

MODEL ENGINEER

Vol. 201 No. 4339

21 Nov – 4 Dec 2008

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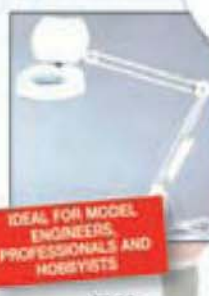
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ON THE COVER...

Tim Coles winds up his GT3 gas turbine locomotive to its full 160,000 rpm. Tim's displays were one of the highlights which drew the crowds to the sides of the track brought over from the Sinsheim exhibition in Germany. Brilliant weather, brilliant locomotive and brilliant track. Perfection! (Photograph by Roger Bunce)

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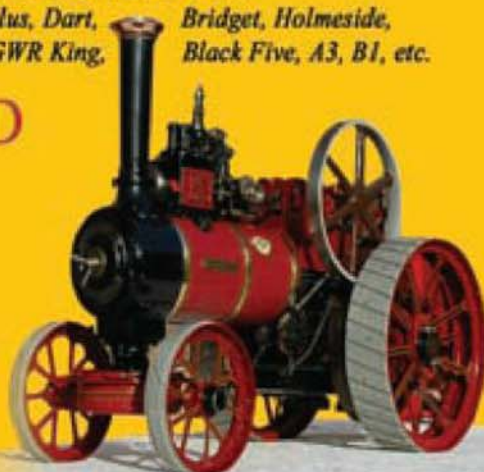
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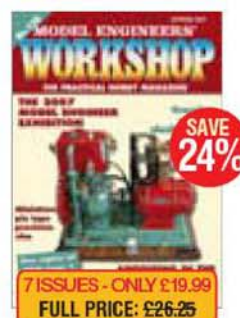
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Changing times

Following the change of the name of the company that publishes M.E. from Magicalia Publishing Ltd to Myhobbystore Ltd, please note that the email addresses have also changed. Emails which ended in @magicalia.com are now changed to @myhobbystore.com. So for the editor please use david.carpenter@myhobbystore.com.

The old addresses will continue to work for a time, but as there have been some difficulties you are urged to use the new address from now on.



Now's the time

Now is the time to order your Christmas cards. Our favourites are from the Welshpool & Llanfair Light Railway. See illustration.

Five cards cost £2.00; 12 are £3.80 and 20 cards are £8.30. Order from W & L Sales, Owl Halt, Manor Road, Sealand, Deeside, N Wales CH5 2SB. T. 01244 815273.

Maurice 'Jack' 'Monty' Hall Ellis 1916 - 2008

Monty was born in Bishops Stortford on St Swithun's Day 1916. He attended St Michael's Church of England primary school and later gained a scholarship to Marling School, Stroud. The family then moved to Bristol. His parents were both teachers and, in 1936, his father was made Headmaster at Iron Acton school. Monty welcomed the move from the city. He recalled how the railway station was still open in those days, how life centred around the village green, and how there were no streetlights or piped water!

Monty then moved to university to study electrical engineering. In 1935 he became an assistant traffic superintendent at the Post Office. In 1941 he was seconded to Liverpool to assist in the restoration of the telephone service that had been badly disrupted by

enemy bombing. In 1942 he was called up and served in the Royal Corps of Signals.

Monty married his first wife, Nelly, in Le Havre in February 1946. He returned to civilian life in 1947, where he resumed his post office career in Bristol and became Senior Telecommunications Superintendent - a post from which he retired in 1976.

Following a divorce from his first wife, Monty went to live at Westways in Rangeworthy (in the village he was always known as Jack). There he married his second wife Joan in 1967. That happy marriage ended in Joan's sudden death in 2004.

Monty was a linguist. He learned Morse code early in life, which was particularly important during his wartime service. He taught himself Welsh and could also speak German. Monty was a musician and devout Christian. He was organist and choirmaster at Holy Trinity Church, Rangeworthy for 27 years. Not only did he play the organ, he could fix it when it went wrong! He was also a poet.

After he retired, Monty published three books covering the history of the telephone systems of Bath, Bristol and Weston-super-Mare. He began writing articles for M.E. in 1964 and his regular series 'Letters to a Grandson' began in 1999.

Until a week before his death he was still riding his bicycle around the village. He died at his desk, Sunday 5 October - no doubt pondering his beloved Grandson.

Monty was often described as a lovely chap. He never said ill of anybody and no one said ill of him. He will be greatly missed by family and friends in America, the villagers of Rangeworthy, and by model engineers to whom he gave so much through his letters to Adrian.

M.E. is grateful to the Reverend David Russel for his help in preparing this tribute and to Bob Cox for the photograph.





Turbine nozzle velocities

SIRS, - R. F. Parsons' problem concerning steam velocities in turbines (M.E. 4330, 18 July 2008) could stem from treatises on nozzle design, parts of which can be misconstrued.

Several articles concerning high steam speeds in turbines have appeared in M.E., but not all have been easy to interpret.

The 5 May 2000 issue featured a full-size 2-row Curtis machine, the first row nozzles having Mach 2.5 exit velocity, a relative wheel entry being at Mach 2.0.

The 1 July 1988 issue depicted D. H. Chaddock's *Laval* machine using similar velocities (and similar Puckett nozzles) and rotor blades $\frac{1}{10}$ the size of the Curtis, having a face radius of less than one millimetre.

The Curtis machine had blading with an efficient size range recommended by Goudie (2nd edition, pp. 340).

Regarding small blades being suspect, fall off of output is inferred. Pitch was used as a measure of blade size, although this is also the blade face radius.

Chaddock's *Laval* wheel, and those of J. Bamford and W. H. Elkin, all using supersonic relative entry velocities, operated at drastically reduced diagram efficiency, but ran at designed speed.

Extreme steam slowing and re-heating at wheel exit accompanied low power outputs.

Flow-wise, intensifying of the weak diagonal shocks in the nozzle jet due to extreme curvature of blade channels is a likely explanation.

Colour tempering of the blades corresponding to a rise in steam temperature of over 200deg. C occurred in the Chaddock and Bamford machines.

An interesting article concerning a dysfunctional model turbine illustrates R. F. Parsons' point about steam not entering the wheel. A simple chevron bladed wheel (no face radius) caused the nozzle jet to ricochet from the wheel face irrespective of nozzle angle. Abandoned in favour of an I/C engine, it surely

Crankshaft vibrations - a warning

SIRS, - Nemett's diagram (M.E. 4335, 26 September 2008) shows an in-line six based on his twin-cylinder I/C engine. I wonder whether he realises that it may be necessary to beef up the crankshaft in order to achieve an equally satisfactory design with six cylinders.

I am reminded of the experience of Henry Royce of Royce Ltd. In Manchester in the first decade of the last century. He produced an admirable twin-cylinder car of 10hp which impressed the then Charles Rolls enough to form the Rolls-Royce company. At Rolls' request he extended the concept at first to a 3-cylinder (15hp) design and then a 4-cylinder (20hp) and finally a 6-cylinder (30hp).

The 3 and 4-cylinder were successful but the 6 suffered from timing gear rattles caused by torsional vibration of the over-long crankshaft.

A front flywheel was tried (stationary engine practice) but this resulted in some broken crankshafts. Henry solved the problem temporarily by inventing a vibration damper. This was a small flywheel attached to the front of the crankshaft by a friction clutch. The energy lost as heat damped the vibration.

The ultimate solution was to increase the size of the crank webs and journals to stiffen up the crankshaft. Changing from three blocks of two cylinders to two blocks of three cylinders may also have improved the vibration characteristics. This was done on later engines.

I can recommend for further reading on this subject, No. 6 in the Technical Series of the Rolls-Royce Heritage Trust *Royce and the Vibration Damper* by Tom C. Clarke.

Neil Heppenstall, Cheshire.

He does indeed realise. The illustration referred to was in fact only part of the story. The external details were updated (from the twin) to show six cylinders for the illustration, but the internals were not. The crankshaft is still the 2-cylinder version and so the end floats around in mid-air inside the crankcase. I am thinking about the crankshaft layout to use but it will be beefed up and will also incorporate extra bearings - Nemett.

Write to us

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demonstrated the effect of diminishing blade radius.

Prolonged investigation of Professor Chaddock's data has led me to abandon thoughts of velocity compounding. The steam left the wheel with a velocity of less than 400fps (Mach 0.25), hopelessly inadequate as Chaddock inferred in 1988.

He suggested pressure compounding, as had H. H. Harrison in the 1930s, the latter suggesting the Rateau/Zoelly machine, which being wholly subsonic, should have higher nozzle and blading efficiencies.

It should be a simple matter to adapt a *Laval* machine, via its nozzle inclination/steam pressure/temperature, to provide a subsonic relative entry, say at Mach 0.7 as used by Rateau. Testing such a wheel would provide the elusive blade

loss coefficient (k) for the subsonic conditions.

The effective k value for the supersonic machines was about 0.125 (Chaddock and Elkin) is horribly poor.

Assuming a subsonic value for k nearer to full size (0.85) than the worthless 0.125, it should be worthwhile embarking on a multi-stage Rateau/Zoelly machine.

My efforts are currently aimed at finding relevant losses in nozzles, blading and glands using simple low pressure test units which are also intended to investigate lightweight construction methods for Rateau/Zoelly machines.

Darwinian doggedness, rather than cleverness, as inferred years ago by Denis Yates appears to be the requirement for success.

Bob Pridmore, Sheffield.

Small hinges

SIRS, - The letters from Gerald Martin (M.E. 4319, 15 February, 2008) and Arthur Bellamy (M.E. 4328, 20 June 2008) on making small hinges bring to mind a note of mine (M.E. August 1993) describing making very small hinges from thin material by rolling up and silver-soldering the end to form a knuckle. The trick is to insert a propelling pencil lead to work as a core plug to prevent the solder flooding the hole.

My hinges were 28g. brass with a 0.5mm lead used.

David Upton, Surrey.

Propane tank temperature

SIRS, - In *Post Bag* (M.E. 4332, 15 August 2008) Mr. Purves, who refers to Mr. Graham, discusses the problem of liquid propane or butane becoming so cold on evaporation that the flame is inconsistent. Their solution was to get heat from the burner to the tank to aid in maintaining pressure.

Having encountered the same problem for butane in my model boat the problem was solved in a different but quite effective way. This was to ignore the pressure in the source tank, (assuming the boat is not an ice-boat, and therefore the ambient temperature is reasonable for boating); then making a new burner to operate at the low pressure of 2 to 3psi. A pressure-reducer was made to reduce the tank pressure (always higher than this unless at the North Pole!) to 2-3/4psi in my case. This worked very well with few worries which are probably soluble by other model engineers. The compatibility of butane and the neoprene diaphragm and also the rubber (?) seal in the automotive tyre valve, being merely deemed okay. Also extra care needs to be taken in a model boat with ALL possible connections where butane might leak into the hull. If this occurred 'at sea', KAPUT goes the boat!

John C. Chappell, Ontario.

Rocket drawings

SIRS, - For some time now I have been trying to obtain working drawings of Stephenson's *Rocket*

in either 3½in. or 5in. gauge, without success.

Martin Evans did produce an outline drawing for this locomotive, but it is not suitable. However, it was with great interest to see on the front cover of *Model Engineer* (4334, 12 September 2008) a 5in.gauge model by Mr. J. Swindlehurst.

I would be grateful if you or your readers could inform me where I can obtain drawings.

Mike Johnson, Suffok.

Battery locomotive electronics

SIRS, - I wish to communicate with others who build their own battery-powered locomotive speed controllers and diesel engine sounders.

John Fletcher, by email.

Mass-produced models

SIRS, - I must take issue with the comments of Mr. Fielder (M.E. 4333, 29 August 2008) that the possession, use or customisation of mass-produced models can be said to be a part of model engineering as an activity. Language must have some boundaries and engineering is generally held to be an activity that involves the primary making of parts and by their assembly, in our case, models. Purchasing or building models whole or in kits does not require that crucial basic step of making something. If, however, one does make a part and then adds that to a model that one activity may be model engineering. If one buys a kit of castings and machines those into a model then that too is model engineering. Painting or even altering a mass-produced kit however is not engineering as all the engineering was done by the manufacturer before he marketed the model. I am not being snobbish about this as I too make and customise models from plastic kits, I collect and repair mass-produced models of working steam engines and I collect and also restore cast metal soldiers, but none of those activities can be labelled model engineering. When I make parts by hand or on machines and then assemble them into a model that alone is model

engineering. If we are not careful about our definitions then model engineers will go the way of their full-size counterparts where a man who fits a new fuse or a gas fitter is incorrectly labelled as an engineer!

Paul J. Weighell, Surrey.

Ortec DRO power supply.

SIRS, - Having inadvertently disposed of the power supply adapter for my Ortec Dro I would be most grateful if any reader can supply details of the specification (dc volts and current) in order that I can purchase a suitable replacement.

Bob Raffan, Cheshire.

Slapped wrists

SIRS, - What a pity that Malcolm Stride did not get more information when he was at the Reading SME Open Day. He photographed what he describes as a "very nice 0-6-0 tender locomotive" (M.E. 4335, 26 September 2008). Does my magnifying glass deceive me or are those outside cranks and coupling rods on the tender, there also seems to be some sort of exhaust manifold on

the top of the tender, pointing at the driver's knee. Could this possibly be a steam tender? A search of my reference books suggests that this is indeed a lovely model of Mr. Archibald Sturrock's Class 400 goods engine with a steam tender, even the pipes sticking up on the back of the tender are as per the prototype, though the horizontal pipe connecting them is not. This pipe alone suggests that this is a working steam tender as its function is presumably to direct the exhaust from the tender cylinders to a less sensitive part of the driver's anatomy. So this not just a very nice 0-6-0, but an absolutely fascinating 0-6-6-0, surely worthy of more than just a passing glance and a quick photograph. Just how much extra information could have been gained from a few minutes spent chatting with the driver we shall never know. What a wasted opportunity!

Dave Cox, by email.

I consider my wrists suitably slapped and promise to do better next time - MLS.

Simple dividing in the lathe

SIRS, - This is a simple idea for dividing a component being machined in a lathe using the chuck or a diameter already in progress, the idea is to divide the diameter into equal parts of 360 degrees.

First select a strip of strong card approximately 25mm wide and longer than the circumference of the chuck, start by taping one end of the strip to a plain part of the chuck outer diameter. The other end is wrapped around the diameter to meet the start end. Mark the joint with a pencil line and remove from the chuck, cut the strip to length at the pencil line, this length is now equivalent to 360 degrees.

To start the divisions fold the strip in half and mark with a line this is now our 180deg. point, fold each of the two halves in two to give two lines of 90deg., fold again to give two lines of 45 degrees. To mark the last fold I found it best to measure the length of the 45deg. fold and then divide into 45 equal spaces this is now the pitch for the rest of divisions.

The strip is now taped back on the chuck to give a large diameter equally divided, and now most divisions can be obtained as a part of degrees.

In use, the lines are chosen from a fixed scribing block and the indexing can begin with a suitable tool to scribe a line on the component in use.

The ratio between the chuck and the item is accurate for most use and this is where the marking of the strip can give rewarding results.

I hope this method will be useful to readers.

Albert B. Spiller, Essex.

Ewins oil pumps

SIRS, - Jack Shilling states (M.E. 4335, 26 September 2008) that "the piston cannot rise, not even a fraction of an inch, unless the oil is increased in volume, by adding more oil to the cavity".

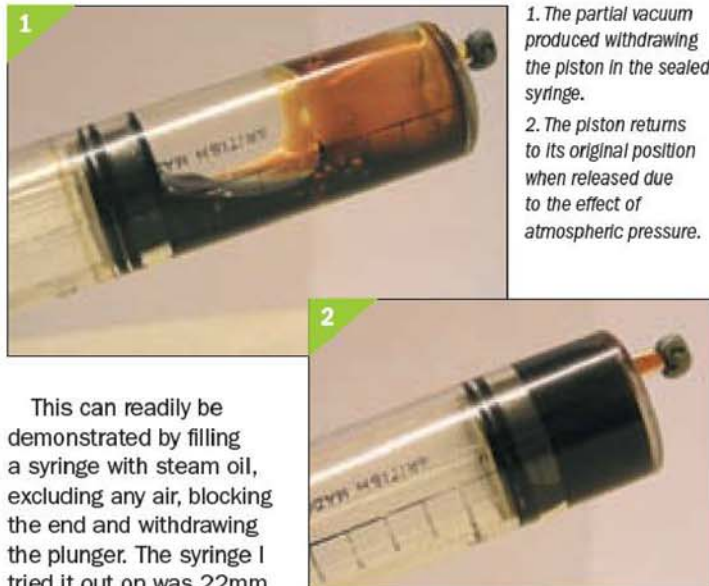
This is simply not true. If it were, mercury barometers would not work.

Every liquid has a vapour pressure and when the pressure over the liquid is reduced, by whatever means, including the withdrawal of a piston in contact with it, a small amount of the liquid evaporates to partially fill the space which without the presence of air would otherwise be a perfect vacuum. If the liquid is very involatile, this vapour amount will be very small indeed, and the space will thus become a near-perfect vacuum, but it will still be produced.

In a barometer, the space above the mercury is not a "perfect vacuum", it contains mercury vapour in a quantity corresponding to the saturation vapour pressure of mercury at the ambient temperature (about 0.00003psig at room temperature). This vapour pressure is not very high, but it exists. The mercury in this case corresponds to both the piston

and the fluid. If the barometer is tilted so that the mercury liquid fills the top end of the tube, the mercury vapour in the "vacuum" space immediately and instantaneously condenses, and the space (assuming no air has got in) disappears completely.

While lowering the piston in the delivery stroke of the Ewins pump it cannot compress the liquid, and so delivers it to the cylinders. The reverse, raising the piston blocked by the delivery check valve, will definitely cause a near vacuum if there is no leakage of oil into the cavity. The cylinder oil has a very low vapour pressure, so there will certainly not be much vapour present, but there will be some in this near vacuum: there has to be. The maximum force required to raise the piston from the liquid and create this vacuum will correspond to atmospheric pressure (less the vapour pressure of the oil which is small) acting on the cross-sectional area of the piston, and this force is rather less than that required to get the oil into the steam pipe, which may be at 80-100psig, and so is easily supplied by the actuating mechanism.



This can readily be demonstrated by filling a syringe with steam oil, excluding any air, blocking the end and withdrawing the plunger. The syringe I tried it out on was 22mm diameter, and a calculated force of about 8.5lbs will produce the vapour-saturated partial vacuum.

This was difficult to photograph without assistance, but I hope the pictures are good enough to show it happening. Note the bubbles which occur when the plunger is withdrawn (photo 1). Some of these could, possibly, be dissolved air coming out of solution, but they are mainly caused by small amounts of the oil vaporising under the vacuum. There were more bubbles but they had collapsed by the time I could press the shutter! When the plunger is released, they

and the space all disappear, as is shown by the other picture (photo 2) which was taken immediately after release.

The piston cannot be "hydraulically locked" when the Ewins piston motion is reversed, as Mr. Shilling described. It can only become hydraulically locked if trying to compress the incompressible liquid against a fixed volume.

Tony Finn, East Riding of Yorkshire.

The phenomenon when applied to mercury barometers is called a Torricellian Vacuum. - MLS.

