to further rack/adhesion locomotives in his letter to *M.E.* 4632 in response to my letter in *M.E.* 4627. I certainly was not aware either of the railway he mentions - Dampfbahn Furka-Bergstrecke (DFB) - or

the Langbian Cog Railway in Vietnam. Of the three steam traction only rack railways I have had the privilege of travelling on (more than once) in Switzerland, it just so happens that they all featured different rack types, viz: Abt, Riggerbach and Locher. I have, however, travelled on other Swiss rack/adhesion railways and they have been electric traction - to my mind they don't really count as they are not steam.

I'm thoroughly enjoying Mr. Buck's Magdalen Road Revisited series, especially of his work on the thoroughbred of all express locomotives, the A4.
Tony Reeve (Tasmania)

Coupling Rods

Dear Martin,
Sometime after Duncan Bell raised his query in *M.E.* 4627 as to why some small tank locomotives were operated with some of their side rods removed, I was mulling this over and I seemed to remember having read in one of my books recently - possibly in the last six months or so - about something similar. Plausible explanations were given by two writers in *M.E.* 4632 as to why this might be so. The removal of side rods to alter an 0-6-0 into a 2-4-0 or 0-4-2 may be a bit more common than first thought.

My late brother-in-law in Bristol sent me a book many years ago about a now defunct railway (closed in the early 1940's) that had operated in the West Country. The railway was the Weston, Clevedon and Portishead Railway (WC&PR). I had reread this book recently after many years. I believe this railway was one of those that Col. Stephens became involved with at some stage. It took 12 years to build the first eight miles and another 10 years for the next six miles from Clevedon to Portishead. It was run on the smell of an oily rag and used a succession of hand me down rolling stock and locomotives, although at some stage the railway did own two new tank locomotives.

Due to circumstances, the WC&PR was forced to hire, for the summer 1902, a Kitson 0-6-0 saddle tank locomotive named *Emlyn* No. 82 from the Emlyn Engineering Works in Newport. *Emlyn* ran on the WC&PR as a 0-4-2. There is a photo of *Emlyn* in the book and prominent is the absence of the rear side rods. Why no rear rods, I have no idea - there is no reason given in the book.

Tony Reeve (Tasmania)

Dear Martin,
I have a tip for Martin Ransom to get correct spacing on coupling rods and axles. I may be teaching my granny to suck eggs but here goes.

Cut the two blanks for the coupling rods, drill one crank

pin hole in each, smaller than the eventual crank pin, and drill another hole in one blank at the final wheel spacing. Now bolt them together using the original two holes and use the coupling rod with two holes as a drilling jig for the second hole in the second rod. These can now be used as a drilling jig for the axle holes in the main frames after joining the frames together with either Superglue, bolts, solder or double sided carpet tape. I have used this system since the 1970s, starting with '00', then '0' then 16mm and now in gauge 3 and it has always worked for me. Best of luck.

Best regards, Eric Sanders

Casting

Dear Martin,
I've only recently embarked on model engineering as a hobby, having made a Stuart S50, 10V and half beam. I'm now 'having a go' at making a farm boy hit and miss engine. This will be a real challenge for me and I was delighted to see part 1 of Gerald Martyn's article on setting up a home foundry. I really enjoy learning new things and I think I just might be one of those folk to 'have a go' at setting up my own home foundry to make the flywheels. I hope to put the drawings into Fusion 360 and generate patterns on my 3D printer. Nothing ventured, nothing gained!

I'm really looking forward to the rest of the series.

All the best, Andrew Whale

Lubrication

Dear Martin,
I can relate to the lubrication problems encountered by Jeremy Buck. I had the same problem on my 7¼ inch gauge King where the axle centres are end and cross drilled to carry oil to the wheel bearings. There were also problems with lubricating all of the inside valve gear, some of which is under the smoke box. Fixed parts can be fed from oil pots but the combination levers, rocking levers, inside cross head and slides as well as the valve cross heads are all invisible and move about.

The idea of splash and dash works but is not reliable especially for long afternoon runs and where it is necessary to relubricate the motion without returning to the steaming bay.

Another way had to be found. My fix was to make a universal oil can.

Take one car parts shop oil can, take off the spout and fit a 4mm nylon snap-in air fixing (my oil can had a ½ inch BSP thread). Now you can make up as many individual necks from copper and 4mm nylon pipe as you need with differing lengths, different bends etc. ½ inch copper pipe will push tightly into 4mm nylon pipe so no complex or expensive

fittings are required to join the flexy bit to the copper.

Oh yes, the wheels - easy: take a piece of 8mm brass rod, drill through, fit a 4mm snap-in pipe fitting to one end and make the other end pointed to suit your wheels, with a small 'O' ring around near the end. A short length of nylon pipe completes the tool and you can put in as much oil at full can pressure to suit your needs.