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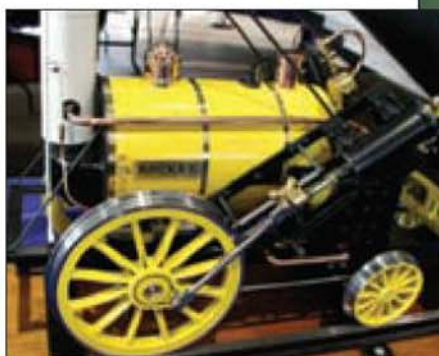
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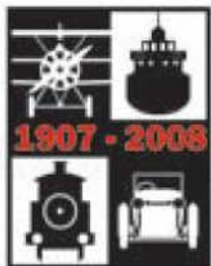
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Something fun and easy-to-build for the holidays from Jan Ridder. A simple pop-pop merry-go-round that floats in a bowl of water to display photos, trinkets or what ever you want.



Many outstanding examples of locomotive building at the 2008 Model Engineer Exhibition. John Swindlehurst was awarded a Bronze Medal for his 5in. gauge model of Stevenson's 'Rocket' of 1829 which also featured on the cover of M.E. 4334.

The Sinsheim track at Ascot



MODEL ENGINEER EXHIBITION

Michael Jones describes the track set-up and some of the locomotives that ran.

1. Hans Schruppf, who designed the track plan and supervised its installation at Ascot for the Model Engineer Exhibition.

2. Arnold Muenchberger travelled from Germany to assist Hans Schruppf in supervising the track assembly.

In the next few issues, we will present reports on various parts of the Model Engineer Exhibition including looking at various categories of models.

Organisation of this event takes place over many months and special thanks should be given to Lou Rex for his organisation of the model entries with his computerised and paper systems, which coped with the sudden last minute rush of competition entries.

Model Engineer would also like to extend its thanks to Andreas Wittur, head of Messe Sinsheim, GmbH for allowing the Model Engineer Exhibition to borrow the track and for Jan-Elizabeth Musché's much appreciated efforts to liaise between the two organisations.

The much talked about event of the Model Engineer Exhibition was the installation of part of the world famous Sinsheim track from Germany. Although planning for the track had taken place over several months leading up to the event, the reality of installing the track started when Hans Schruppf and Arnold Muenchberger arrived from Germany to supervise the track laying and make sure everything went together according to plan (Photos 1 and 2). Hans is the track master for the Sinsheim event held in January (and for other venues in Germany where parts of the track are used) He designed the plan for the Model Engineer Exhibition.

Tuesday

On Tuesday morning the HGV trailer from Germany arrived with the 12 large boxes of track and a rolling workbench. Track boxes were distributed strategically along the roadway opposite the Ascot Racecourse Grandstand and a crew of eight, strong young men, set to work lifting track panels from the boxes and laying them down according to Mr. Schruppf's plans. It seems that inside the boxes was packed not only a lot of track, 2.5km of it, but the sun as well. By Tuesday

afternoon the high clouds of the morning had dissipated and the worksite was bathed in strong, warm sunshine.

Each track panel is three metres long and only one end has fishplates permanently (loosely) attached, requiring the track to be handled in a specific orientation. Initially, track sections are positioned and slip into a rough alignment. The entire track (or nearly most of it) needs to be laid out before bolting anything together. By the end of Tuesday, about one-third of the track had been laid. The impression one gets is overwhelmingly of assembling an electric train track to run around the Christmas tree.

The initial plans for the track had not included a head shunt track attached to a goods yard, something the GL5 had requested. The response was "ja, wir sind flexible," ('yes, we are flexible') and so we decided to make some last minute changes to the track. We didn't set up the turntable, we added many more points to create a small goods yard and we modified where the traversers were placed to make access to them easier.

As evening fell, about one-third of the track had been set out, including the embryo goods yard. There were still many points to connect, and much else besides.

Wednesday: more track laying

By 0800, the track laying crew was back at work. By noon a little over half the track was in place on the ground. Earlier

in the morning As the track laying progressed two things became evident. First, it was a really long track and from the extreme ends you couldn't see both ends of the track. Only at the crown of the slight incline could you get a glimpse of both ends, but only just. Secondly, we realised that bicycles would have made the trip from one extreme of the track to the other much faster.

By Wednesday afternoon, we decided that we could safely start installing and fastening up about 8,000 nuts and bolts (M4). This work was facilitated by a miracle of modern engineering: cordless electric drills. The hard part of the work was end-to-end alignment of the track sections. When it came time to add nuts and bolts, much greater precision was required for the fishplates to line up properly and this more evident than at the points and transitions from the curves to straight sections. Accumulated tolerances made the track fall short sometimes. The solution was to insert a tiny section of rail, perhaps even only one or two sleepers long.

Thursday: finished early

This was another bright, sunny day and the last one before the exhibition opened on Friday and the locomotives arrived to run. Wednesday's progress had been good, but we were glad to have simplified the track layout earlier.

The morning progressed uneventfully and by about 4pm the track was finished, although Hans and Arnold were able to find little things to adjust on the track.

In the early evening some of the GL5 members began arriving.

After several days getting sunburned, on Thursday night over dinner, Arnold said (in German), "my wife is never going to believe I've been to Britain, she'll think I've been on holiday in Crete."





3. Alan Wood of the GL5 Association leads a double-headed mixed goods train powered by two 15xx locomotives. Prototypical speeds and ways of operating were the rule.

4. Dave Noble on the track with an LNER 'B1' 4-6-0 with a rake of private owner coal wagons.

5. GL5 goods wagons featured various unusual loads and weathering to achieve a prototypical look.

6. The goods yard and shunting lines for the GL5. The activity in the yard attracted a large number of exhibition visitors.

Model Engineer Exhibition operations

Friday was another day of unrelenting sunshine and sunburns.

The track was ready, coal and water were in hand, and the locomotives began arriving. The GL5 group were up early raising steam and were first on the track each day. Unfortunately, space doesn't permit us to show photos of every locomotive which ran.

Saturday's weather was a carbon copy of most of the week. Late in the morning a rumour (which was true) floating about the exhibition was that Tim Coles had fixed a problem with his gas turbine locomotive, the GT3 and it was to come from the exhibition hall to the track for a test run.

Those familiar with the demonstrations by the Gas Turbine Builders Association (GTBA) of one of their miniature power units was in for a treat: useful application of the power produced to propel a locomotive.

Sunday brought more sunshine and fine weather to greet the locomotive drivers who appeared



at the Sinsheim track on Sunday morning.

Because of the extreme length of the track there was no fencing - it was an impractical thing to consider. Visitors were welcome to walk the length of the track, take photos, chat with the drivers in the steaming bays (traversers) and generally use their common sense to stay out of the way. It worked very well and visitors got a better view of the trains.

The smooth operation of the track was also aided by the loan of four riding cars by the **Ickenham and District Society of Model Engineers** who have been stalwart supporters of the Model Engineer Exhibition for many years.

The GL5 Association

Members of the GL5 (**Ground Level 5 Inch Gauge Main Line Association**) brought wagons and locomotives to run on the Sinsheim track. During the weekend, they were able to demonstrate prototypical railway operations to the public using their 5in. gauge equipment. In the shunting yard they made up goods trains and despatched them onto the main line where they were driven at prototypical speeds (**photos 3 and 4**). When the trains arrived back at the yard, the wagons were shunted onto the appropriate track. Then, the process would be repeated but with a different order of wagons needed.

The myriad of wagons present was an interesting sight (**photo 5**). Many were weathered to a prototypical appearance, including bird droppings on the roof (scale sized!) and one brake van featured smoke

curling up from the stove pipe.

Walking along the track as one of the GL5 goods trains passed by did feel a bit like being Gulliver in the land of the Lilliputians with 6in. high people.

The goings-on in the shunting yard attracted the crowds to watch the proceedings and to ask questions of the members (**photo 6**). *Model Engineer* thanks the GL5 for their support. W. www.gl5.org/

GT3 turbine locomotive

On two days of the exhibition, Tim Coles ran his gas turbine locomotive the GT3. This engine is based on an experimental 4-6-0 prototype built by the English Electric in 1961. It features a steam engine layout with driving wheels and connecting rods. The model follows the

prototype by driving the centre wheels mechanically.

After transporting the engine to the track, as the two halves of the engine were coupled together and preliminary checks made, James Hill of the GTBA explained to the large audience how the engine start-up procedure worked (**photo 7**). In short, the turbine is run up to speed by a starter motor, butane gas is introduced and gradually kerosene (paraffin) is introduced to the turbine. The sequence is controlled by an ECU (electronic control unit) which monitors the operation and start up sequence.

When the engine is running at an idle speed, the starter motor automatically disengages and the engine is able to run under its own power. In our video on YouTube, the point at which the paraffin is introduced is noticeable as the exhaust roar deepens and the turbine can be heard to increase its speed. The maximum rpm for the turbine installed in GT3 is about 160,000.

So, Jerry Burchell manned the CO2 extinguisher and James Hill kept up his commentary until drowned out by the turbine exhaust noise, although it was not as quite ear-splitting as suggested it might be.

Tim Coles kept an eye on the





7. James Hill of the Gas Turbine Builders Association explains how it works and what to expect when the GT3 is started. 8. Cooling down the turbine after the run. A box with a battery and push button switch is connected to the starter motor to spin the turbine so it cools evenly (l. to r.) Tim Coles, owner and builder of the GT3 with the battery box in his hand, James Hill (checking the temperature) and Jerry Burchell.



There is video of the two days of running on YouTube. W. <http://uk.youtube.com/watch?v=nXSuSgGbrHc>

GT3 update

Following the successful runs on the Sinsheim track, the GT3 ran in revenue, passenger hauling at the Cambridge MES public running day, shortly after Ascot. This was something of a historical first, as it isn't believed that a turbo-mechanical locomotive of any scale has earned revenue in this country before. The full-size GT3 only ever ran in trials covering just 17,000 miles.

In the winter of 2008-09, Tim Coles hopes to complete the painting of the locomotive. The prototype was a red oxide livery. W. www.railphotoarchive.org/rpc_zoom.php?img=0923000018018

For further information about the Gas Turbine Builders' Association visit their website. W. www.gbta.co.uk

Thanks

At the end of the 2008 Model Engineer Exhibition, the Sinsheim track was dismantled in about half the time it took to assemble. By mid-day Tuesday, the track was packed (along with the sun and nice weather) on a trailer ready to go back to Germany.

Our two associates, Hans Schrupf and Arnold Meunchberger's skills and knowledge were invaluable to successfully set up the world famous Sinsheim track for the first time outdoors and in Britain. Many thanks to them for their efforts and willingness to spend eight days away from their families and workshops.

instrumentation on the back of the tender and when he gave the thumbs up, it was time for the three of them to set off down the track (cover photo).

The Saturday run was deemed a success despite being held up a bit behind a steam locomotive. The fuel consumed for a single lap was 6 litres which gives one an understanding (even in the miniature version) of why gas turbine technology was never a viable alternative to diesels.

After the run, it's important to cool the turbine down carefully. There's no high tech to this procedure. Connect a battery to the starter motor and pulse it a few times until the air coming from the exhaust is cool (photo 8).

Sunday's demonstration was to an even larger crowd than the previous day. The track was cleared of other traffic, James gave his talk, Tim was at the controls and Jerry was the safety officer on the fire extinguisher. Another successful and interesting run was made by the GT3.

Some locomotives and drivers on the Sinsheim track at Ascot

Visitors to the Model Engineer Exhibition will doubtless have their own favourite photographs from the event. Here are a few more pictures of some of the locomotives on the Sinsheim track.



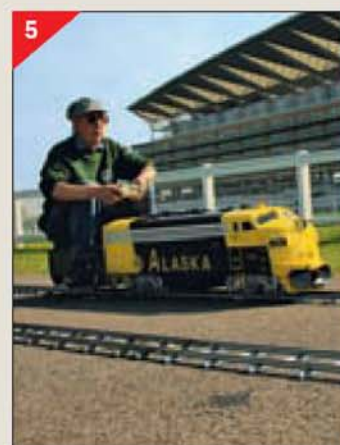
1. Jon Mottershaw brought his LNER Nigel Gresley class 01 2-8-0 locomotive Amy Grace. He is seen here returning from a water-shuttle. Steadied by his passenger, a large container of water was transported to the GL5 shunting yard from the main store at the other end of the track.



2. Taking a break to answer his mobile is John Peterson with his lovely 4-4-0T North London Railway (NLR) locomotive.



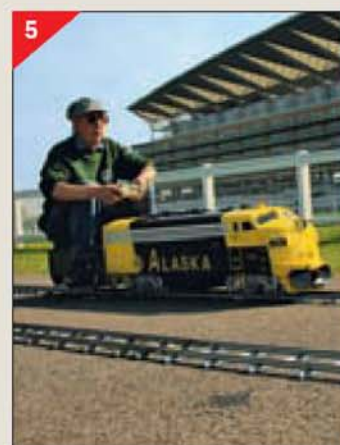
3. Lady Galtbe is an 0-4-0 electric saddle tank brought to the track by Graham Blissett. It included a rake of two passenger carrying coaches cars and one driver's truck. The whole unit did not fit on one track of the traverser, so only the locomotive is shown here.



4. Martin Weeks brought Red Rum, his 'Metre Maid' 0-6-0 variation of the 'Sweet Pea' narrow gauge locomotive design. It was a strong runner throughout the day with several drivers having a chance on the throttle.



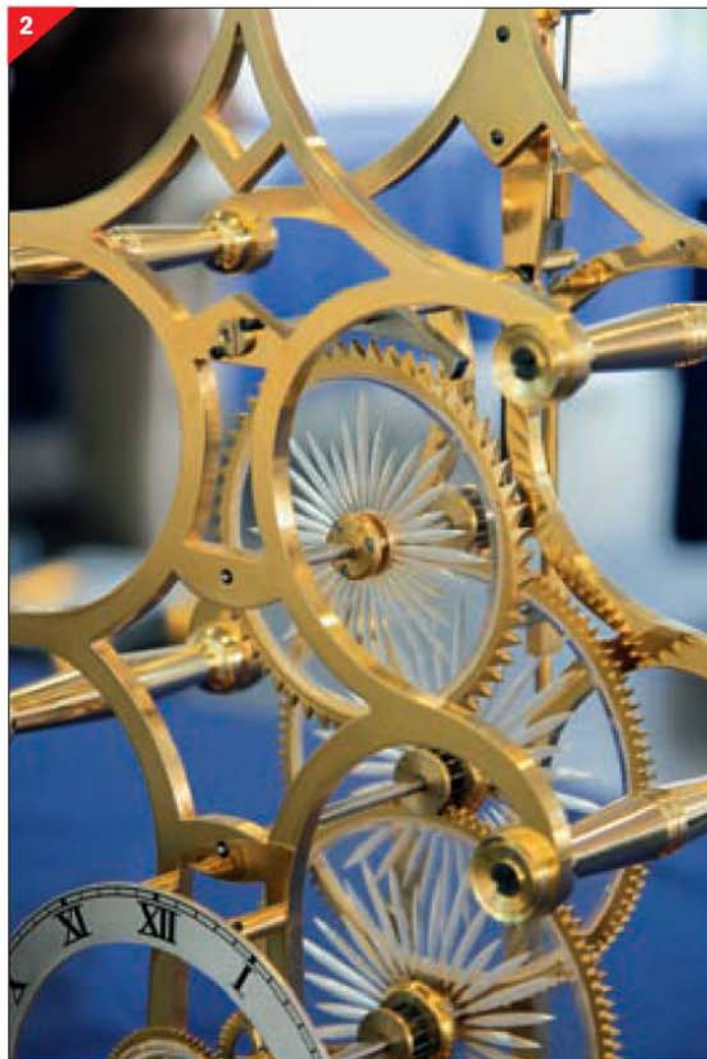
5. The livery of the Alaska Railway was chosen by the owner, John Chubb, for his Maxtrak locomotive. He's made modifications to the detailing including adding a snowplough to his model.



6. Ian Amott raising steam on his 0-4-0 Maxtrak Dixie locomotive. Although there were some initial concerns that the saddle tank water capacity wouldn't be sufficient, Ian provided extra capacity in his riding car, but completing the circuit didn't seem to be a problem without the extra water.



Photos by Roger Bunce



CLOCKS

Roger Bunce looks at Class A6 - Horological, scientific and optical apparatus.

There were three clocks entered in this year's competition; all were based on designs by John Wilding and all were skeleton clocks. Two were almost identical crystal wheel clocks. One was made by Alan Thatcher and was fitted with a case (case removed for **photo 1**), and the other, without a case, was made by Nicholas Hooper (**photo 2**). Interestingly, Alan machined the frames of his clock, and most of the other major components, using a CNC miller that he made

himself. Both clocks have an anchor escapement and fusee driven train. The spring barrel is located in the lower part of the frames. This design of clock appears to be based on an English skeleton clock made by James Edwards of Stourbridge, c.1830, and is shown on the dust cover of *Skeleton Clocks* by F. B. Royer-Collard, N.A.G Press Ltd., London. The major differences between these two examples and the original is the original has flint glass wheel centres, a translucent glass dial and is chain driven. In these two examples, Perspex was used instead of glass; the chapter ring was metal and the lines bronze and steel respectively.

The third clock was also made by Nicholas Hooper (**photo 3**). It has an anchor escapement, a fusee driven train and strikes one-at-the-hour. The clock is similar in style to the one shown on page 24 of Rayer-Collard's book.



That clock was made around 1835, was fitted with a dead beat escapement and the train wheels all have six crossings.

All three clocks were awarded bronze medals at MEX 2008. It is not my intention to discuss the relative merits of these clocks - they are three very good clocks and a credit to their makers. However, it may be useful to explain, in general terms, how we go about judging: First, and most important, prizes are awarded according to the 'standard' established over many years and not the standard in a particular year. Secondly, marks are awarded in each of several aspects and the marks added up to give a final score. In the case of clocks, these aspects include:

- Originality
- Complexity
- Style/aesthetics
- Construction accuracy
- Evidence of time keeping
- Finish
- Materials
- Casework
- Research
- Documentation

Each is considered in respect of the very best ever encountered for that aspect. For example: I think everyone would agree that a clock such as Peter Woodward's W5, mechanical master/slave clock, deserves full marks for originality. This clock is described in, among other publications, *Woodward on Time*, pub., Bill Taylor and the British Horological Institute. Other clocks would be marked in relation to that level of originality. I emphasise that, as far as originality is concerned, it is originality attributed solely to the entrant that counts.

This is a glimpse into the process that makes the MEX standard high - very high!

Other clocks at MEX

Clocks have been around for so long, it is always exciting to find something 'a bit different'. In that respect, readers will recall Donald Unwin's Square Wheel Clock M.E. 4334, 12 September 2008, and our current series on John Wilding's

'pigeon clock'. I was very pleased to meet John on the Ritetime Publishing Stand and see his pigeon clock, and his other great clocks, in the 'real'. Like many other clockmakers, it was John who first got me interested in making clocks - that was over 30 years ago. John was telling me about his latest project; all I am prepared to say at the moment is - it will be his best clock ever!

I was also delighted to meet the 'First Lady of Model Engineering' - Cherry Hill, seen here taking to John Wilding (photo 4). Two M.E. heroes in the space of two minutes - doesn't get much better than that!