Also, it is easy to top up the locomotive lubrication during the afternoon's run simply by snapping in whatever part you need using the nylon pipe as the interface.

Good luck, Vic Whittaker (Leyland)

Dancer boiler

Dear Martin,
The article about building the *Dancer* boiler was most interesting and I offer my compliments to Mr. Olsen for both design and workmanship. Hopefully he can consider my comments as being constructive criticism as these are based on my own experiences with small and large marine water tube boilers.

With the fast steam raising capabilities of the water tube boilers achieved by using small tubes the quality of the feed water has to be of the highest quality. The Admiralty allowance for impurities in full sized boilers was just over four parts (4.4) per million. Above this level the dissolved particles tended to settle on the tube wall, severely reducing heat transfer.

If contaminated feed water had been introduced into the boiler, this was rapidly shut down and working parties sent into the main upper water drum to fire compressed air propelled steel brushes through each tube to clean out the encrustation, a gruelling job in the tropics and not for those with any degree of claustrophobia. Other parts of the feed water supply system were designed to be dismantled for such cleaning as required.

All the above applied to large superheat boilers but even within the ETW recommended Dry (saturated) Steam range similar problems did become obvious although at a slower rate.

The quality of feed water was also to become a problem with the model water tube boilers, based on the Bolsover Express design that I built. Even using distilled water and regular blowing down, tube encrustation slowly became obvious. A redesign using bolted flanges so that the tubes could be removed and prodded through, or even replaced, helped considerably. Boiler immersion in recommended chemicals also helped, but the only real long-term solution that I found was to use a more easily dismantled fire tube boiler and accept a slightly lower steam output.

To return to my original comment, has Mr. Olsen given some thought the possibility of being able to dismantle his boiler for the inevitable small tube cleaning?

Best Regards, James Wells

John Arrowsmith makes a trip to Premier Patterns in Birmingham to take a look at the polystyrene patterns for the cylinders of *Night Owl*.



The main cylinder blocks ready to send to the foundry.

The GWR 4709 *Night Owl* Project

The origins of this project go back to 2002 when the Great Western Society (GWS) decided that one of Churchward's finest locomotives, the 47XX, 2-8-0 Heavy Freight engine was one locomotive that should be considered for preservation. Of course with only nine being built originally, none were saved from the scrap man, so thoughts turned to the possibility of recreating such a machine. Long discussions with the Vale of Glamorgan Council who had suitable donor locomotives under their control (Woodham's scrapyards at Barry) finally resulted, in 2010, in an agreement that the GWS could acquire three locomotives, 4115, 5227 and 2861 which could be used as a basis for a new locomotive, 4709. Paul Carpenter was appointed as Project Engineering Manager and

many of you will have seen him at various model engineering exhibitions promoting this project. Paul and his small team had the unenviable task of collecting relevant Swindon drawings and component parts, which is where the above mentioned donor locomotives come in, providing numerous parts for this 'new' build, either as templates for completely new components or by 'donating' suitable parts for refurbishment and then assembly. The last 10 years has seen considerable progress made on this engine, which is based at the moment at the works of the Llangollen Railway, and with considerable input from Tyseley Engineering at the Railway Centre to help with the designs and building, some of the main components are now being progressed.

At the London Model Engineering Exhibition in

January this year I was asked by Paul Carpenter if I would like to prepare a short article on the building of the new cylinder set for 4709. The design for these new cylinders had to be modified from the original Swindon drawings so that the locomotive could comply with the present day loading gauge requirements of Network Rail. To achieve this, the height of the smokebox saddle had to be reduced and the total width across the cylinders also had to be reduced.

This is how I came to be in Birmingham in February at Premier Patterns Ltd., along with Paul, to inspect the brand new polystyrene patterns. The workshop has a well designed layout with all the machinery necessary to work the various materials used in these modern processes. Talking with the operatives it was

obvious that they enjoyed their work and took a keen interest in what I wanted to know.

The cylinder design for 4709 was programmed using a CAD-CAM drawing system which produced a 3D model to check dimensions and proportions. This can then be used for production. Pattern grade polystyrene of 18/22 gm/cu.m. was used to create each section of the cylinder block, which was then glued together to produce the full size pattern (**photo 1**). I was interested to learn how the large bores are produced without the outside surfaces collapsing into the bore as the polystyrene is dissolved. It can be achieved by using suitable size bars placed strategically within the sand, the number and size of which depends on the diameter of the bore. Each internal passage way is built into the relevant section so that on the casting the inlet and outlet ports are all completed at the same time (**photo 2**). The valve chamber has all the necessary porting included, with connections to the main bore (**photos 3 and 4**). Strengthening ribs are included on the outside surfaces.