Here's another little horological gem from MEX: Mike Kapp's 'Mystery Clock' (photo 5). Mystery clocks are not new. Cartier, the famous jewellers, began making them in about 1912. The main feature of a mystery clock is that there is no apparent means of driving the hands - they just appear to float on a transparent dial. Incidentally, a 1919 Cartier mystery clock was recently sold in New York for \$1,600,000! - if that sounds like 'a good little earner' - read on:

Mike made his clock as a 'brain teaser' for The Society of Model and Experimental Engineers and posed the following questions:

- What keeps the pendulum swinging - there are no weights, no springs, no motor and no escapement.
- The second hand is driven by a pawl, but what moves the pawl.
- Where is the connection between the pendulum and pawl.
- How do the other hands move - there are no gears connecting them.
- The pendulum is 2in. too short for its one-second swing - so how does that work.

Intrigued? All will be revealed:

Mike has kindly agreed to 'spill the beans' with a short descriptive article and then, hopefully, a 'make it article'. So, forget the Lottery - forget the financial crisis - just get on and make a few mystery clocks! **ME**



1. Alan Thatcher's crystal wheel clock.
2. The upper train of Nicholas Hooper's crystal wheel clock.
3. Nicholas Hooper's skeleton clock with one-at-the-hour strike.
4. John Wilding and Cherry Hill at the Ritetime Publishing Stand.
5. Mike Kapp's 'Mystery Clock' on the SMEE Stand.

Superheating a dip into the past

Bill Steer takes a look at the evolution of superheating used in miniature locomotives.

There has been a lot of discussion recently, in these pages, concerning the pros and cons of superheating. Indeed, talk to any group of model engineers about its value and one is likely to be met with a barrage of diverse and sometimes controversial ideas. Often these are based on years of experience; a 'feel' for the way a locomotive is performing or, perhaps, the appearance of the exhaust. Others believe that it is important to follow full-size practice - superheating is another detail and a model would not be complete without it. We then come across those

who would never superheat under any circumstances, claiming that it simply reduces cylinder life etc. At this point the theoretician steps in and reveals his latest 'model'.

With so many different facets to take into consideration, no wonder the tyro may feel confused when he comes to make the superheater elements for his first locomotive. Drawings for the older, but still very popular designs, usually specify copper (non-radiant) superheaters - relatively easy to make in a home workshop. Most contemporary drawings, however, call for radiant superheaters, constructed from stainless steel, with welded return bends - not so easy to make and also rather more expensive. Should he stick to the simple solution and make them of copper or go for something more up to date? To make things worse, the whole argument as to the effectiveness of superheating has once again re-emerged. This made me begin to wonder just what we have learnt during the last hundred years-or-so, since superheating was first adopted. In an attempt to answer this, and other questions, I found myself turning back the pages of the history books, I wanted to find out just how and why superheating had evolved in our miniature, coal-fired locomotives and what was the evidence as to its effectiveness.

As our old friend LBSC might have said, pull up a fireside chair and join me, we may even be able to dispel one-or-two myths on the way.

What is superheating?

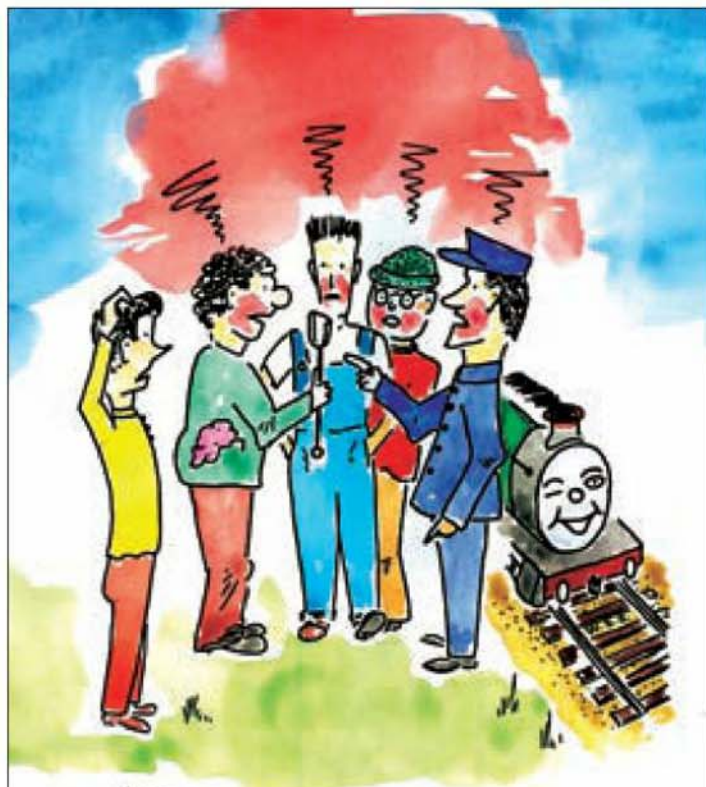
Before we start to blow the dust from the covers, perhaps I should mention, for the benefit of those new readers who may

be unfamiliar with our ways, that superheating is, in fact, the name given to a way of applying extra heat (heat being a form of energy) to the steam leaving a boiler.

Why should we want to do this? Firstly, the amount of energy that can be extracted from the fire and delivered to the cylinders of an engine is of fundamental importance - steam, generated within the boiler, is simply the medium (and a very good one at that) by which this energy is conveyed. Now, since the amount of energy that can be carried by the steam is dependant on its temperature, from the laws of thermodynamics, the hotter it is, the greater the energy available for the cylinders to convert into useful work.

The other reason for superheating is to offset the effects of condensation within the cylinders. This has long been felt to be a significant factor in limiting the efficiency of a reciprocating steam engine and so, again, the hotter the steam is, the more likely this will be overcome.

Using the laws of thermodynamics to describe the action of a practical working steam engine, in detail, is not trivial; neither is a full understanding of the effects of cylinder condensation. Indications, however, have generally suggested that although improvements in thermodynamic efficiency may be achievable, greater rewards might result from solving the condensation problem. Consequently, initial experiments with superheating have often been directed towards the latter, both in full-size and in miniature. The



*Superheating:
that which can occur when a tyro innocently asks a group of
model engineers about ways of improving the thermodynamic
efficiency of a steam engine.*

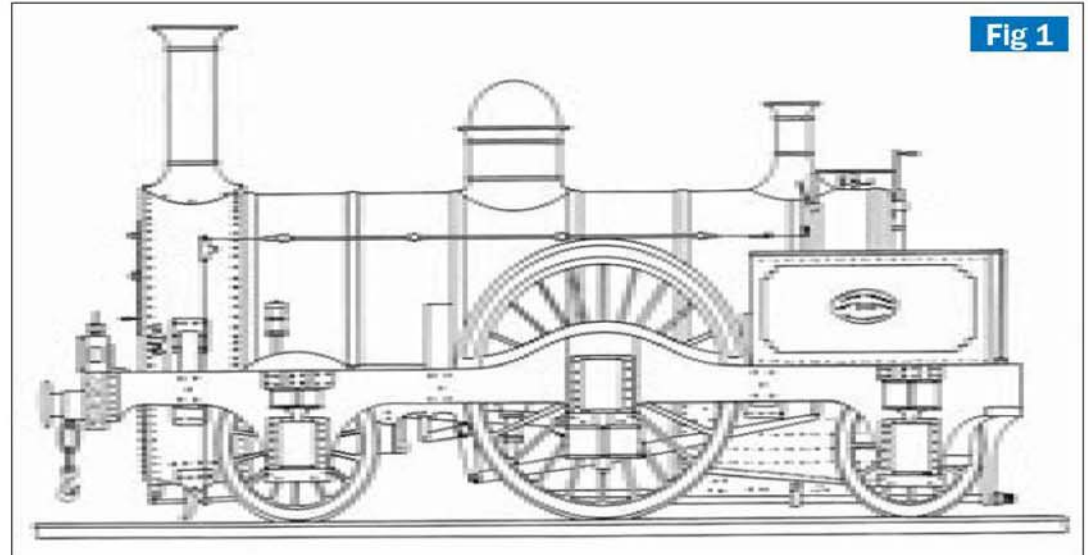
main thrust of development has been to devise practical and effective ways of getting added heat into the steam as it leaves the boiler. Having said that, let's begin.

Early superheating

To put things into perspective, it is worth taking a look at early full-size practice. Reaching for a copy of that much respected work by E. L. Ahrons, *The British Steam Locomotive, 1825 - 1925* (ref. 1), we find that one of the earliest references to superheating points to J. E. McConnell. This gentleman, in 1852, was responsible for designing a new class of large 2-2-2 locomotives, one of which is shown in **fig 1**. Incidentally, for clarity of point, many of the accompanying illustrations are either simplifications, or in some cases, compilations redrawn from those appearing in the referenced sources. Although much care has been taken to uphold accuracy of detail, they should not be taken as definitive.

Returning to McConnell's 2-2-2, these were built to meet the intention of the L&NWR board to run express trains between London and Birmingham in two hours, and are reported as having superheaters incorporated in their smokeboxes. The superheater used, consisted of a flat box placed a small distance in front of the tube plate. The box was traversed by short tubes aligned with the flue-tubes in the boiler and arranged so that the gases from the latter passed through them. The steam, on its way from the boiler, passed through the box and was consequently heated further by the tubes.

A similar principle, but employing a different arrangement was used by Sir John Aspinall in 1899 for one of the L&YR 4-4-2 engines. This device was placed within a chamber recessed into the boiler barrel immediately behind the smokebox and provided a superheat of 95deg. Fahrenheit. This must have been considered a worthwhile achievement since five similar



engines were given the same treatment three years later.

By modern standards these smokebox heaters would simply be classed as steam dryers. It was Wilhelm Schmidt, of Cassel, who first developed the smoke-tube superheater (in which the superheater element lies along the full length of a flue-tube) and consequently achieved high temperature superheating. Ahrons indicates that as far as he could trace, G. Hughes of the L&YR. was the first person to fit Schmidt superheaters to British locomotives; this was in November 1906, to a pair of goods engines. In 1908, D. Earle Marsh of the LB&SCR. also fitted them to his 4-4-2 express tank engines.

Developments at the GWR

O. S. Nock (ref. 2), tells us that the GWR had undertaken experiments with a Schmidt superheater in 1906, fitting one to engine No. 2901, *Lady Superior*. Churchward, was apparently not entirely happy with this system, particularly as its adoption was governed by the use of other Schmidt patented devices. When building No. 4010, *Western Star*, in May 1907, he therefore turned to the American designed, Cole superheater. This formed the basis from which the Swindon range of superheaters were later developed.

It is interesting to note that Churchward was concerned

about problems of excess cylinder wear as a result of high levels of superheat. His answer to this was the Swindon No. 3 superheater (which produced a lower temperature than the Schmidt), coupled with the development of regulator controlled, hydrostatic lubrication.

Other companies were also beginning to experiment at this time. In particular, Gresley had fitted large superheaters to the Ivatt Atlantics, turning their average performance into something reported as 'being little short of sensational' (ref. 3).

Superheaters in 'our' sizes

Taking the oldest volume of *The Model Engineer* in my own collection (dated 1907, and yes the *The* in the title remained until September 1955), we find a couple of references to superheating; the first in an article called *The 'New' Steam and its Application to Models* (ref. 4). This is primarily concerned with flash steam boilers, but in his introduction the author talks of the advantages of superheating: "Most modellers are aware of the great improvement in an ordinary boiler when the steam is reheated by carrying it through a tube in contact with the flame, and thence to the engine."

The other reference concerns a question, raised by a reader, about a 2in. scale model of a GNR Atlantic he intended

Fig. 1. McConnell's Express Engine, L&NWR, 1852-54; possibly the first locomotive to be fitted with a form of superheater.

building. In this he mentions that he will not be using superheater tubes; tantalisingly, nothing further is said about this either in his question or in the response given (ref. 5).

These two references (both appearing in the same week's edition) suggest that builders of small locomotives were becoming well versed in the methods and that some were probably experimenting in this area. Moving back a little in time we find that this is so.

Henry Greenly

Writing in 1904, in his book *The Model Locomotive - Its Design and Construction*, (ref. 6), Henry Greenly (a well-known model engineer of this era) talks about the problem of cylinder condensation and makes a number of suggestions for its prevention. One of these is the use of superheated steam, and further on he describes a number of superheaters suitable for model locomotives. These represent what was generally regarded as the state of the art in full-size practice and, like those of McConnell and Aspinall, are intended to be positioned within the smokebox. **Figure 2** illustrates his ideas at this time.

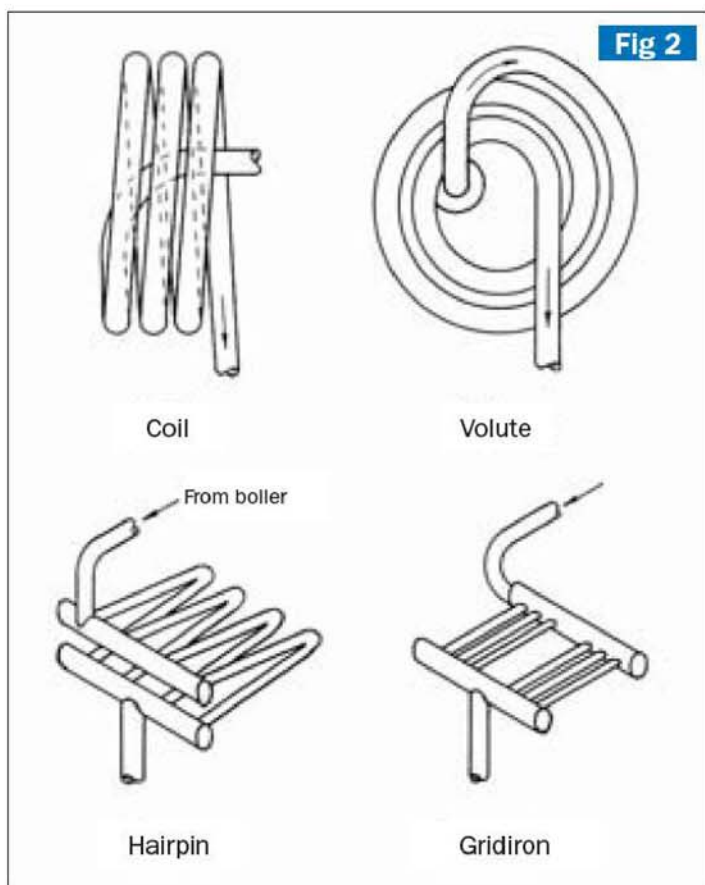


Fig. 2. Greenly superheaters, 1904.

Fig. 3. Smithie-type water tube boiler.

Fig. 4. Greenly's flue-tube superheater, 1922.

He comments that continuous coil type superheaters will have a retarding effect on the flow of steam and although they may be satisfactory for engines of up to 3½in. gauge, for those to be 'ridden upon' (the larger gauges), the hairpin and gridiron are best.

This book also contains a number of fold-out drawings for locomotives of ½, ¾ and 1in. scale showing applications of the above. It needs to be remembered that, at this time, almost all engines built to these scales were fired either with methylated spirit or vaporised paraffin oil. The former generally using a Smithie-type water tube boiler (fig 3), and the latter, a locomotive type, with firebox and flue-tubes.

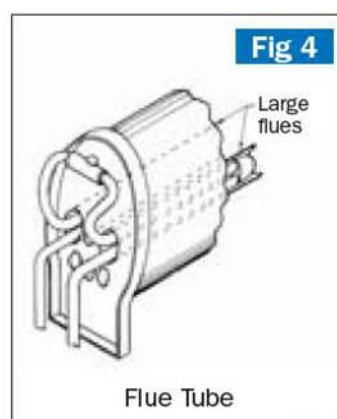
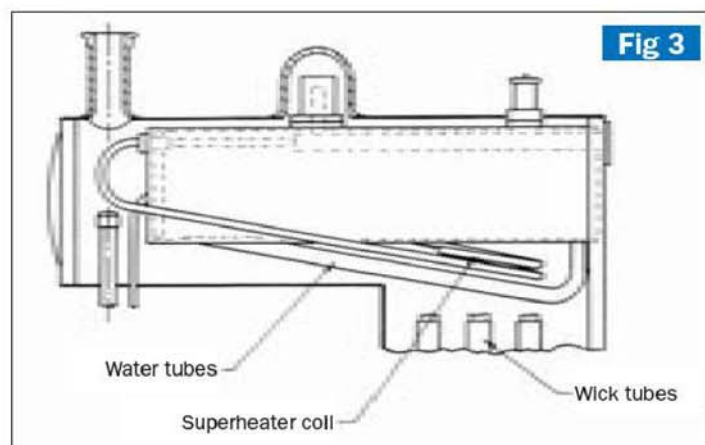
Advances in superheating

By 1922, Greenly had completely revised, and largely rewritten his book, which took

on the new title of *Model Steam Locomotives - Their Detail and Practical Construction* (ref. 7). Like his previous work, a drawing again depicts superheaters. However, with improvements in boiler design, and also reflecting full-size developments, it now includes (as well as the smokebox type) an additional sketch of the flue-tube variety (fig 4).

Referring to this innovation, Greenly comments: "Where the flue-tube superheater is employed a steel superheater tube is recommended, with possibly a protective cap at the bend inside the flue, and as the temperature of the steam may be very high the use of iron cylinders and mechanical lubrication is advisable if not essential to continued success."

Possibly due to his concern over cylinder lubrication, Greenly, himself, continued to favour smokebox superheaters; his gridiron designs still being incorporated into the 15in. gauge engines built for the RH&DR, in the late 1920s. However, these were soon removed in service and, after



several years of running with wet steam, experiments began with the flue-tube variety (ref. 8)

Mention is also made, in Greenly's book, of a number of experimenters who favour the use of solid fuel and "who have made quite a success of loco-type boilers in gauges as small as No. 1 (1¾in.)." In particular, he talks of the Manchester Model Exhibition of 1913 where he demonstrated such a 2½in. gauge Pacific engine. "It was kept in steam for six or seven hours a day, for three days; it could be left at any moment for considerable periods." Further on, he positively extols the virtues of solid fuel firing: "Undoubtedly generating steam from solid fuel is highly satisfactory, and whenever it is possible should be adopted."

This little snippet has interesting connotations. Due to his association with Bassett-Lowke and coupled with the saga known as the 'Battle of the Boilers' (ref. 9), Greenly is often unfairly regarded as having been biased towards spirit-fired, water-tube boilers in the smaller gauges - this is clearly not the case!

Battle of the boilers

Digressing for a moment, for the benefit of those unfamiliar with this widely reported 'Battle', it began in earnest in 1922 with a letter to *The Model Engineer* by a then unknown contributor writing under the pseudonym of LBSC, condemning the use of both water-tube boilers and methylated spirit as a fuel (ref. 10).

After much heated correspondence and a demonstration before the Society of Model & Experimental Engineers (SMEE), the battle culminated with a trial between two 2½in. gauge engines, *Ayesha* and *Challenger*, at the 1924 Model Engineer Exhibition. *Ayesha* was the coal-fired locomotive designed and built by LBSC and *Challenger*, a water-tube boilered, spirit-fired locomotive built within the works of Bassett-Lowke, to a special design by Henry Greenly.

From the early accounts (refs. 11 and 12), both engines put up a good performance, but in reality it sounded the death-knell for spirit firing and water-tube boilers.

LBSC

It was following the demonstration to members of the SMEE, that Percival Marshall first invited LBSC to contribute to *The Model Engineer* on a regular basis.

Making his debut in the issue for 19 April 1923, he began by giving instructions for producing a boiler with a wide firebox. This was for a locomotive he described as his Brighton 'Atlantic' (believed to

be the original Ayesha). The superheater for this particular boiler appeared in the second instalment (one week later) (ref. 13) and is shown in fig 5. We are informed that it resembles real locomotive practice and although no other specific reason for its inclusion is given, in his introduction, Curly (a common nickname of LBSC) hints of experiments he had previously conducted that proved the benefits of high-pressure, dry steam.

In his usual style, LBSC gives full instructions for its manufacture: "Cut two 12in. lengths of tube and bend the ends slightly over as at A, then file flush along the dotted line. The two filed faces are then brazed or silver-soldered together, taking care not to get any solder or spelter inside the joint and the result is shown at B."

For nearly a quarter of a century, this recipe was repeated for all his designs. The only significant variation being the early substitution of 'soft brass wire' for silver solder - presumably, at some stage it was discovered that in use, the temperature at the joint could exceed the melting point of the solder! The main problem with making this type of return bend is in preventing excess spelter from blocking up the tubes; warnings about this were always given and these became more pronounced as time went on.

In 1947, a new design for the return bend was presented (ref. 14). This was for *Hielan Lassie* (fig 6). It consists of the two tubes now brazed into a suitably shaped copper block (note the similarity to that depicted in Greenly's 1922 book). Describing the change, LBSC says, "The main reason why I now specify block bends, is because I have had so many complaints about beginners getting the spear-heads bunged up when doing the brazing." This style continued right up to his last complete locomotive design, *Pansy*, in 1958 (ref. 15). (His series describing the construction of *Evening Star*,

which began publication in *Practical Mechanics* in 1961 (ref. 16), ended abruptly in December 1962 before getting as far as the superheater.)

At this point it is worth spending a moment or two thinking about these two types of return bend: On the one hand we have a true spearhead, offering little resistance to the flow of flue gases as they pass by, and on the other, an enlarged section, that will inevitably cause a restriction. This restriction, in due course, becoming the instigator of a total blockage as fly ash and small cinders build up ('birdsnesting'). Had the effectiveness of the original spearhead superheater been reduced as a result of a manufacturing compromise?

Responding to comments from readers, LBSC, in 1953, adds further justification to the change in his adopted style of return bend (ref. 17), and points out that the increased thickness of metal at the bend also helps to reduce the effects of ash scouring in that region. Of course this begs the question: would not the reduction in flow of the flue gas, caused by a partial blockage, have a similar net effect? Interestingly, he mentions that scouring, which generally occurs when the firing is fierce, is not usually a problem with spearheads used in conjunction with boilers employing a combustion chamber. At the same time he also acknowledges that spearheads show little tendency to cause tube blockages.

As we move on, it's worth noting that in one of his 1954 'Lobby Chat' articles, LBSC gives a dissertation on the use and benefits of superheaters (ref. 18). This summarises much of what he had previously written and, as usual, is presented in his easy going style; it provides a good introductory background to the subject. His early experiences are again related in another article *Some facts about superheating* which appeared in 1956 (ref. 19).

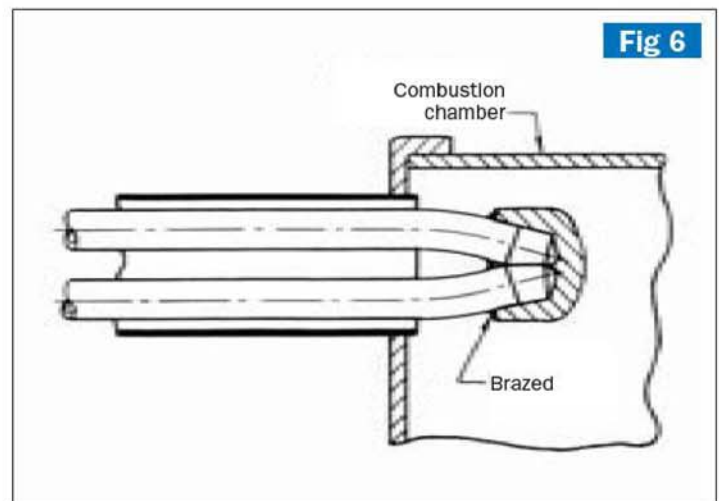
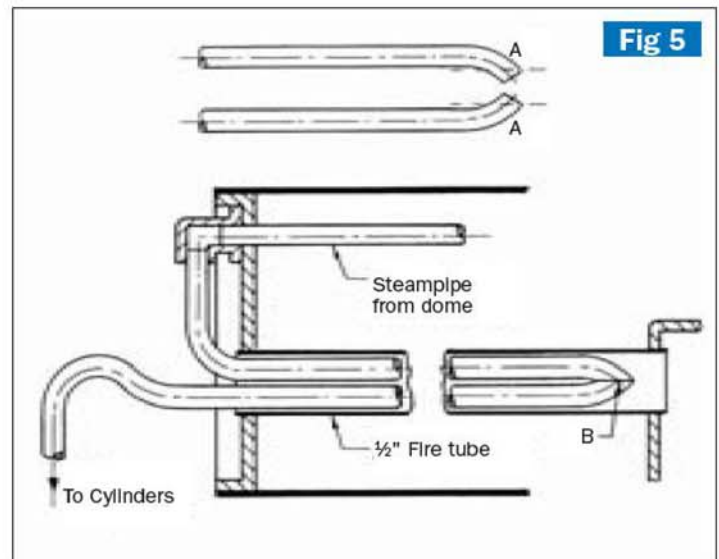
● To be continued.

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Fig. 5. LBSC's early flue-tube superheater, 1923.

Fig. 6. Return bend for LBSC's *Hielan Lassie* (3/4in. gauge), 1947.



Novelty - a Gothic style beam engine

Karl Konrad briefly describes the history of the original engine and provides advice on how to make this attractive and unusual model.

When looking for new models to build, I visited Lothar Matrian. Lothar is a well-known model engineer here in Germany with similar interests to Anthony Mount in England. I noticed a general arrangement of *Novelty* on his drawing board. I was impressed and immediately knew that this engine, with its Gothic side panels, was going to be my next project (fig 1).

Lothar told me that he had taken measurements of the original *Novelty* in the Henry

Ford Museum in Dearborn, near Detroit, USA, and was now working on the drawings in 1:20 scale. Following that, he was going to make wooden patterns, have castings made, and then make the model. However, that work would take several months.

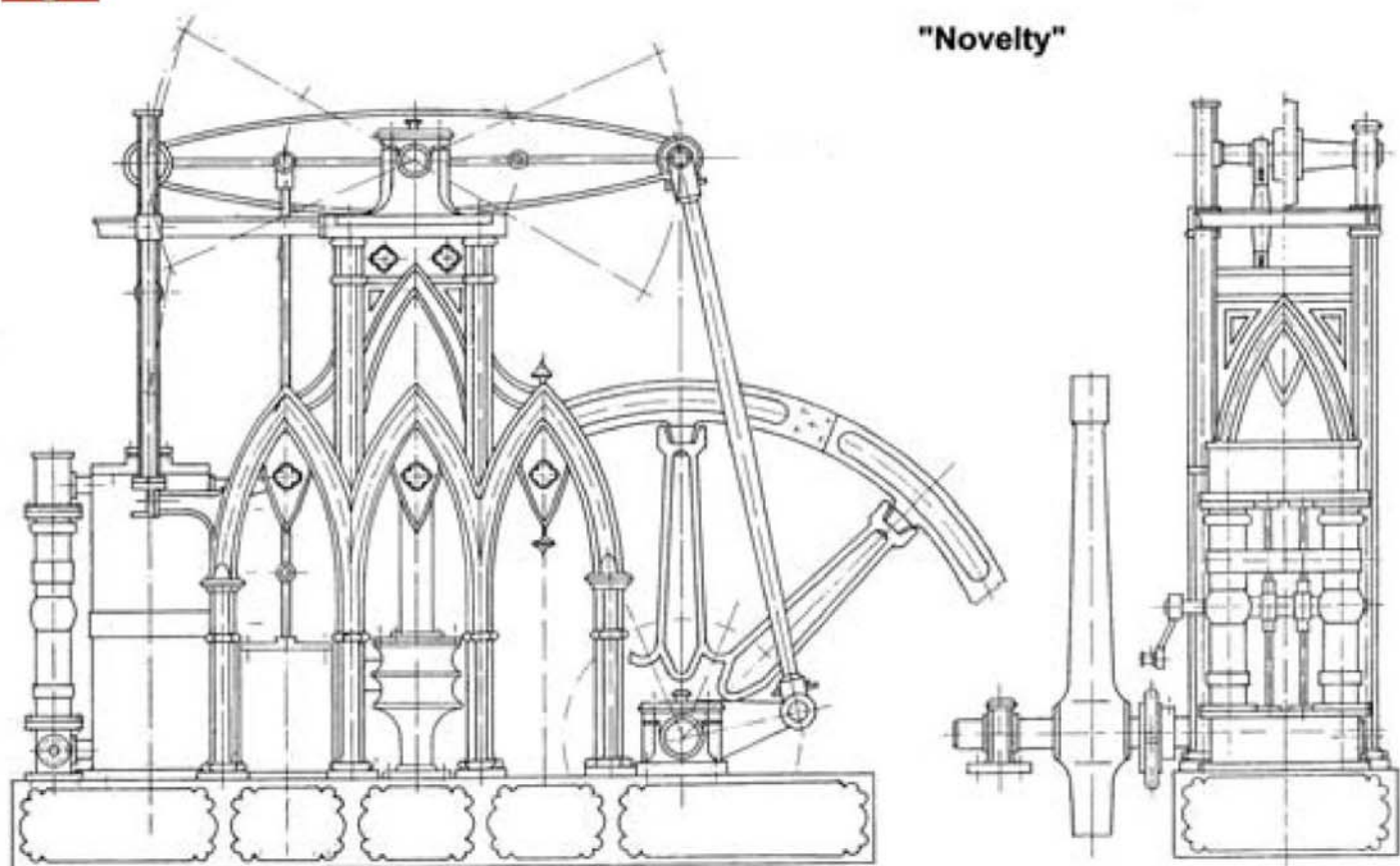
The original *Novelty*

The measurements of the original machine are impressive: Its height is approximately 7m from the base plate and the total height from floor level is 9.4m. The total length is 8m and the

diameter of the flywheel is an impressive 5.8m (photos 1 - 3).

In about 1857, the engine was purchased and installed in the Tatham & Brothers Lead Works located at 226, South 5th Street, Philadelphia. This firm was absorbed by John T. Lewis & Brothers at some point. Both the engineering firm that maintained the engine for many years and John T. Lewis and Brothers believed the engine was built by I. P. Morris of Philadelphia as a marine engine in 1836. However, the overriding

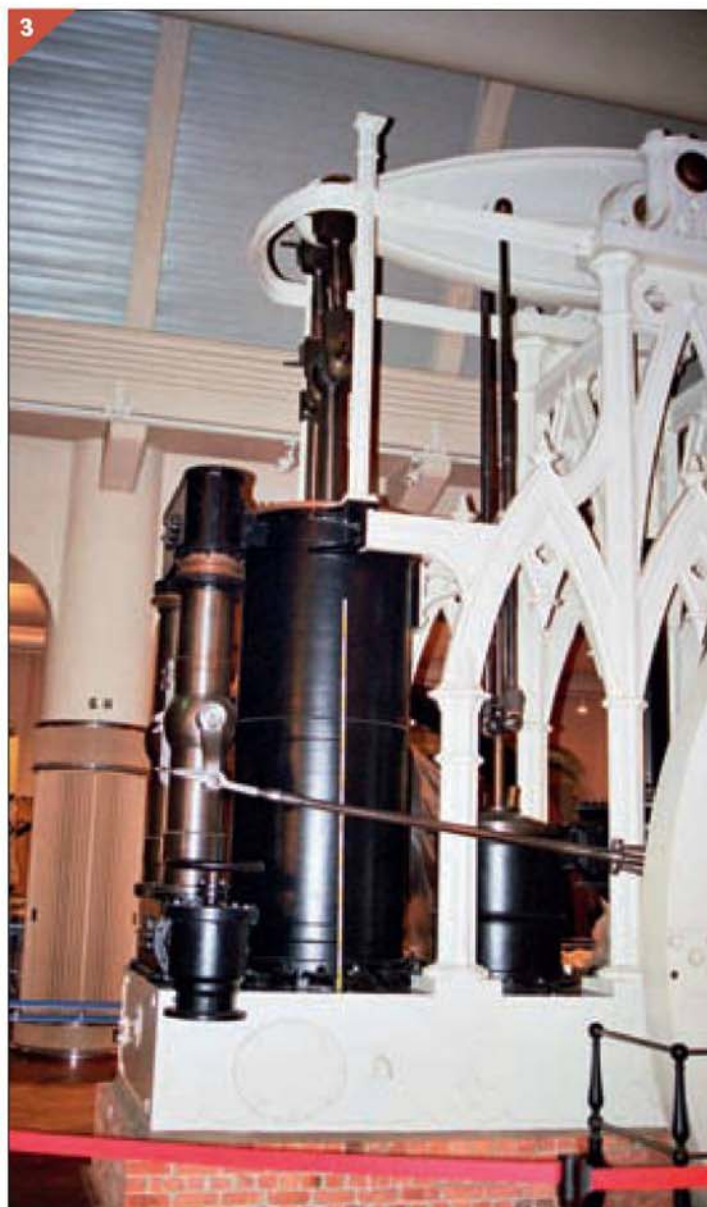
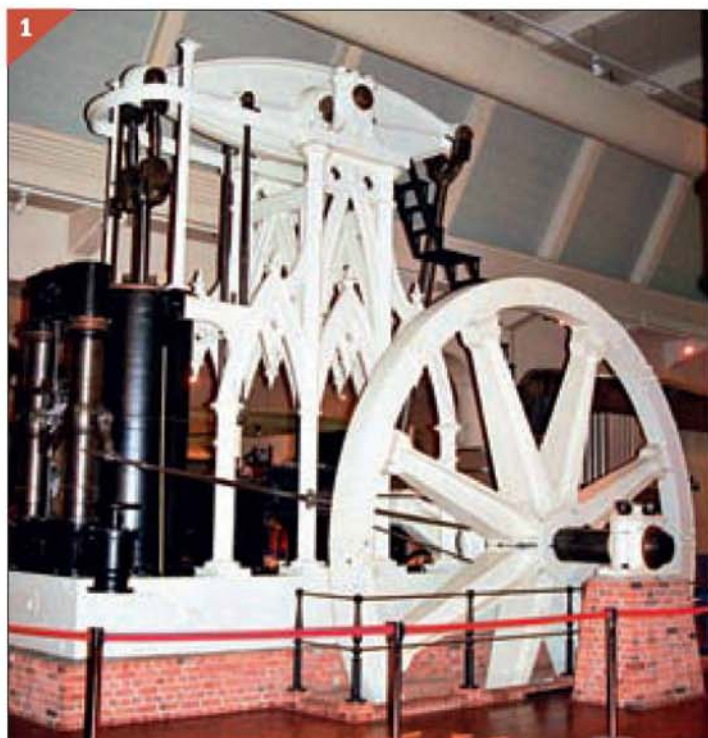
Fig 1



MS-Gußteilesatz bestehend aus 33 Gußteilen,
13 Blättern DIN A3 Fertigungszeichnungen

Bohrung:	28 mm	Länge:	450 mm
Hub:	94 mm	Breite:	280 mm
Schwungrad Ø:	276 mm	Höhe:	420 mm

Novelty	2005
Matrian, Dortmund	



evidence is that it was actually built by the Novelty Iron Works, New York, in the mid-1850s - hence its name. The Smithsonian Museum has a copy of a Novelty Iron Works drawing showing an engine that is virtually identical to this machine marked 'L. F. No. 61' and dated 1853. Although the Novelty Iron Works did build marine engines, it is clear that both engines were designed for stationary use.

From an engineering perspective, the machine is quite typical of its era; it was operated as a condensing engine and is fitted with a condenser and air pump. The engine does not use parallel motion to connect the beam to the piston rod, instead, there are two surprisingly

delicate crosshead guides that constrain a massive wrought iron crosshead. The engine was originally fitted with some sort of externally mounted governor, which controlled the speed via a simple throttle valve located in the inlet steam pipe. The outer part of this throttle valve is still in place.

Throughout its working life, the machine was deployed at various locations and was adapted to the technology of the day (valve gear, regulator etc.). The machine was donated to the Henry Ford Museum on 11 February, 1930.

Drawings and castings

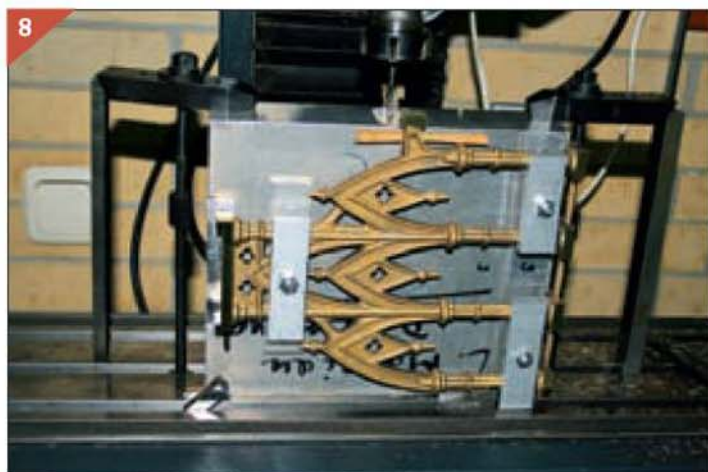
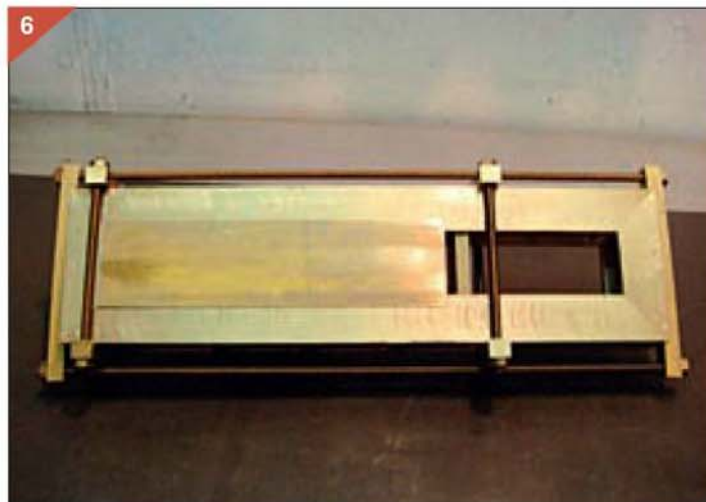
As every model engineer knows, time goes by really quickly. A year later I contacted Lothar



again, by that time the drawings and set of castings were available. He had made 25 wooden patterns from which 33 brass castings per model were being made (photo 4).

1-3. The original engine at the Henry Ford Museum.

4. Castings for Novelty.



5. Milling mitres for the base frame.

6. Clamping base the frame together ready for soft-soldering.

7 & 8. Milling the Gothic side parts.