The saddle section of the casting also includes the exhaust port and this is a well defined part of the pattern along with all the bolting hole bosses (**photo 5**). All the internal passageways have smooth transitions from one section to another so that steam flow restriction is kept to a minimum. Bosses for the steam drain cocks, the snifting valves and steam inlet from smokebox to cylinders are also part of the pattern (**photo 6**). I have included a picture of the cylinder pattern orientated to show how it will look when bolted to the frames (**photo 7**).

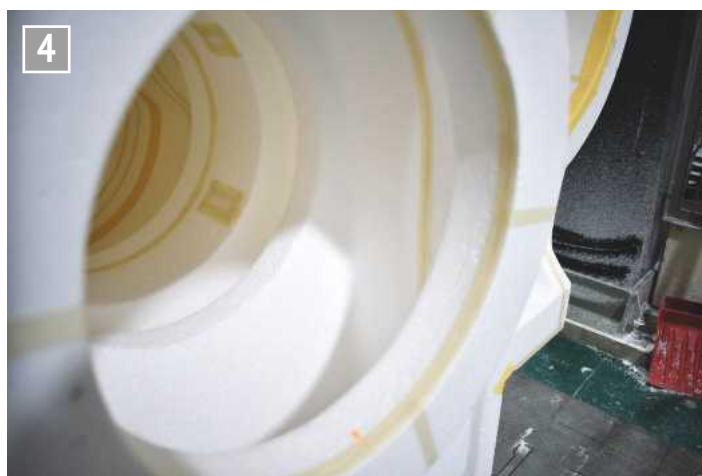
The next stage of the cylinder manufacture will be the casting of 220 grade cast iron and for this the pattern will be sent to the Shakespeare Foundry in Preston where the mould will be constructed and the metal then poured.



The main cylinder bore.



View through the piston valve chamber.



Inlet ports in the valve chamber.



Saddle section with bolt pads and exhaust flange.



Outside view of the steam inlet from the smokebox and snifting valve boss.



The pattern - photo orientated to show how it would look bolted to the frames.

Hopefully this process will also be reported in *M.E.* Following the completion of the cylinder block it will then be sent for heat treatment to relieve the stresses before machining. The machining will be carried out by Roach Engineering in Birmingham, also to be followed and reported for *M.E.*

I hope this short review of a pattern making process for a rebuild of a GWR locomotive is of interest and that it shows that, despite all the reports in the press and media, that there are no skilled engineering personnel in the UK any more, there are in fact highly skilled operations still being

carried out, albeit without any fanfares. My thanks to Mark and Steve and all at Premier Patterns for their help and keen interest in this project. It was a real privilege to meet you all. For more information on this project visit the Great Western Society 47XX Project website: www.4709.org.uk

ME

Garrett 4CD Tractor

in 6 inch scale

PART 70

Chris Gunn discovers how to make wicks for the lubricators.



Continued from p.689
M.E. 4638, 8 May 2020

This article has been written to guide the builder through the construction of the 6 inch scale Garrett 4CD tractor designed by Chris d'Alquen. The writer has previously built a 4 inch scale Garrett and a 6 inch scale Foden wagon so has the benefit of considerable experience in larger scale modelling. Most machining can be done in the average home workshop but the supplier from whom the castings and drawings are currently available is able to provide a machining service for the largest items if required.

The next item I dealt with was the large 'G' which decorates the smokebox door.

I intended to fit this to the door using a series of bronze studs. I positioned the 'G' on the door and adjusted until I judged it was centrally disposed and square. Then I drew round the 'G' with a white marker and marked where the holes were to be drilled in the door, which would correspond with the meatiest parts of the 'G'. I drilled the holes through the door, as shown in **photo 605**.

I repositioned the 'G' back on the door in line with the markings and then managed to get a couple of 'G' clamps (see what I did there?) on it at the centre, where the angles were not too severe, and I spotted through the holes and marked the back of the 'G'. I then set the depth stop in my pillar drill to stop short of a piece of ply, supported the 'G' on the ply and drilled the holes for the 1/4 inch



Whitworth studs. I chose this as it was a coarse thread and I had some 1/4 inch diameter bronze. The holes were tapped and some studs made in bronze. I also opened up the holes in the smokebox door as the studs would be used to pull the big 'G' back to the contour of the smokebox door, and would tend to bend a bit,

so I wanted to give them some room to do so. **Photograph 606** shows the big 'G' with the studs and nuts fitted.

The 'G' was then fitted to the door, with the nuts tightened in a sequence starting from where the 'G' was in close contact. The ends of the 'G' gradually pulled in but I did not force it, as I thought I



Drilling smokebox door.