9. Preparing to solder the transverse castings to side parts.

corners (**photo 5**). These are fixed together using soft solder (**photo 6**). In doing so, one must ensure that the facing sides have the proper ornament structure. A brass plate is fitted into the frame and soft soldered into place.

Gothic sides

The two Gothic side parts are mounted on an aluminium block so that surfaces can be machined simultaneously.

This guarantees that both the side parts have identical measurements (**photos 7 and 8**).

When work on the side parts has been completed, they are mounted temporarily on the base plate and the transverse castings soft soldered into place. In doing so, it is important to insert a spacer at the beam bearing level in order to ensure the distance between the side parts is exact (**photo 9**).

● To be continued.

Further information

The drawings and castings for this, and many of Lothar Matrian's other engines, are available from him: T. +49(0)231/71 49 88, E. matrian-dampf@dokom.net Lothar can also supply a catalogue on disc, showing photographs of his engines and casting kits.

Base plate

The foundation frame is made from four U-section pieces with 45deg. angle cuts at the

The Badmintons:

the odd men of the Great Western

Peter Rich describes a class of early GWR locomotives where experimentation made many into one-offs.

I've been out with the pipes again today practising a few reels on the banks of the Severn when once again my mind drifted off into the realms of model making and one-off full-size prototypes. To this end it occurred to me that there has been very little mention of William Dean's first real adventure into modern express passenger locomotives for the 20th century which appeared in the shape of the 'Badminton' class 4-4-0s of 1897. Having said that, I should say that in reality it was the chassis which was of pure Dean design while the boilers were the work of his assistant, G. J. Churchward.

The situation at Swindon at this time was quite delicate because William Dean, the Chief Engineer, was ill in that his mental powers were failing. I don't quite know what to make of this information because another account written by Denis Griffiths, in his book about Great Western engineers, states that this was not true and that, although he was ill, Dean was fully aware of what was going on.

However, Dean's condition undoubtedly became gradually worse and the board of the Company and Churchward coped with the situation in a very humanitarian way. While Churchward took an increasingly greater responsibility, Dean was never told this and was allowed to believe he was still in charge and continued in office until he was eventually persuaded to retire in 1902. The Company found him a house at Folkestone to retire to where he died in 1905.

I was working up a fair turn of speed on the chanter when it further occurred to me that the first engine of this class, No. 3292, would fit into the realms of our 'one-offs', which I have highlighted in recent articles. Far be it from being a 'one-off' in the class, the title could apply to quite a few of the others because in this group of 20 class 4-4-0s, quite a few experiments took place which affected the appearance of some of them early on, and all of them eventually, by the time they were withdrawn from traffic in the late 1920s.

The standard 'Badminton'

The more I thought about this I realised that it would require quite a few drawings to properly illustrate these differences so I came to the conclusion that the best resolution would be for me

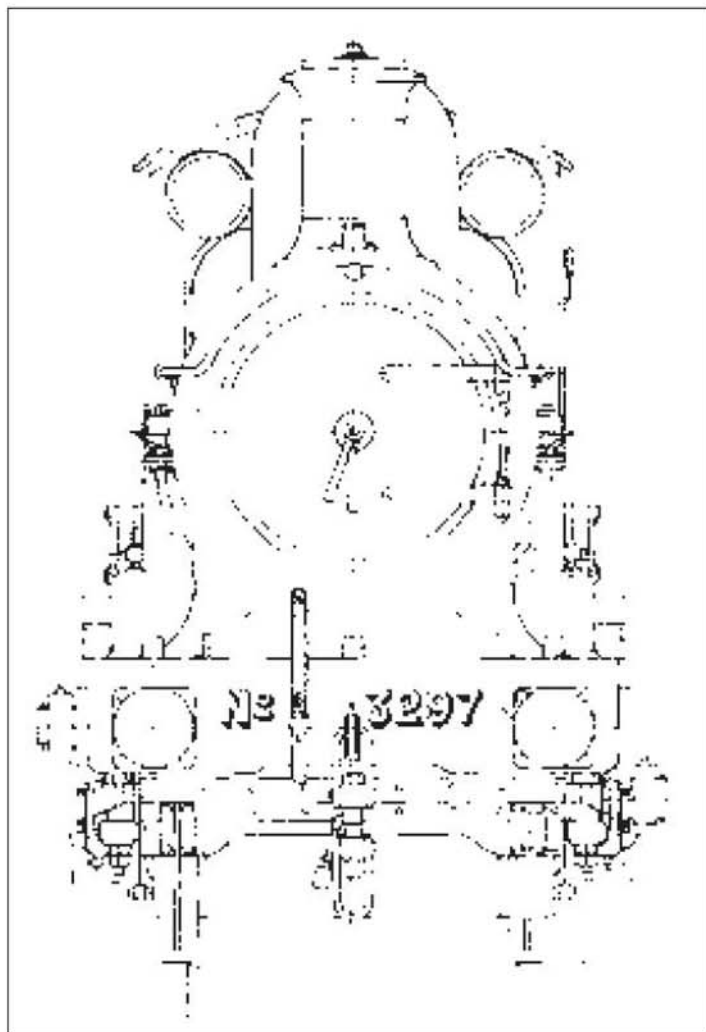
to draw the standard production model as my main illustration of the class and to mention the differences between the one-offs in the text, so that is what follows. Should there be any interested builders out there who want to have a go at one of the 'one offs' I would be prepared to make separate drawings of the alterations.

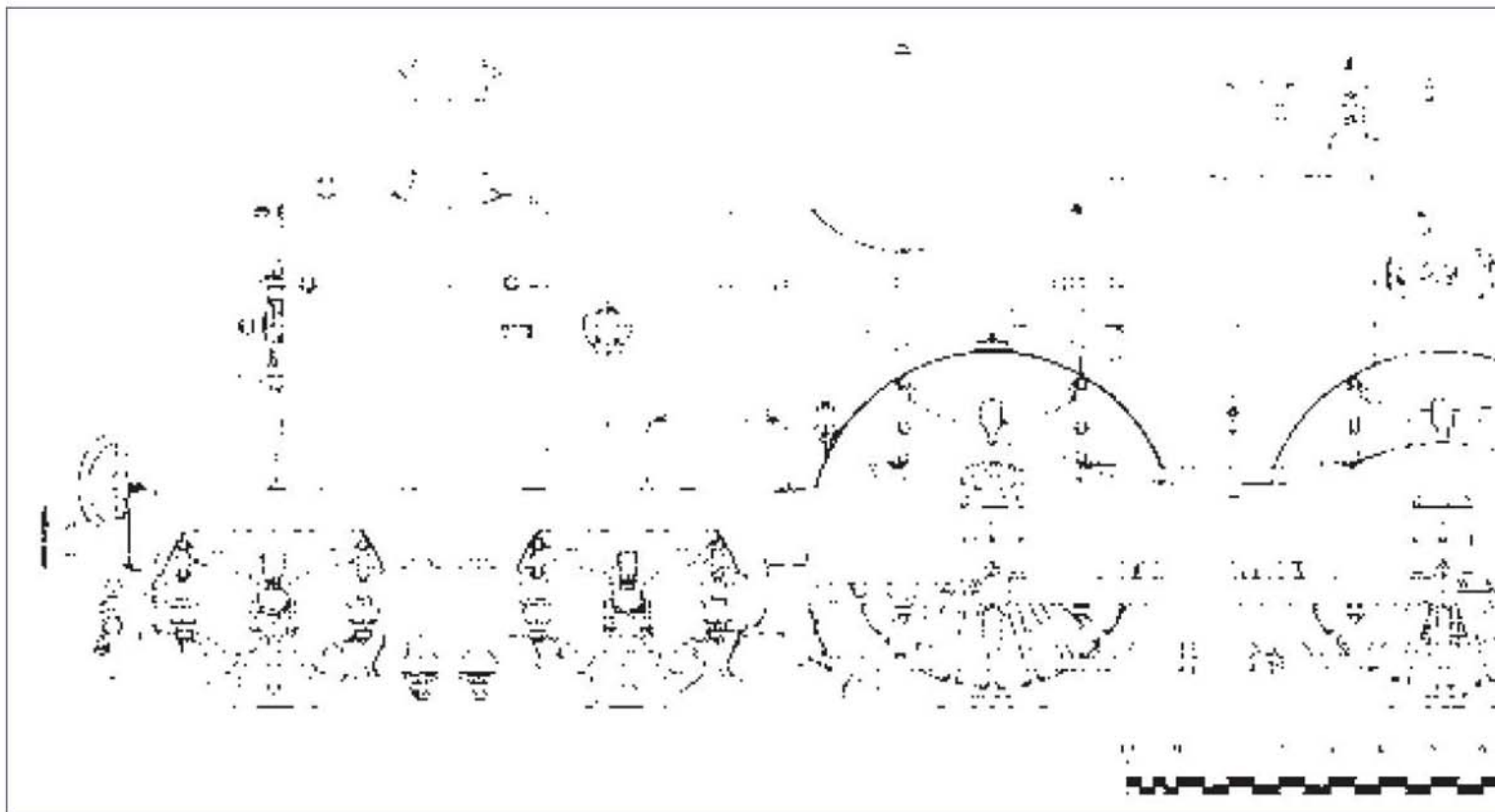
In order to highlight the differences it is necessary to know what the standard production model looked like and my drawings illustrate the appearance of the majority of the class as they were built during 1898. One or two things should be pointed out about the class in general because they introduced a few items, which became 'standard' on the Great Western for many years until its demise in 1948.

Distinctive features

The first feature, which I suppose made the whole class a 'one-off' at that time, was that they were the first GWR locomotives to be fitted with Belpaire firebox boilers which, according to RCTS (Railway Correspondence and Travel Society) records, was a last minute decision made by G. J. Churchward, because drawings for round top fireboxes had already been made for them before his intervention.

At that time flat-sided spokes were the general order for wheels, but these engines were the first to introduce oval shaped spokes in their driving wheels which also, unusually, had ribs between each spoke at the wheel rim. Except for the first few Churchward 4-6-0s, I don't know of any other engine on the Western that carried this feature and I often wonder whether the 'Badminton' wheel patterns were altered for the first use on the 4-6-0s. On the





subject of their driving wheels these engines also introduced the 6ft. 8½in. dia. driving wheel that Churchward adopted as his standard for express passenger engines.

These engines were also first fitted with the later familiar steam fountain on top of the boiler backhead inside the cab, however, it was rather more forward of the front spectacle plate hence the rounded steel cover on top of the firebox attached to the front of the cab. Prior to this the fountain had been combined with the regulator stuffing box.

The familiar curved nameplate over the driving wheel splasher was also introduced on this class, after some experimentation. At this time, it was wider than that which we knew later and was fitted directly to the boiler barrel over the driving wheel and without a distance piece between them.

It should be mentioned, too, that their crankshafts were set 'Stroudley'-style with their cranks coincident with the outside cranks rather than at the more usual 180deg. from them. This last feature required very large crescent

shaped balance weights on the crankshaft wheels which were set opposite the cranks, hence they are not seen on my drawing.

A further feature of the class, which I think was unusual at the time, was that the trailing axle also had axleboxes in the inside frames supported by under hung coil springs. Most of the 4-4-0s of the time had outside axleboxes only with larger leaf springs above them.

Performance

Before moving on to the differences I feel I should mention something about their performance in service because these engines were being introduced as replacements for the already very successful Dean Single 4-2-2s.

From the comments of contemporary authors they did not create a very good visual impression on introduction, but what they lacked in appearance they more than made up for in performance. They were the forerunners of the 'Atbara' and 'City' classes and it is from the 'Badmintons' that these later engines got their ability for power and speed; 'Badmintons' were very fast engines.

On introduction, they started to take over the main expresses between Paddington and South Wales and the West Country and on the north to west route between Shrewsbury and Bristol which is not a very easy route to work with all its inclines, etc. O. S. Nock, in part one of his book *Great Western 4-4-0s*, provides logs of two runs between Shrewsbury and Bristol in 1899 on the Wool Buyer Special. The train was worked by Badminton No. 3301 *Monarch* in both directions. The locomotive would have been in its original condition and it is recorded that the engine regularly ran at speeds between 60 to 70mph and at one point exceeded 80mph - and this over a very difficult road!

The one-off differences

Now let us have a look at those differences which appeared in the class and which we model engineers need to be cognisant of if we are going to build models rather than small locomotives.

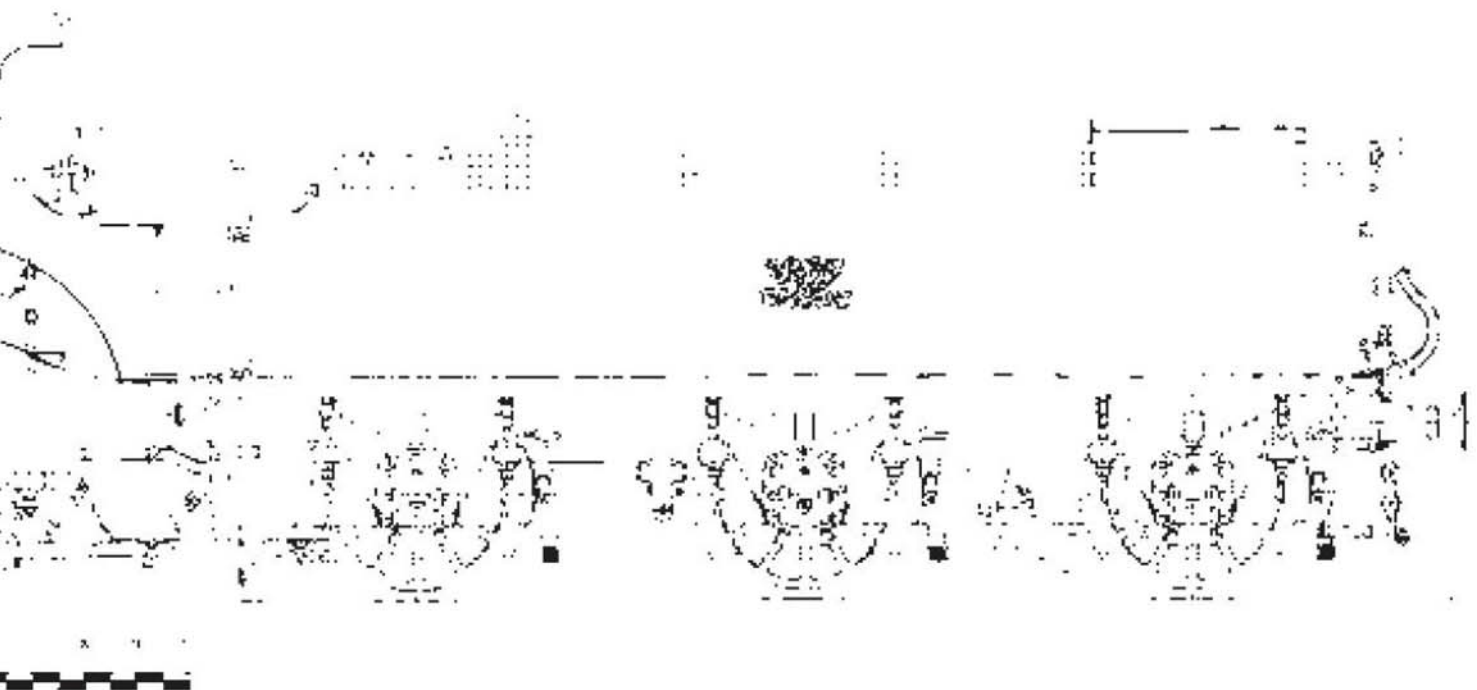
First, I'll deal with those locomotives which were different from the 'standard' when they were built.

The first engine of the class, No. 3292 *Badminton*, appeared

as shown in my drawing but with a much larger cab which extended forward past the front and outside of the driving wheel springs. It carried side windows high up on the cabsides with a handrail underneath. It was also the same as the next batch described below. At this time it was unnamed, but after four months it was fitted with a normal cab, as shown, and the nameplates applied.

The next four locomotives were built as per my drawing except they did not have the external delivery clack valves on the side of the boiler barrel as shown, feed water being supplied via backhead mounted clacks.

When No. 3310 *Waterford* appeared, it carried the second of the Standard No. 2 Belpaire firebox boilers then being developed by Churchward. The first was fitted to No. 3312 *Bulldog*, which had just been built. *Waterford's* boiler differed from the first boiler as there was no dome fitted and the safety valve was moved forward on to the boiler barrel to occupy the position which became standard GWR practice over the years on the larger boilers. This boiler was pitched very high compared to



the other locomotives and its chimney was a lot shorter, but the smokebox was of similar construction to the others.

Waterford further differed because it was fitted with a very large cab which had pillar handrails similar to the Collett engines of later years. The cabsides carried very large oval shaped number plates that also combined the name and works plate.

Tenders

Number 3310, was also among the very first to be fitted with one of the Dean 3,000 gallon tenders which had squared-off top, front corners to its tank side rather than the tumble home as shown in the drawing. This tender was unusual in that it also had the old type Dean frames where the lower part of the hornblock legs were blended in to the hornblock and the horn keep was a large round hollow bar bolted between the faces of the hornblock as shown on the drawing. I don't think there were many around like this. For those who are not familiar with the later style, the frame was continued down below the hornblocks and a separate plate hornkeep was bolted across

the frame. In their original as-built condition, all the standard locomotives of the class were attached to the Dean 3,000 gallon tenders, as shown.

Earl Cawdor

The previous description covers the class as originally built, but within a very short space of time, differences started to appear on certain engines, one of which is No. 3297 *Earl Cawdor*, the subject of my drawing. In early 1899 the appearance of this engine, together with No. 3308 *Savernake*, was altered by the fitting of a large, extra tank structure on top of the rear of the tender which was painted to match the green of the tank sides and was fully lined out. This was done so that No. 3297 could haul Queen Victoria's Royal Train throughout from Windsor to Folkestone on 11 March of that year and No. 3308 was altered purely as a stand by engine. For this occasion, No. 3297 also carried four large decorative coats of arms fitted alongside the smokebox and on the tender sides and large crowns on the lamps.

In 1903, there were two further rebuilds which altered

Leading dimensions in their original condition

Cylinders	18in. dia., by 26in. stroke
Driving wheels	6ft. 8½in. dia.
Bogie wheels	4ft 1½in. dia.
Leading overhang	2ft. 6in.
Trailing overhang	4 ft. 6in.
Wheel base	7ft. 0in. + 7ft. 3in. + 9ft. 0in. Total 23ft. 3in.
Boiler	Pitch 7ft. 7¼in. Barrel dia. 4ft. 5in. Firebox length 6ft. 4in., Tubes 244, all 1½in. dia. Pressure 180psi
Total weight	84 tons, 13cwt.

the visual effect and these occurred on our old friends Nos. 3297 and 3310. Dealing first with No. 3297, Churchward allowed one of his assistants to develop his ideas about boilers and *Earl Cawdor* was fitted with a very large round-topped firebox boiler with a drumhead smokebox. The engine also had a large cab installed with two windows in each side. J. N. Maskelyne published a nice article and drawing about this engine in this condition in *Model Engineer* in the 1950s.

Later this cab was replaced by one of Churchward's standard type and a more

normal Standard No. 4 tapered boiler replaced its round-topped one in October 1906. Thereafter, the engine followed the pattern of the rest of the class. At this stage of the engine's career it was fitted with the latter-day deeper-toned whistles, which became the GWR standard and whose sound became familiar to all of us who can still remember them. I reckon that even now after 40-odd years I can still recognise the sound of a GW locomotive whistle at a couple of miles distant.