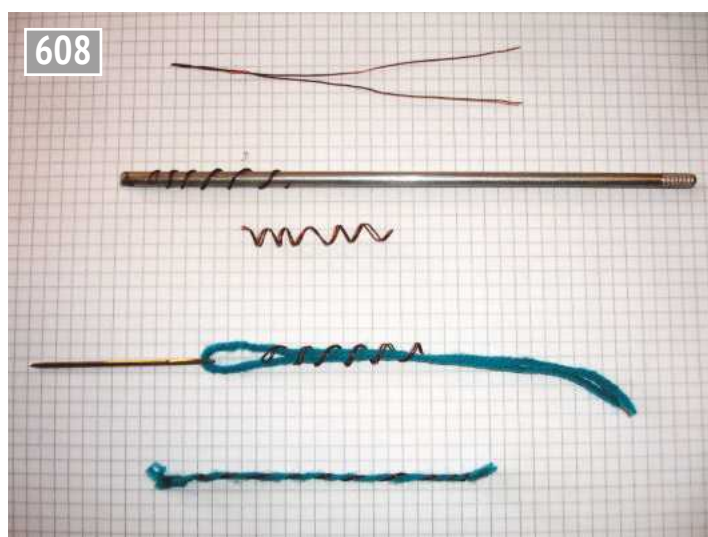
Drawings, castings and machining services are available from A. N. Engineering: Email: a.nutting@hotmail.co.uk



'G' with studs.



Smokebox door with 'G'.



Lubricator wick manufacture.



Crankshaft oiler.

would have another attempt when the engine had just been steamed and the door was hot. **Photograph 607** shows the smokebox door complete with the big 'G'.

The next item I dealt with were the wicks for all the lubricators.

I had made the lubricators with a syphon tube and it was time to install the wicks. When I was testing the engine I just kept squirting oil on every bearing surface, which was a bit messy, but with further steam tests on the horizon it was time to do the job properly.

There were a few threads on a couple of the forums I read, so I gathered together the information which follows. The information I gleaned told me it was important to use worsted wool but I was curious to know what this meant and Wikipedia

told me that this meant that the wool fibres were all brushed in the same direction, which was a good attribute for a wick, I suppose. I knew we had a wool shop in town which was a bit of a time capsule; nothing much had changed in the shop for 40 years I guess and sure enough the shop was able to supply me with a ball of blue worsted wool from their clearance shelf. It did not match the engine, but no one would see it.

I then read a piece which told me the way to make the wicks by winding a piece of wool between two strands of light copper wire. I duly found a broken plug-in charger and smashed it to pieces to recover the transformer, which gave me the copper wire I needed. I cut a piece off, doubled it back on itself and wound this

around a piece of steel bar to make a spring like spiral. Then I took a piece of wool and threaded it through with a wool needle (which is one with a bigger eye than normal) that I borrowed from my wife. The wool was then threaded through the copper spiral and the ends of the copper pulled to tighten up the spiral on the wool and the wick was done, apart from a bit of trimming up. **Photograph 608** shows the stages in making the wicks.

I soon optimised the length of everything until I got the wick length I needed. This was determined by installing the wick in one of the lubricators and threading it down the syphon tube until it was below the tube and the upper end was bent over. I also tested the wick at this stage by holding a lubricator in the vice, filling the

lubricator with oil and placing a container underneath, then leaving it to see what happened. The oil duly drained through and I found it emptied in about three hours, which was probably about right, being equivalent to a half day of rallying.

I imagine that the size of the syphon tube and the wick would have an effect on how fast the lubricator would empty but, as this seemed right for my engine, I decide to leave it at that. The tube I used in the lubricators were some scraps of $\frac{3}{16}$ inch copper tube I had in my semi-scrap box. Once all the wicks were made these were installed in the various lubricators; **photo 609** shows the wick in the crankshaft oil pocket. This picture also shows the round oilers fitted to the eccentrics as originally