Meanwhile, *Waterford* maintained its differences from ➤

BADMINTON CLASS 4-4-0

the rest of the class for a while. Its original boiler was replaced by the Standard No. 4 first fitted to locomotive No. 3405 *Mauritius* in 1902. This had turned that locomotive (3405) from an ordinary Atbara class into the prototype of the famous City class of 1903 from which *City of Truro* (3440) is with us today as part of the National Collection. This boiler was the original of the tapered-barrel type and had straight sides to its firebox rather than the curved type which appeared on the next boiler. The first No. 4 boiler had a parallel barrel and was fitted to loco No. 2661, an Aberdare class, in September 1902.

The next visual alteration to their appearance occurred in 1906 when all but three of the class were fitted with the Standard No. 4 boilers together with the Churchward pattern cabs and in which condition they were on a par, and rated, with the City class. This situation, however, did not last very long because all engines were altered to the Standard No. 2 tapered boilers in 1911 - 13 and as such were assimilated into the Atbara class.

In my opinion, the Badmintons were the last of their era. They were the final group of large engines fitted with boilers featuring large brass steam domes and exemplified what I think steam locomotives are meant to look like. On later engines, except for the smaller locomotives, the large dome was done away with in the name of progress. I well remember the old Dean Goods engines working the Brecon passenger trains from Newport in the early 1950s and it was always a matter of regret that these engines were replaced by the more modern LMS Ivatt 2-6-0s around 1953.

Modelling notes

My original drawings are prepared for 5in. gauge, for those interested in building a model, and I have included a scale to assist with dimensions. I have included drawings of the front and rear of the engine, but not the tenders, as these will be appearing at

a later date in connection with another locomotive.

There are just a couple of small points of authenticity to mention.

Prospective constructors should be aware that the section of parallel foot-plating between the driving wheels was set at 1½in. higher than that to the front and rear of the driving wheels. This was also the case with some of the later curved framed 'Bulldogs', but in their case to the rear of the trailing driving wheel was also set higher.

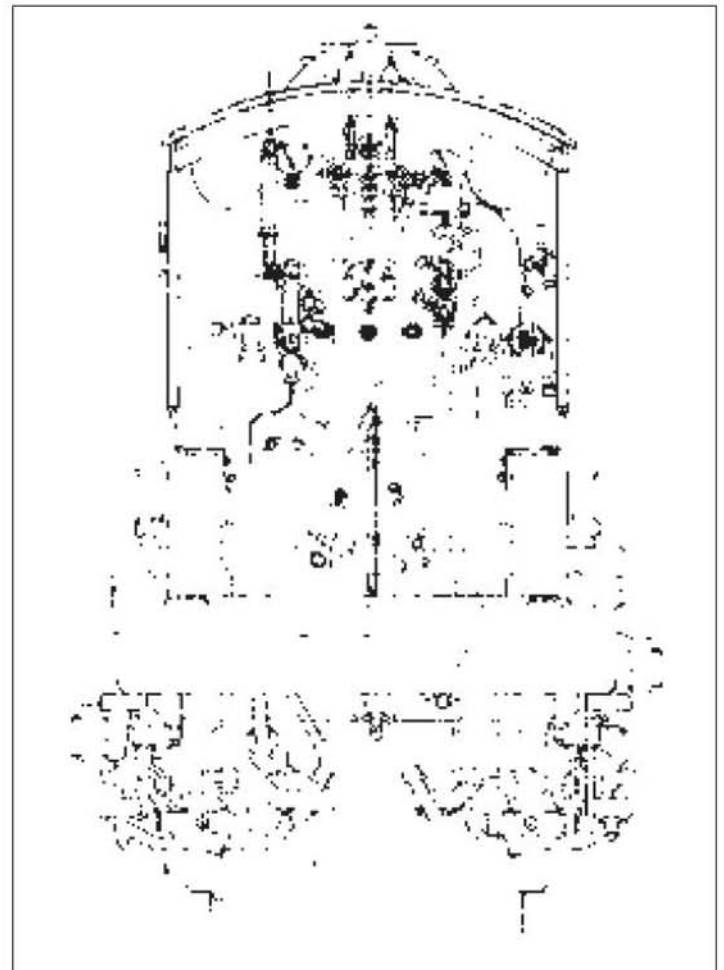
The small box seen sitting on top of the driving wheel splasher was the main oil feed box for the inside axlebox, the pipes leading out from the rear of the box and down the inside face of the splasher. They were cast in brass and would also have been fitted on the rear splashers inside the cab.

Liveries

These locomotives were the first 'express passenger' class to be introduced after the Queen Victoria Diamond Jubilee livery of 1897, which was probably the most elaborate one ever applied to GWR engines, was adopted and therefore they did not carry the double black lined boiler bands which dated from 1889. This livery was only applied to those locomotives which, in their normal tour of duty, could be found on passenger trains.

Lesser passenger locomotives retained the previous livery until everything changed in 1906. As a point of interest here, locomotives normally regarded as 'goods engines' had a different livery - that of pre-1889. They continued to be so turned out until 1906. Only the passenger engines had the more elaborate liveries applied.

It is difficult, on a drawing like that shown, to properly represent this livery in a meaningful way. It is sufficient to say that where the frame border lining came to an end, it was generally turned in to a angle corner or frame edge, etc., as shown. The panel lining on the upper works was usually where the lining was required to turn through a right



or obtuse angle; it was done with a small radius. Where an acute angle was involved, then the lining was brought to a point. Having said that, the lower rear cabside lining of the Badmintons proved the exception to the rule.

For those of you who want to build close scale authentic models of this period of time I have included the front buffer beam numbers on the front view drawing, but take note that the numerals then were of a different shape prior to 1914 than that which became familiar later. The main body of the numerals was in gold, not yellow as later, and the shading was black. Not all locomotives carried the numbers as shown and you need to refer to a photo of your prototype. The tender engines only carried it on their front buffer beam. The reason they were not applied to tenders was, of course, because these could be, and were, exchanged between locomotives.

There have been references to tank engines carrying the

number both front and rear, but I have not found any evidence that it was applied to the rear buffer beam.

Looking at the lines of this class both in my drawing and in photographs I can well understand why they were regarded as somewhat less than attractive compared to the earlier Dean Singles and Armstrong 4-4-0s. Having said that, at this distance in time, we now would find them very attractive, indeed, in their Indian Red livery.

The odd men?

Why did I refer to 'Badminton' locomotives as the 'odd men out'? I can not think of any other GWR class of engines in which had so many visual and internal differences applied to such a small number of engines.

The old fingers are starting to bounce again and I've got to go out and get a quiet couple of hours on the pipes. *Twm Barlwm* or the foreshore?

Hmmm, the foreshore I think, it's not so far to walk.

ME

Early Drummond flat-bed lathes

With World War One underway the need arose for a more

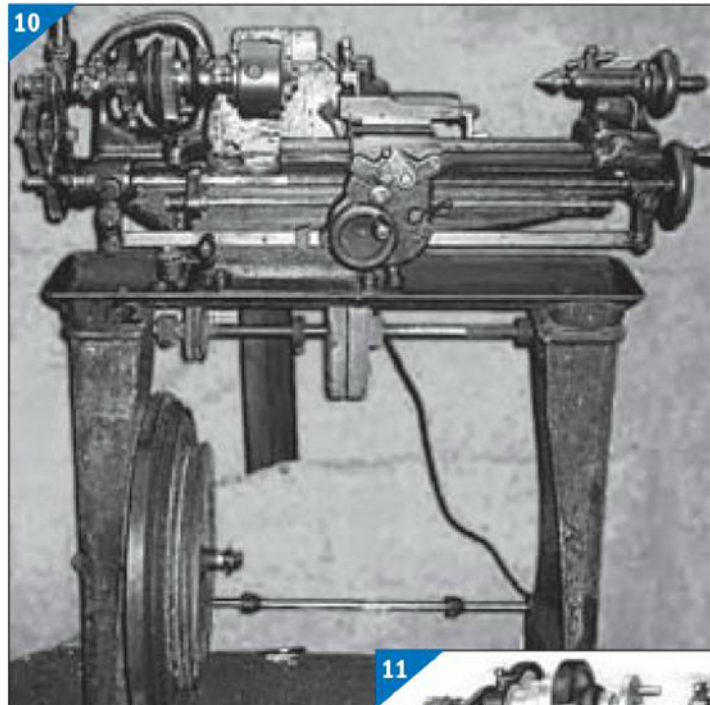
sophisticated small lathe for use on board ships and in 1916 the Mk. 1, BS Type, Drummond was introduced for Admiralty use (photo 10). Drummond lathes were already widely used by the armed services and this new model incorporated a number of modifications to ease the difficulties encountered when machining in rough seas. It was based largely on the standard B Type machine, but fitted with power operated longitudinal and cross feeds. The drive came from a shaft below and parallel to the leadscrew, driven by gears at the left-hand end. The provision of power feeds meant

that the leadscrew had to be fitted with clasp nuts (instead of a full nut used on the standard machine), so a saddle traverse hand-wheel, through rack and pinion gearing, was also included. Another and important refinement was the fitting of a tumble-reverse mechanism to the changewheel drive - an accessory that later became available across the range. The tumble assembly was carried on the slotted bracket on the headstock front that normally carried a stud to mount the extra changewheel required for left-hand screwcutting. The B Type lathe beds of that era can be identified by the 'pads' cast onto the front face of the bed to accept the power cross-feed layshaft assembly. Two versions of the power cross-feed model were made: on the very rare Mk. 1 type the feed-selector arm worked across the front of the apron while on the much more common Mk. 2 type it was positioned to hang downwards and indent into the underside of the casting. There is no evidence that the BS Type was available for civilian use, it being entirely absent from Drummond catalogues of the time.

The 'M Type'

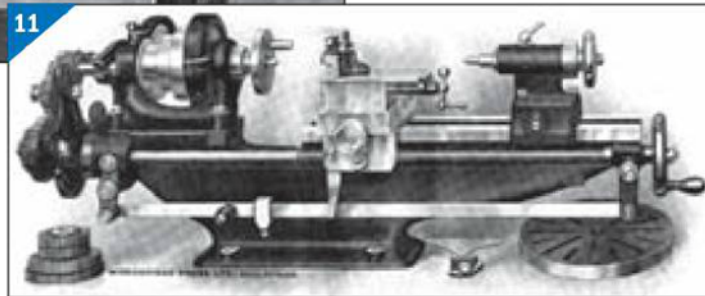
In 1921 Drummond again stiffened and improved the lathe and renamed it the M Type (photo 11). This particular version, to be altered again in 1925, was to have the shortest run of any model (except

perhaps the original model, produced in 1902 and modified in 1904). Modifications again concentrated on improving rigidity and the headstock, an entirely new, heavier, and much improved design, lost the distinctive overhead bracing bar that had previously spanned the bearings. The headstock was no longer swivelled on top of the bed (to avoid flexing), it was now positively located against the flat vertical surface of the front bed shear and clamped down hard by four bolts. It was fitted with larger bearings, the adjustment of which reverted to an earlier Drummond design, where a large ring, screwed onto the end of each bearing itself, pulled it into the tapered headstock housing. A proper ball-bearing thrust race was fitted to the inside left-hand end of the spindle and, as an aid to heavier rates of metal removal, a long-needed, three-step flat-belt pulley replaced the by now hopelessly inadequate small diameter round 'gut' drive. The spindle nose was again, as in 1912, upgraded and fitted with a 1in. x 12tpi thread backed by a 1½in. register, designed to improve the rigidity of screwed-on attachments. The backgear was changed from 20:60T to 22:66T and, instead of being slid into place, was engaged by rotating an eccentric shaft. To avoid using a spanner to disengage the bull wheel from its embrace with the belt pulley, a cleverly designed 'ramp' (which acted as a cam) was machined into a plate on the front of the gear. If everything was adjusted properly, a swift push by a gnarled thumb against a knurled-edge knob was sufficient to persuade the close-fitting engagement pin out of mesh with the pulley flange. To engage direct drive, the backgear was swung away and ➤

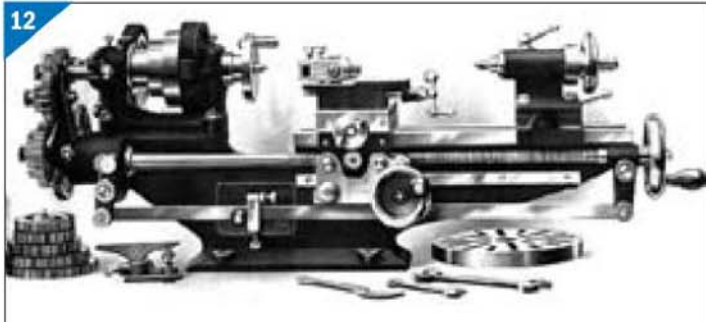


10. Drummond Mk 1, BS Type, introduced for Admiralty use.

11. Drummond M Type introduced in 1921, but this version only lasted 4 years.



12



12. Final development of the M Type that lasted from late 1924 to 1942.

13a. ML1 Myford sold from early 1935.

13b. Very late Myford ML.2.

13c. 1938 Myford ML.3.

13d. Final version of the ML.4 built from 1939 to 1942.

taper tailstock was also further increased in strength and the barrel diameter increased from $\frac{3}{4}$ to $\frac{7}{8}$ inch. The previous rather crude screw-in barrel clamp gave way to a much more elegant and efficient 'cotter' or 'internally-split' locking device and some machines (but surprisingly not all) were given a hollow barrel to solve the problem of removing centres and chucks.

While the T-slotted cross slide casting was unchanged, the top slide was new (though the early-pattern clog-heel toolpost was retained). Its feed screw was off-set to the side in order to provide a longer and slower wearing nut, and to allow

the tailstock to come right up to the right-hand face of the cross slide. Its base had an improved (though still hard-to-read) scale, graduated in degrees on an inserted brass plate. The crank handle on the cross-slide feed screw was abandoned and a neat and effective 'two-fingered' grip used in its place, together with a long-awaited zeroing micrometer dial.

Although the changewheels remained unaltered, the studs, instead of being fitted with slow-to-remove knurled-edge finger nuts, employed a patented design of push-in 'spring' retainer - a simple and effective design that remained until the end of production. On previous models the change wheel banjo arm had always been held by a crude through-bolt that ran up against the mounting boss (a design that made it difficult to get enough grip to stop the arm being moved sideways when heavy cuts were taken). The solution was to use a stud and nut to clamp a curved extension to the rear of the casting. The treadle flywheel was balanced and ran on a ball race, as did the 'Pitman' driving link. Both changes helped the operator to maintain a good speed with less effort.

Improved functionality

Further important changes were made in late 1924 that greatly improved the functionality of the lathe including a 'dis-engageable' leadscrew nut unit. This was a rather awkward assembly formed from a substantial

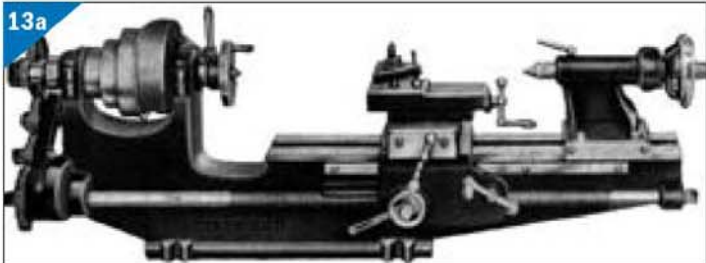
bronze 'swinging arm' and located by a spring-loaded plunger on the left side of the apron face. The nut was only a 'half' type, the upper portion consisting of an adjustable, plain, half-round bronze thrust pad retained by a massive bronze nut against the inside face of the apron. The carriage was further improved by the addition of a direct (though unfortunately high-g geared) rack-and-pinion feed, as originally fitted to the power cross feed of the BS Type lathe. The top slide was thickened towards the rear, where it supported the feed-screw cross plate. An enormous improvement was made by incorporating, as standard, a quick-set toolholder of the 'Norman Patent' type. The 'Norman' was simple, but highly effective, and consisted of nothing more than a split hardened block, with a broached square hole, arranged to slide up and down and clamp to a 1.25in. dia. pillar, cast integral with the upper section of the top slide (photo 12).

At this time, a long-bed version of the lathe was introduced and also made available to the armed services in a very rare BS Type power cross-feed version. Although further minor modifications were made, this was the essentially the form in which the lathe continued until 1942.

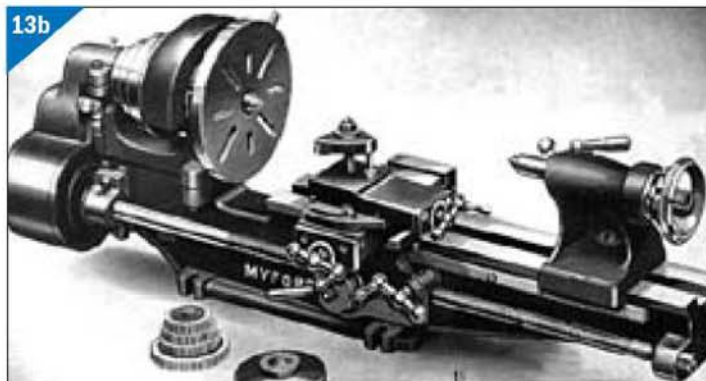
Ministry of Supply

In 1942 an agency of the Ministry of Supply, the Machine Tool Control Board (a body responsible for all the Nation's engineering production), decided that Drummond should concentrate on production of their 'Maximat' multi-tool lathe (introduced in 1935). They required Myford to take over manufacture of the M Type, a long-established design that had been adopted some years before as the standard small machine for the Armed Services. One might question why Myford were not allowed to sell their own lathes into this market but, unfortunately, their contemporary models, the ML1, 2, 3 and ML4 (photos 13a - d

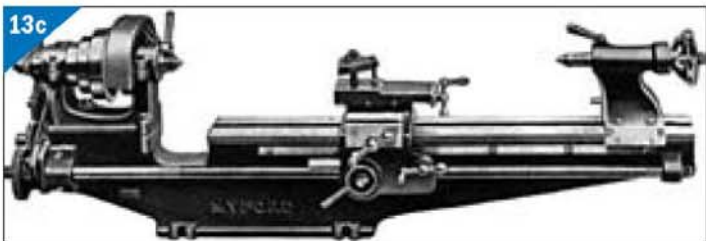
13a



13b



13c



13d





respectively), were completely unsuitable for professional work. With all machine tool production allocated to approved industrial users, there was (at least in theory) no private market for Myford. Hence, with some spare production capacity - and the necessary expertise - Myford were the logical choice to build the Drummond.

However, despite their responsibilities, production of the ML2 and ML4 did continue together with a newly introduced machine, the so-called '4-inch Precision' - of which around 400 examples were made. This was made in collaboration with Jones and Shipman (**photo 14**). They also found time to design and manufacture several small capstan lathes, loosely based on the ML2 and ML4, as well as other production lathes with beds and headstocks of an entirely different design (many of these can be seen at www.lathes.co.uk).