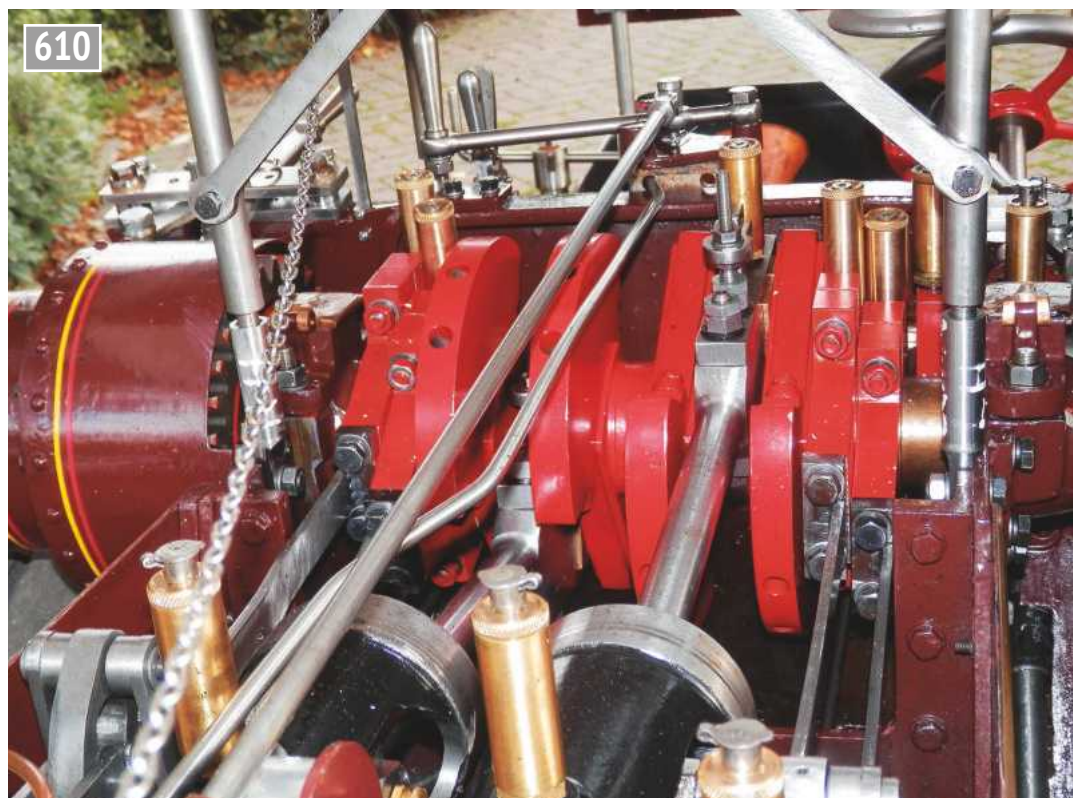
made, with a threaded cap with a breather hole in it.

After my first and only rally, at the time this is being written, I decided to modify all of the lubricators for a couple of reasons. The first was that I noticed that droplets of oil were being flung out of the breather hole on the eccentric and water pump eccentrics. The second was that some of the lubricators shed their caps after some running. The final reason was the amount of time it took to oil up, which involved unscrewing the caps on 20 lubricators and replacing them; doubly difficult when wearing thin gloves.

I had a number of the ball type oilers, so I modified the caps on the crankshaft mounted lubricators so I could tap these in and I just had room to drill a small breather. This means the lubricators can be filled with an oil can with no cap removal. I did not have enough of these for every lubricator, so the lubricators attached to static parts of the motion were modified by adding flip top oilers. Obviously, these are not typical but very much more practical, and I can refit the original caps should the engine be on display. **Photograph 610** shows the flip topped lubricators in the foreground and the ball topped ones in the background.

I have not mentioned the little end lubricators. These are positioned between the two trunk guides where there is not a lot of room. They cannot go on the outside of the trunk guides because the valve guide boss is in the way. The ends of the little end pins were tapped $\frac{1}{8}$ inch BSP and TAT style grease nipples fitted. The grease gun end is slipped on from the side. Conventional grease nipples cannot be used as the grease gun could not be applied to them. This type of grease nipple and the grease gun fitting can be obtained from vendors on well-known auction sites, just to name an easy to find source.

The next item I will deal with is the duckboard for the



Modified lubricators.

tender and this was a job I had done many times before in my working days. I have mentioned before that we used to make machines to manufacture wooden pallets and there are many varieties of pallet, which means different techniques are required to nail them together. I quickly found that some visual aids made the explanation of the different techniques easier to follow. I made a series of scale miniature pallets and used to take these around in a fitted briefcase when on a sales trip. **Photograph 611** shows pictures of some of the miniature pallets I made.

These were made from the redundant sapele roof supports from my first house, which I cut up into scale pallet boards first by ripping the 6 x 2 inch section down into 2 inch wide strips $\frac{1}{8}$ inch thick using a slitting saw in my vertical miller. I set the machine up and clamped some temporary fences on the machine bed to cut the strips down into miniature boards about $\frac{1}{2}$ inch wide.

During this operation on the first batch the saw grabbed the wood and pulled it in followed by the tip of the second finger

of my left hand, taking the tip off apart from a sliver. This meant a quick trip to the hospital for some stitches. They managed to sew it back on but not quite in the right place so I have a permanent reminder of making miniature pallets, and also a reminder of the right way to feed wood into a saw blade! So, if you adopt the same method, take care. If you do not have a redundant sapele roof support knocking about then small sections of hardwood can be bought from model boat building suppliers.

The first thing is to establish the length and width of the top of the tender tank and cut the stringers and deck-boards to the appropriate length. I left a gap for the pipes to and from the pump. **Photograph 612** shows the set-up for cutting some of the deck boards from a section of the old roof support. This is about the last of it, and it should be noted that this was removed from its original duty over 50 years ago and is still coming in handy. Once the set of boards were sawn they were held together in a pack and



Miniature pallets.



Cutting tender floor parts.



Planing tender floor parts.



Glueing Tender floor.



Tender floor.

planed to the same width, as shown in **photo 613**.

If you do not cut up your own material and buy pre-cut sections you can start from here. The boards were trimmed to length and then I set up the stringers and boards on the loose top plate of the tender. I just fitted the two outside stringers at this stage and then applied some wood glue to the joints between the two outer deck boards and stringers, then clamped the outer deck-boards to the stringers. Next, I added all the deck-boards with some steel packers to space them out evenly with a dab of glue at each joint, as shown in **photo 614**.

After this picture was taken I used more lumps of steel to hold the assembly together until the glue dried. Once the glue was dry, I removed all the

steel and turned the assembly over, and glued in the two additional stringers.

Once all the boards were glued, I sanded the top deck smooth on the linisher and marked out the positions for the nails. This is a bit of a throwback to my miniature pallet making days, as one of our selling points was that

our machines put the nails accurately in position, so this is the way I did it. However, this does have a function in the construction of the duck board for the 4CD, as in use it will get wet and hot and the nails will hold it together if a joint fails. I use the term 'nails' loosely as I had some small $\frac{1}{16}$ inch soft iron rivets, so I drilled the

holes $\frac{1}{16}$ inch and inserted the rivets and carefully shortened them with my disc grinder then gently peened them over. It does not take long to do and in my view is worth the effort. Once the nails were done it only remained to give the duckboard a few coats of exterior varnish and the job was done, as shown in **photo 615**. ●To be continued.

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CLUB NEWS

Geoff Theasby reports on the latest news from the Clubs.



I hope that members of the societies featured here are putting extra thought into writing for their club's newsletter since we are all 'confined to barracks' for the duration. There is no excuse for boredom! You've done all the extra crosswords in the papers and jigsaws of stately homes, watched all the railway videos on YouTube, or the boxed set of *The Train Now Departing*, *Railway Roundabout* etc. and the workshop has never been so tidy. Be a little more creative. The crosswords and quizzes, sudoku or calculus ... get your thinking caps on; write something, even if you have never attempted the task before. That's how I began over 50 years ago (*Practical Wireless*, February 1967) and look what happened to me!

Debs is using the 'stay home' restriction by getting into Skype, Whatsapp, etc. to talk to her grandchildren in Leeds and Manchester. Two-year-old Robin and I were comparing screwdrivers. He has a red one and I have a blue one! (Editor Martin has a yellow one!) Robin already knows that screwdrivers are for 'fixing' things. I see a budding engineer, or as the Jesuits say; 'Give me the child and I will give you the man'. (*Robin and the Amazing Technicolour Toolbox* - Geoff)

In this issue, Metal Mickey, turned out nice again, a Prince,



Drying out. (Photo courtesy of Barbara Smith.)



The flooded tunnel at SFMR. (Photo courtesy of Barbara Smith.)

Mamod, a universal truth, mince pies, a milestone and Nigel's conglomerate?

The Link, April, from **Model Engineers Society (NI)** has Chairman John Mathews writing on the coronavirus outbreak and the subsequent panic buying of baked beans and toilet rolls. He wonders if laxatives will be next Secretary, David Heatley finds it strange with nothing

to write about. (He should try sitting here! says Geoff, who goes on ... Hmmm, what to suggest? Sing selections from the Student Prince, perhaps, or produce a list of suitable books to read? I'll start you off with some music for engineers.) Meanwhile, back at Cultra, Jim McKillop has produced a poem about 'Mickey, Man of Steam' who not only took his traction



First train through. (Photo courtesy of Barbara Smith.)

engine to many rallies but who could build one, too. Finally, there are some cartoons about the Covid-19 virus to cheer us all up.

W. www.mesni.co.uk

Music to turn to in the workshop:-

- *Turn, turn, turn* - The Byrds
- *Bend me shape me* - Amen Corner
- *Bend it* - DDBBM&T
- *Lathe operator* - Dr. Sphincter
- *Rust* - Fleetwood Mac
- *The Locomotion* - Little Eva
- *Steam* - Peter Gabriel
- *Rolling stock* - Starlight Express
- *Corrodeo* - A. Copeland
- *Swarfega* - 28 Hertz

Lest there is doubt, they are all on YouTube.

Stockholes Farm Miniature

Railway suffered flooding as mentioned last time but the photos arrived too late. Ivan's name, therefore is Ivan Smith. (photos 1, 2 and 3).

Trackerjack, February, from **Teeside Small Gauge Railway** tells us of a night run and a New Year evening with nibbles and drinks, which were mostly wine, supported by something a little stronger (Ir'n Brew, or Oxo, I understand - Geoff) and **Fruit Cake!** The Night Run was organised at the request of the Park and two trains were provided, running mostly full up to 9pm. Passenger numbers were estimated at 350. The signalling has been upgraded and is run by 8051-type microcontrollers, while the lights themselves have been redesigned after a visit to the Beer Heights Railway.