Myford and Drummond

One can imagine the situation at Myford's Beeston works as the first trucks arrived from Surrey carrying the Drummond equipment including castings, machined and part-machined parts, patterns, drawings, jig, fixtures and tooling. There can be little doubt that, under the pressure of war-time schedules - and with a suitable Myford badge unavailable - the first machines to be built would have been sold with Drummond markings including the maker's plate and its essential screwcutting chart. Several of the M Types to pass through the writer's hands appear to have been made by Myford. They were fitted with a flat-belt drive, came with old-fashioned,

wall-mounted countershafts, exposed change wheels and were just 'different' to the Drummond-built versions. Some nuts were chemically blacked, the paint finish was rather better, there were subtle changes to knurling and machining and the handles of the carriage and leadscrew handwheels was made of metal not horn.

One serious drawback to the original Drummond M-Type was that neither a modern self-contained stand nor any form of integrated drive system had ever been developed for it - and the changewheels were dangerously exposed. In this respect the lathe was hopelessly old-fashioned and nearly 10 years behind American machines like the Atlas 9 and 10-inch (**photo 15**) and South Bend '9-inch Workshop' lathes (**photo 16**). These all had either built-on multi-speed countershafts, under-drive stands, or neat bench-mounted drive systems - as well as guards for gears and belts. In order to update the Drummond, and turn it into something that could be 'plugged in' and used immediately, or mounted on a bench with the minimum of trouble, several important modifications were made:

The headstock pulley system was converted to use a V-belt, heavy two-step cast-iron pulleys were fitted to the motor/countershaft drive (giving 12 speeds in all), and the changewheels were fully enclosed with an inner pressed-steel guard and a slide-off, heavy cast-iron cover. It was offered with either a neat, bench-countershaft unit or fitted to a very heavy cast-iron stand with two sheet steel trays between the legs and a long countershaft unit hinged from the back. The motor to countershaft V-belt was guarded by a sheet metal cover (with a distinctive mesh face) and, like the bench model, a powerful over-centre tensioning arrangement was fitted to tighten the headstock belt. A large-frame 950rpm, single phase motor, was fitted as standard giving speeds of:

26, 38, 46, 55, 67, 97, 234, 339, 412, 494, 600 and 874 rpm. A 1,425rpm motor could be specified if higher speeds were needed.

These late M Type lathes are easy to date - the change-wheel cover carries a sheet brass change-wheel chart stamped with the year of manufacture. Myford also built a version of the BS Type power cross-feed model, and it seems that some 'specials' were also constructed, though no documentary evidence for them survives.

From 1946 Myford were very busy with their new and highly successful ML7. However, the M Type continued in production until the late 1940s. The last examples, all of which seem to have been long-bed models (probably built up from unsold spares), were stamped '1951'. The change-wheel set for the M Type was altered from previous versions. The new arrangement (including metric conversion gears) consisting of: 20, 30, 35, 38, 40, 45, 46, 50, 55, 60, 65 and 73 teeth gears.

Numbers

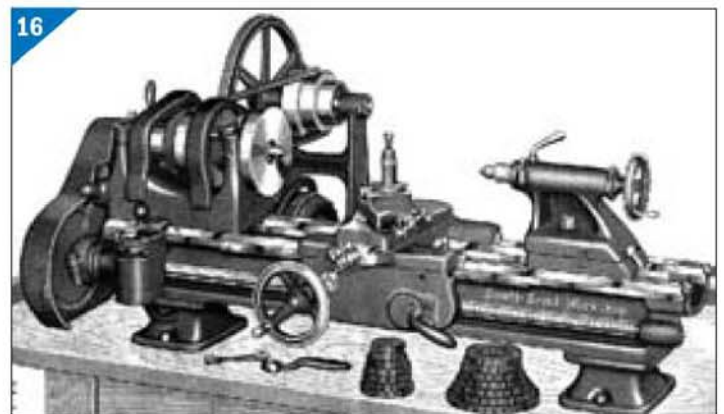
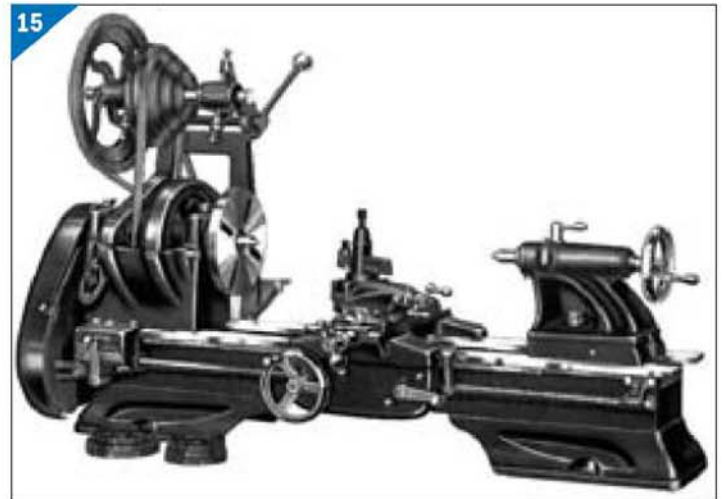
Finally - how many Drummond M-Types were made? With all production records lost, the only evidence comes from a comment in a magazine article of 1921: "Fifty of the new type 3½in. lathes are made each week, and nearly that number of the popular 4in. (Round-bed) models."

Extrapolating from these figures, it would seem prudent to reduce the numbers from 50 to 40 to allow for monthly fluctuations, slow sales in the early years, poor trading during the 1929-1931 depression, a reduction approaching the war in 1939, and run down towards end of manufacture in 1951. Shall we say, 90,000! **ME**

14. Pre War 'Jones & Shipman Myford', Type MF 32, on maker's stand.

15. Atlas, Model D, 10in. lathe remained largely unchanged from 1936 until 1958.

16. South Bend 9-inch 'Workshop' lathe as advertised in 1935, usually referred to as the Model C.



'Engineering' in wood

Eric Basire and **Dave Knight** conclude their description on the use of wood for constructing model diesel/electric locomotives.

I was not surprised that, nine years after I built *Sherlock Holmes*, Dave followed a very similar path when he decided to use wood in his first scratch-built locomotive. Like me, he also lacked drawings and had to do some research. My locomotive was metal construction below 'waist level'. Dave went much further than me in the use of wood:

24-Volt 'Diesel' locomotives

Dave Knight writes: Eight years ago I was challenged to make a 5in. gauge battery-powered locomotive. I had no idea if I could do it, and nothing more was said on the subject. I went home that night thinking - I'm sure I could make one, but where to begin? What about drawings, materials, electronics, batteries, etc.?

My metal working skills are zero, but my woodworking and modelling skills are very good - I have to admit. So, you've guessed it, wood, it was going to be.

This being my first attempt, I needed drawings, but there were none available. What I did have was a Lima model of a Crompton Class 33 (**Photo 12**) and the local Swanage Railway had a prototype. Off I went to measure the full-size Class 33. The staff were very helpful. They gave me a drawing complete with measurements - I was ready to make a start.

I still get the 'mickey taken' when I explain my method, but it works, and I have used it for all the locomotives I have made:

I begin with the body, then make the chassis to fit, then the bogie frames and finally the wheels. I use marine ply because it is robust, great to work with and, if finished correctly, gives a good paint job.

Bodywork

Once the drawing is complete, the side panels of the Locomotive can be made. For

12



12. Class 73 and 33 Locomotives

13. Class 23 Locomotive, bogie details.

14. Class 73 Locomotive, grille, rivets and other details.



these I use $\frac{3}{16}$ in. ply with a $\frac{1}{2}$ x $\frac{1}{2}$ in. section pine framework glued to the inside of the panels to reinforce them. The two sides are then positioned at the correct width and temporary frames glued across, ready for the next stage. The fun now starts:

The cab ends are cut, glued, and pinned together. The roof struts are made of $\frac{3}{16}$ in. ply and glued in place. Construction of the roof is fiddly and time-consuming because you can only put one panel on at a time. These are made of $\frac{1}{32}$ in. marine ply. When bending the wood, one side compresses and the other stretches. To make bending easier, it is necessary to wet one side. Each panel is clamped, glued and pinned in place. Only one panel is made and fitted each evening - it is most important that this part of the process is not rushed!

When fixing the roof, I use strips of metal which run the full length of the body, and which are screwed to the sides of the body. As each roof panel is glued in place, these strips hold the edges in perfect alignment with the sides. When the glue is perfectly dry, the

metal strips are removed and the fixing holes filled.

The rounded ends of the cab roof are made of wood filler. The wood is painted with wood glue first, then filled and left to dry and harden for about three days before filing to shape.

Before applying the first coat of paint, the whole body is sanded using Sand and Seal, which dries very hard. Final sanding is with Flour Paper. This preparation stops the paint from cracking and gives an excellent finish.

Painting can be done using brush or spray. I use an expensive artist's brush, which gives a super finish using Railmatch or Humbrol paint. I use transfers from Maxitrak or Bexhill Engineering Supplies.

Details

The degree of detailing can be taken to any level. As with all modellers, I have a store of bits and pieces 'which might come in handy one day'. From this supply, and from purchases at model shows, I have used a wide variety of items that pass as details on my locomotives. For example, take a look at the bogies (**photo 13**):

The bogie frames are cut from $\frac{3}{16}$ in. ply, with a thin strip of $\frac{1}{32}$ in. ply glued so that it overlaps the edges. The roller bearing caps for power bogies are made from the lids off small pots of Humbrol paint and held in place with four tiny screws or rivets. Pipework is made from wire, bogie springs from copper wire wound into coils, and round hardwood section used to make tanks and cylinders.

Photograph 14 shows the grille details of my Class 73 locomotive. The fine mesh is available as etched thin brass sheet or plastic mosquito netting. The area of the grille is cut out of the main body and strips of thin ply glued in place to make the grille cover. Rivets are simply super-glued in place. The rim of a yoghurt pot lid was used as the frame for a circular roof grille. I get my lighting from a doll's house supplier. Any fitting can be reproduced from the numerous sizes and shapes of bulbs and holders available. The possibilities are endless.

Chassis

The chassis is made of $\frac{3}{4}$ in. angle iron, with 2in. wide $\frac{1}{2}$ in. thick mild steel plate supports for the bogies. The frames are bolted together and then welded, giving a really strong construction. The bogie plates are made from mild steel and are bolted to the frame with rubber tubing to act as suspension springs - this works quite well in practice.

The bogies

The running gear is a unit on its own, with no outside bogie frames, so my frames are dummies simply bolted on. These wooden bogie frames are plain and simple but allow you to add what fine detail you like to suit the model being made.

Wheels and motors

I use Maxitrak wheels and motors. These come complete and are simply bolted to the bogie plate and wired up. I use the three point suspension system which works fine. The 4QD electronic panel is quite simple to wire up using the instructions and wire supplied.



Locomotives

I have made seven locomotives and my eighth is almost complete. The construction of these locomotives is simple because each uses the same chassis. There is nothing complicated to go wrong.

I am pleased to say that the Class 33 is still running today. I have no idea how many miles it has covered but it still looks good and runs smoothly after eight years use. When I began, I never thought that five of my locomotives would regularly run at the **Wimborne & District SME**, giving fun and rides to the general public.

My locomotives:

- Class 33 (2 locomotives)
- Class 23 Baby Deltic
- Class 73 Intercity
- Class 73 Pullman (**Photo 15**)
- Class 25
- Class 37 DRS (**Photo 16**)

Live steam

At the start of this series we said that wood was not suitable for steam locomotives. **Photograph 17** shows Eric's experimental $7\frac{1}{4}$ in. gauge Sentinel Steam Railcar - a wooden body around a live steam boiler - so anything is possible!

Conclusion

We have presented the case for the use of wood in building scale locomotives. We have also given some examples of materials and items that may be used to add extra detail. We hope that this will give readers some 'food for thought'.

ME



15. Class 73 Pullman Locomotive.
16. Class 37 DRS Locomotive.
17. LNER Sentinel Steam Railcar, Tally Ho, $7\frac{1}{4}$ in. gauge.

Nemett continues his look on the benefits of 3D CAD systems in I/C engine design with particular reference to the use of Alibre Design.

Fig 3. The Alibre opening screen.

Fig 4. The properties screen allows basic parameters to be set.

Fig 5. An empty new part screen with the design explorer window on the left.

Fig 6. The basic rectangle sketch showing the constraint symbols and dimensions.

Fig 7. The extrude boss tool is being used to create a solid block.

Fig 8. A boss has been added to one face using sketch and extrude boss.

As previously stated, Alibre Design is a parametric 3D CAD package developed by Alibre in the United States (www.Alibre.com) and which is distributed in the United Kingdom by Digitise Ltd (www.digitise.ltd.uk). It is currently available in four versions to suit different needs.

The lowest version is Alibre Design Express which can be downloaded from the web free of charge and is a trial version limited to the basic 3D modelling tools, the associative 2D CAD functions and limited to just 10 unique parts per assembly. It is a very good way of trying the package and is not time limited.

The next version is Alibre Design which has all the main 3D and 2D functionality including advanced drawing and modelling functions and some associated functions including parts lists (Bill of Materials) and PDF publishing functions. There are no limits on the number of parts in an assembly.

The next two versions Alibre Design Professional and Alibre Design Expert add more functionality including sheet metal configurations and several other functions aimed at design offices and data management.

I used Alibre Design (version 10) for this review although version 11 is being released at the time of writing. The package is available as a download with a release code being provided once the purchase is made. There are some very good tutorials provided in

the package and a full set of training CDs can be purchased. In the UK the company also runs training courses at its Sunderland base and users can purchase a support contract if that is required. In common with most software packages these days comprehensive help facilities are built into the package and a full PDF manual is available on the internet. This is very good and will answer most questions.

During my initial learning period I just used the tutorials and the manual with some email discussion with another I/C engine designer who was moving to the package at the same time.

Like all complex packages, it takes time to learn and some investment in time is needed to get the best from it. I have now used it for the latest design and even after about 10 months fairly intensive use, am still learning new tricks.

Computer system requirements

The recommended system requirements are listed in full on the website but I think they are a touch optimistic. If you are going to use the package seriously for complex assemblies, you will need a fast machine with a reasonable amount of memory. I use a laptop with Microsoft Windows XP and 2MHz processor and originally 1Mb of RAM memory. This was okay, but performance improved dramatically when I increased the RAM to 2Mb recently. Even then adding parts to a complex assembly with around 90 parts can sometimes be a jerky process.

The opening interface

The opening screen consists of a small window (fig 3) which provides access to the Alibre functions and also the built in tutorials. For those using the higher Expert or Professional versions, access to the team design functions is also provided. Users can set a default workspace which will be opened when the system is started. So if you are in the process of creating a lot of new parts, you could set that workspace as the default. The options are Part, Assembly, Drawing and Bill of Materials. It is worth mentioning at this point that I think the Bill of Materials is slightly wrongly named. I spent some 20 years of my working life working with computerised manufacturing systems and users of such systems differentiate between a Bill of Materials and a simple Parts List. The latter is a simple list of parts and quantities required of each in an assembly whereas the former is a structured list which also defines the relationships between the parts (i.e. which parts make up which sub-assembly). This is a common misconception and may be because of the American parentage of the package. Having made that point, the Alibre Bill of Materials is a very useful facility because it is automatically generated from the assembly model and does show the total quantity of each part used in the assembly.

Alibre options

In common with most modern Windows systems, Alibre can be customised to suit the user's particular way of working. These facilities are accessed from any of the main screens and are split into two groups. The Options menu can be used to change the colour scheme and to set various other parameters such as file types and other operating parameters which will not change in everyday use. The Properties menu (fig 4) is used more often and allows users to set descriptive data related to parts, units, materials,

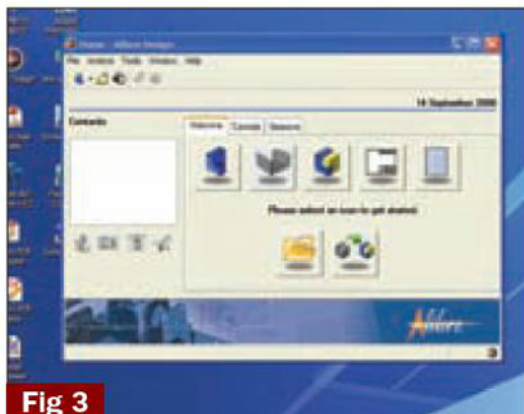


Fig 3

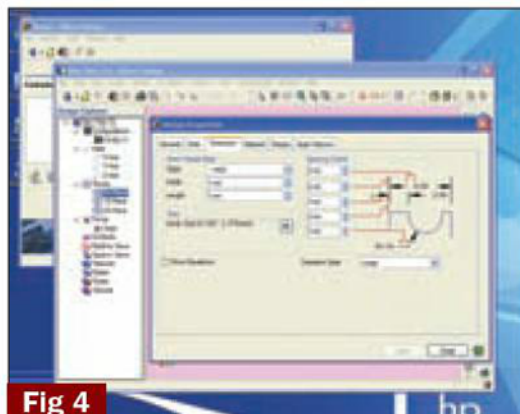
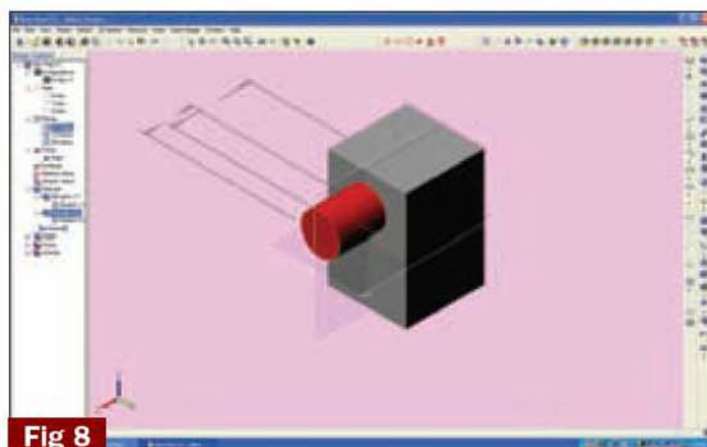
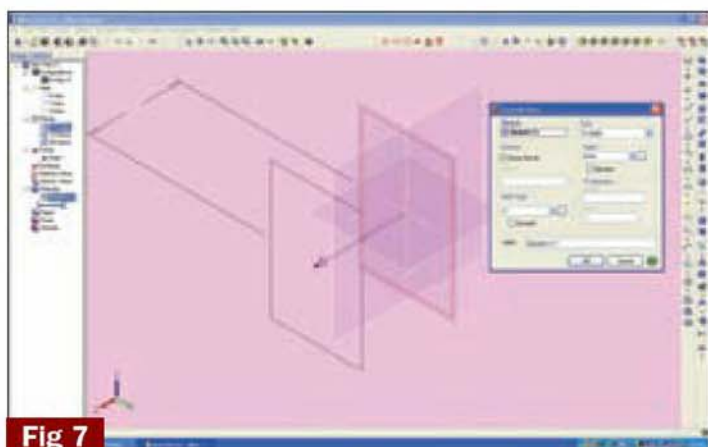
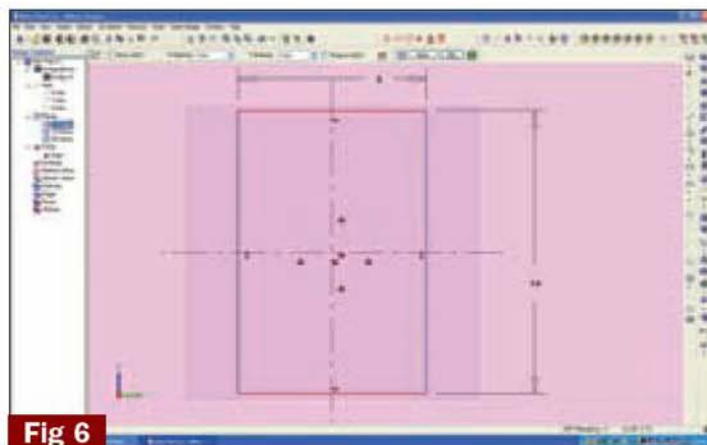
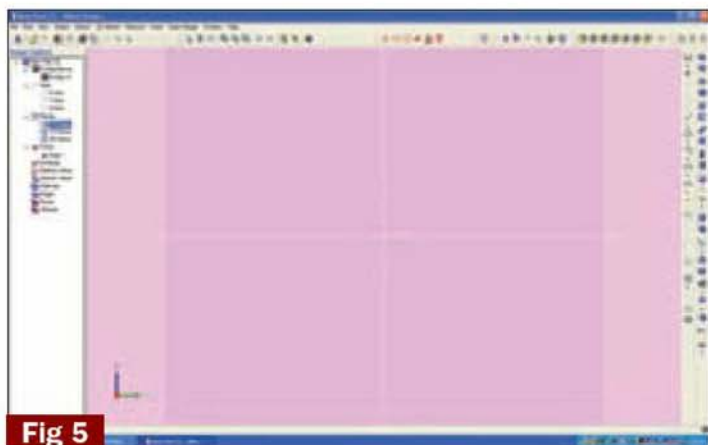


Fig 4



dimension options and extra display parameters.