W. www.tsgr.co.uk

Criterion, March, from **High Wycombe Model Engineering Club** celebrates the club's Centenary this year. Peter Rainer has designed and made suitable locomotive headboards and a 53 page history has been produced by David Savage; see the website. W. www.hwmecc.co.uk

Steam Whistle, March, from **Sheffield & District Society of Model & Experimental Engineers** is, unusually, printed



P2 Earl Marischal at Thurnby GTG. (Photo courtesy of Editor, Ashley Wattam)

on glossy paper which looks well. Alan Thorpe wishes to hold a Mamod Rally at the July Open Weekend and would like to recreate a 100 Ton Pull. Well, the Land-Rover Discovery Sport can do it...

W. www.sheffieldmodelengineers.com

Worthing & District Society of Model Engineers' Newsletter,

spring, has Dereck Langridge musing on Exhibitions and how they seem to be declining in number and also the quantity of models presented. The original incarnation of the Worthing club held a **five-day** exhibition (12 hours per day) in 1951, whilst the last, in 2012, barely covered the two-day hire cost of the hall. A model LMS 2F which was designed by a Worthing member featured in the 1951 programme; over 100 were, even then, under construction and plans and castings are still available. Over the winter John Dean built a scrapper mill; Mike Wheelwright, buffers for his Royal Scot; President, Andrew Breeze made an inverting locomotive stand; Roy Page, a Super Simplex and John Elsworth, a 5 inch gauge B1. A concluding Universal Truth has enlightened Editor, Dereck, which is that memory foam inserts in your shoes prevent you forgetting why you just walked into the kitchen...

W. www.worthingmodelengineers.co.uk

Welling & District Model Engineering Society, April-May *Magazine*, has an item by Bob Underwood about Capt. John Ericsson of Braithwaite and Ericsson, locomotive

manufacturers and his origins. Richard Dedman found a rather well-written poem by Edwin Price of Chester, which begins: *'How fortunate we oldies are, to once have owned a proper car. With leather seats and real wood trim, although with headlamps rather dim'*. Dave Andrew, of VAMES, writes on 'notching up' and practising water economy in steam engine driving. The latter half of the *Magazine* is occupied by Editor, Tony Riley's account of Railway Air Services, formed in 1934, inspired by an article in the *Railway Magazine* of that year.

W. www.wdmes.co.uk

Model & Experimental Engineers, Auckland, in their March *MEEA Newsletter*, say that Graham Quayle has completed his Stuart *Victoria* and has discovered that it was originally designed by Tubal Cain (not the Biblical metalsmith). Michael Cryns has been restoring a French carriage clock of about 1900. The translucent side panels are made from tortoiseshell. André Pointon produced an instrument which measures length by running a knurled wheel along a surface, reading out on a graduated dial. This is related to a map-measurer or 'waywiser' as used by Blind Jack (Metcalf) of Knaresborough, the early civil engineer. (The device dates from ancient Rome, originally, and variously known as a Viameter, Perambulator, Odometer or Pedometer.) Murray has been working on a small heater in which the power was varied by use of a Variac transformer. Prior to the use

of these, variable transformers used a moving winding electrically separated from its fellow winding but within its magnetic field. Relative movement varied the power.

The Gauge 3 Society Newsletter, spring, has David White and John Buxton tracing the history of the Basset-Lowke P2 models. Starting independently to find extant models, they subsequently joined forces in their quest. David thought four were made, one for the legendary ERA racing driver, Prince Bira. John found details of only two, one of which belonged to Prince Bira's niece. Richard Down was engaged to recreate these locomotives 'in the flesh' and here is *Earl Marischal* for readers' delectation (photo 4). Trevor Goodman went to a local talk on 'Making Tracks' hoping to recruit more members for the G3 Society but found an audience of white-haired elderly ladies and came third in the raffle, winning a tin of soup...

W. www.gauge3.org.uk

B&DSME News, March, from **Bournemouth & District Society of Model Engineers** has little to say this time. Editor, Dick Ganderton appeals for extra effort in providing content for the newsletter (see above...)

W. www.littledownrailway.org.uk

Kingpin, spring, from **Nottingham Society of Model & Experimental Engineers** reports that Storm 'Dennis' brought down 30 metres of fencing across the track, in the snow, so intrepid members

went out the following Wednesday (working day) to mend it. With 80 M8 x 150mm coach screws holding it together it should be safe for a while yet. A colour light signal gantry has been manufactured and galvanised for the new Parkgate station. Here is a similar gantry still in use at Llandudno station last year (photo 5).

W. www.nsmee.org.uk

CoSME Link, spring, from **City of Oxford Society of Model Engineers** has another fine picture on the front cover. William Wordsworth would be so pleased. The sight is a harbinger of spring, so called because it harbingers. Ron Head describes a simple-to-make depth gauge, which can be made in an afternoon. Russ Steeves explains how to make a four chime locomotive whistle.

W. www.cosme.org.uk

Bradford Model Engineering Society, *Monthly Bulletin*, April has President, Jim Jennings reflecting on past activities, including the Mince Pie Steam Up. This is a new one on me; locomotives, yes, but mince pies ...? In common with other organisations, everything has stopped due to the coronavirus, although some outside work may be okay, as staying physically apart is easier, most people working individually.

W. www.bradfordmes.uk

Bristol Society of Model & Experimental Engineers

sends *The Bristol Model Engineer*, spring, which has a fine photo of two well-protected passengers enjoying a ride behind Rob Speare's 'Ajax', with a lovely plume of exhaust to leeward (photo 6). Colin MacEke discusses making an Orrery, videos on which can be found on Youtube by searching for 'Orrery, Colin MacEke'.

Ladies' Night in December featured Andy Stowe, a professional Auctioneer, who pointed out that model railways appearing at auction were generally being disposed of by the enthusiasts' wives. For Members' Night, only two brought something to discuss; Trevor Chambers is building a model Anzani aero engine and John Whale, a GWR Saint water pump. Bruno Taylor built a mist coolant system for his mill and lathe. It works well, he says but it runs from the compressor, which is LOUD. Otherwise the cost is under £50, the dearest item being the oil! The Bristol 'O' Gauge show was well supported with many traders in attendance.

W. www.bristolmodelengineers.co.uk

Plymouth Miniature Steam sends *Goodwin Park News* for April. The front cover appears to show a scale model railway line surrounded by 12 inches-to-the-foot molehills but is



Llandudno signal gantry in July 2019.

actually the construction of the club track in 1988. John Briggs discusses the Hydrogen Economy and ecological power generation. Geoff Theasby says; 'I too have studied this matter, from the five years I spent editing an ecological newsletter in the early years of this century. Electrolysis of water to produce Hydrogen is costly and inefficient, unless there is cheap, surplus electricity to hand. Fuel cells are inefficient and relatively untried. It may be easier to feed them with methanol rather than hydrogen. Whichever proves best, it will be an interesting story to follow.'

W. www.plymouthminiaturesteam.co.uk

13 April, a milestone! In all my hobby engineering and electronics chassis-bashing years, I have never been able to drill holes in the correct place without adjustment afterwards. Today, I did it! I mounted an electric motor on a slab of aluminium, with the o/p shaft AND three tapped holes on a pitch circle. How's about that then?!

Leeds Lines, April, from **Leeds Society of Model & Experimental Engineers** greets us with a picture of a fearsome instrument on the cover. I find that it is Nigel Bennet's steam operated water pump for his Don Young *Fishbourne*. Understanding that Mr. Young's pump had problems and finding two other designs weren't suitable, he found one designed in Holland. Redrawing it in CAD (Annotated © Amalgamated Megawhizzo 2019) and then finding a few 'snags' (tell me about it – Geoff), Chairman, Jack Salter thinks that after our period of imposed hermitude, there may be some fine examples of 'Work on the Table' (or shipping container - Geoff) Home-produced respirators anyone? he says.

W. www.leedssmee.btck.co.uk

And finally: Do I talk to myself? Yes. I'm self employed and I sometimes have staff meetings.



New Year's Day at Bristol. (Photo courtesy of Editor, Richard Lunn.)

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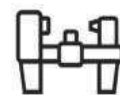
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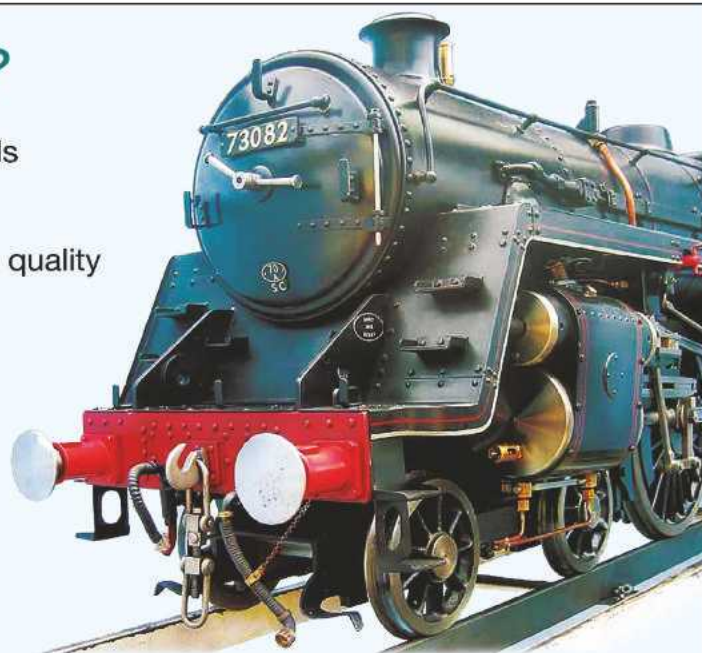
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