There are other options within the various modelling and drawing modules which apply to and are set for those facilities. In addition to these, there are the normal Windows facilities for customising the interface including the layout and selection of tool bars and other parts of the information display.

Creating parts

The first step within the system is normally the creation of new parts using the part creation screen (fig 5). This, common with the other module screens is a typical Windows layout with the main modelling area occupying most of the screen, toolbars and menus at the top, the design explorer window at the left with the various drawing toolbars on the right. The design explorer window forms a very important part of the interface and displays details of the part and all the drawing components (sketches and extrusions etc.) which make it up. It enables

users to easily modify any part of the model and also to 'step back' through the process at any time.

This part of the system can be used in 2D or 3D mode. Normally parts will be started in 2D mode with 3D mode being used in the later stages.

When creating a new part using 2D sketch, the first part of the process is to select the drawing plane (from the design explorer to be used for the first sketch. This fixes the orientation of the part within the window and orients the sketch plane on the screen. I have not found that the selection makes any difference to the later processes and always use the XY plane.

The 2D sketching facilities are then used to create a basic shape (fig 6) which will be extruded to form the solid model. In use, the shape is created and then modified using various constraint parameters to fix the shape itself and also its relationship to the drawing planes. The parameters include dimensions,

equal to, right angles, tangents, concentricity and several others. Dimensions cover all types and include the ability to set up equations which define one dimension as a function of another. For example, I can create a rectangle with the dimension set for one of the sides but with the other side equal to 1.5 times that. Whenever I change the length of the first side, the second will automatically change. The other thing I have found useful is that if a dimension has to be increased (or decreased) by a certain amount, the dimension tool will do the addition if the increase is specified as an addition or subtraction to the original value.

The other thing I have found is that although design dimensions can be transferred through to the 2D CAD drawings, they are not normally that useful. It is better to dimension those drawings in their own right. The dimensions set at the part creation stage are purely there to define the model which is why I do not bother to try to arrange them neatly.

The shape created can be as complex as is needed using the various 2D drawing tools (including fillet, circle, offset etc) and once it is done the solid model is generated by extruding that shape to form a solid which can then have other pieces added to, or subtracted from it using the same process but starting by sketching on one of the faces of the existing model. There are several types of extrusion tool provided which allow the model to be added to, or subtracted from, so that complex shapes can be built up very quickly.

When the relevant extrude tool is selected, the view switches to an isometric type view (fig 7) making it very easy to see the effect of the extrusion. The extrusion parameters are set using the small window which appears at that point and once this is done the view switches to the solid model view (seen in fig 8) and the details of the sketch and extrusion used are listed in the design explorer window. Next, I have selected one face of my block and drawn a circle ➤

and positioned it (using the dimension tools) with its centre on the XY plane and 2mm. from the ZX plane. This has then been extruded (fig 8) to form a boss on the face. I can then apply various features to this using the 3D tools. These include fillets, chamfers, holes (of various types), and feature patterns. Feature patterns save time when putting in items such as a circle of holes and I have found the facility extremely useful.

In the final view (fig 9) of my model, I have created a cavity in

the body, put a hole through the boss by drawing a circle on the end face and using extrude cut to create the hole, and created a pattern of holes on the face. Features can also be drawn on extra planes created for the purpose. These are useful for angled holes such as those for spark plugs and inlet or exhaust passages.

This is the process by which all parts are created. Very complex parts can be created and modified at any stage by using these features.

In addition to creating the part model, there are facilities to input other details such as the material used. This can then be printed out on bills of material and also used to calculate the weight of the part (or assembly).

The other place where parts can be created is directly in 3D assemblies. This facility enables new parts to be matched up to existing parts with sketch constraints being linked to other parts.

The colour properties (colour, reflectivity, transparency) of the part models can be

changed here (and from within an assembly), this is useful in making different parts easily distinguishable within an assembly and also if some parts are made semi-transparent then the inner details can be seen in context.

Once parts have been created, they can be assembled using the 3D assembly mode.

Creating assemblies

Assemblies are created from the assembly screen which is very similar in appearance to the part screen except that the 2D sketching toolbar on the right is replaced by the assembly modelling toolbar.

The new assembly screen (fig 10) is opened with two windows, the main assembly window and a window for selection of an existing part to start the assembly. Once a part has been selected, it appears in the main window and is placed in position by clicking the mouse. More than one instance of a part can be inserted if needed although this is not normally the case for the first part and once

all instances are inserted finish (in the small window) is clicked to stop the process. At this stage, it pays to anchor the part (from the design explorer) before doing anything else. If this is not done, parts can be moved during later stages which can cause unexpected results because other parts will be constrained to this part later.

In order to continue the assembly, the insert part/subassembly screen is opened again (from the insert menu) to select the next part which, at this stage, is placed into the main Window at any convenient point.

Now that the part is inserted the constraint tools are used to relate the new part to the existing part. These tools are used to apply a series of constraints which define how various features on both parts relate to each other. The basic constraints used are align and mate, which can have an offset applied where there is a gap between the two related features. Other more specialist constraints are orient, tangent to, and angle.

Fig 9. The block has been hollowed, the boss has been bored and four counter-bored holes have been added.

Fig 10. An empty new assembly screen with the part selection window on the right ready to start building the assembly.

Fig 11. A crankcase has been added and anchored and the crankcase nose is in position ready for assembly constraints to be applied.

Fig 12. The two faces to be aligned have been selected (highlighted in red) using the constraint window.

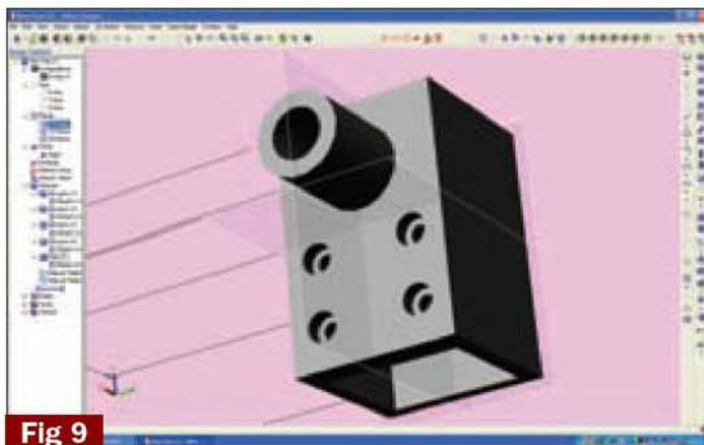


Fig 9

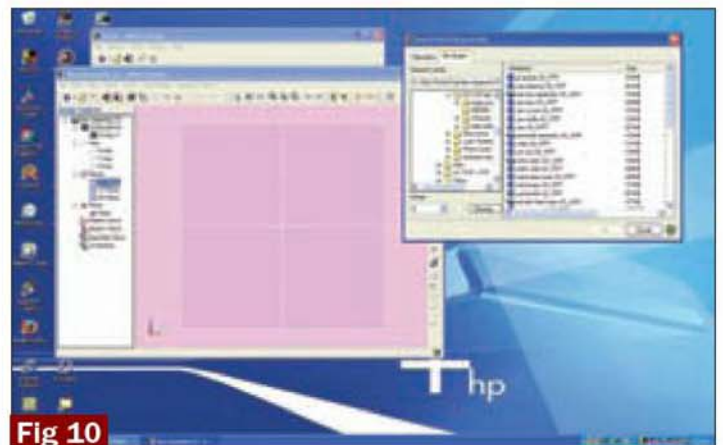


Fig 10

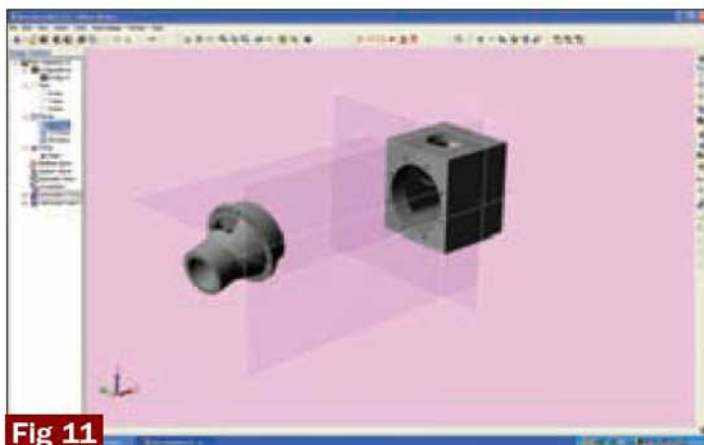


Fig 11

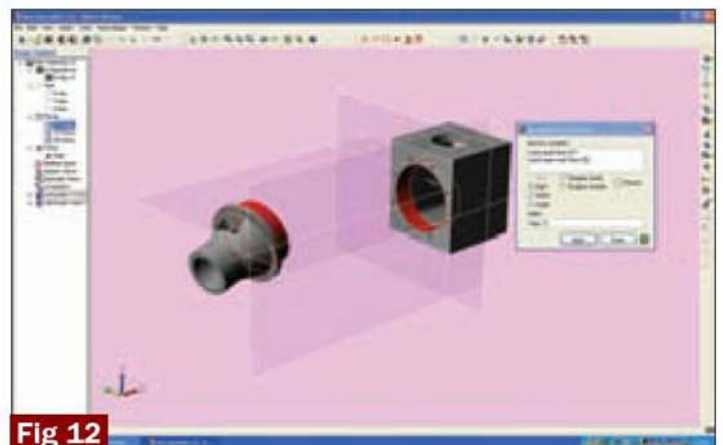


Fig 12

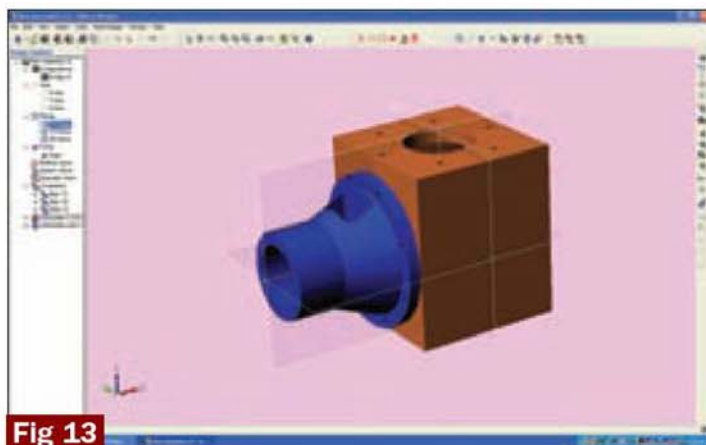


Fig 13

There are also some manipulation tools (move, rotate) which are used to roughly position parts before the constraints are applied. I have found that it pays to use these to obtain a basic orientation beforehand otherwise the constraint may not do exactly what you expect, for example, bolts can end up upside down in their holes.

In my example (fig 11) I have placed a crankcase in position and anchored it before inserting the crankcase nose and moving into a sensible position to start.

The first constraint I will apply is to align the large hole in the crankcase with the boss on the nose. To do this I select the insert assembly constraint tool and then select the two faces to be constrained (using the small window) which are highlighted in red (fig 12) before selecting align and clicking apply. The crankcase nose then moves into exact alignment and the new constraint is listed in the design explorer window. I then applied an align constraint to two of the bolt holes which rotated the nose into the correct alignment. The nose is now constrained in two directions, it can only move in and out and it cannot rotate. It only remains to apply a mate constraint to the two mating surfaces. At this point it is possible to set an offset to allow for the thickness of a gasket if required. The relationship is now fully defined (fig 13). It is also possible to duplicate parts in an assembly using the insert

part/sub assembly pattern tool. This saves much time when inserting patterns of fixing bolts or even, as I have done, the cylinder assemblies for a 6-cylinder engine.

Using the constraint tools in this way it is easy to set up an engine assembly for an I/C engine with the moving parts free to move in their designed ways. One thing I have not found a way of doing yet is to define constraints for the relationship between cams and tappets but this may be possible in the higher versions of the product.

Once the assembly is complete, the clearances can be checked (fig 14) using the tool provided. This can be used globally (for the complete assembly) or for specific components. The interfering points (cylinder liner/con rod and cylinder liner/crank web) are highlighted in bright red and the details are shown in the small window. I can modify the liner directly from within the assembly to cure the problem.

The assembly can be rotated and viewed from any direction using the mouse and individual parts can be hidden so that other parts become more visible.

Publishing and import/export functions

Once part and assembly models have been created they can be published in several ways. They can be exported as image files, published as PDF files or printed. The image files can be incorporated into Alibre 2D drawings and there is a

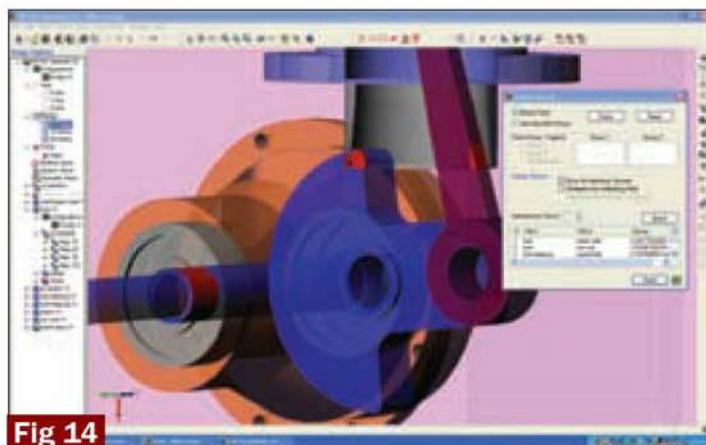


Fig 14

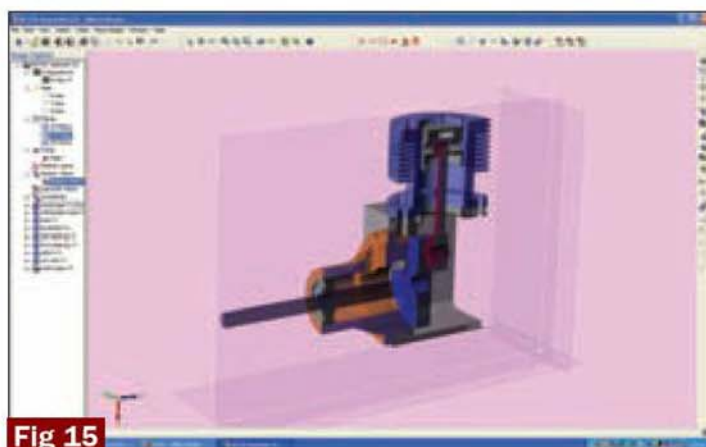


Fig 15

photo-render upgrade available for higher quality images, although the existing one is very good.

Files can be exported and imported in a wide variety of CAD formats for use with other packages or for the generation of CNC files. There is also an Alibre CAM program available. I have used some of these options for exporting files and most often for importing standard parts such as bearings.

Special views

There are a couple of special views which can be generated (manually or automatically) from the assembly. These are exploded and sectioned views.

Exploded views are created manually by using the special tools to move parts away from the assembly and part trails are automatically created so that the assembly details can be seen. Exploded views can be created automatically and then the different parts moved around using the manual tools. You will have seen some of these views in the magazine

Fig 13. The crankcase and nose are now fully constrained with the constraints shown in the design explorer.

Fig 14. Clearances being checked using the Interferences tool. Problem areas are highlighted in red and listed in the small window.

Fig 15. Sectioned views are easily created.

and they are very useful for understanding how an assembly fits together.

Sectioned views (fig 15) are created automatically once the section plane (and direction) and the parts to be sectioned have been selected. Once the view is created, it can be rotated and viewed from different directions. It is easy to create partial sections such as a 2-cylinder engine with one cylinder sectioned. Be warned that sectioned views of complex assemblies may take several minutes to generate.

● To be continued.

LETTERS TO A GRANDSON

M.J.H. Ellis concludes his description of the high-tension magneto.

Continuing from my last letter: It is now time to consider just what happens in a magneto when the points of the contact-breaker open. When I was young and simple, I thought that as the points opened, the spark took place. Now, with the perception that comes with age, I can see that I was wrong.

Points open

In fact, for a moment after the points break contact, nothing changes much at all. Deprived, of its easy path through the contacts, the current in the primary winding takes the path offered by the condenser. But the situation changes very quickly. As the condenser is charged up, the voltage between its terminals increasingly opposes the current and, as the current falls, so also does the emf across the primary winding. Soon, a point is reached where the two emfs are equal and opposite, and the current is reduced to zero. If there is no change in current, there is no change either in the magnetic flux linked with the primary, and so no emf is generated in it.

The condenser now has the upper hand, and discharges through the primary. I believe that it is this abrupt reversal of the current which, by producing

an equally rapid change in the magnetic flux in the armature, induces a voltage in the secondary winding high enough to produce a spark at the sparking-plug.

Of course, while this is going on, the armature is steadily rotating in the magnetic field of the permanent magnet. But whatever emfs may be generated there, I think that they must be comparatively insignificant, and do no affect the validity of the main argument.

Flywheel magneto

As I said, this type of separate magneto was probably the most common. The 'Scott' motorcycle - an icon in its day to most motorcyclists - necessitated a separate magneto, and this was reputed to give trouble because it had to run at engine speed. But times changed for the better and magnetos were 'incorporated into the engine'. These were derivatives of the flywheel magneto, which, to the best of my recollection, was first introduced by the Villiers Company in the UK, towards the end of the 1920s. At any rate, I thought then, and still do, that the flywheel magneto was a very good idea. Only the flywheel moved, and later types had an additional coil that provided power for the lighting. The only minor inconvenience was, being inside the flywheel, the contact-breaker was awkward to get at.

New materials

I have always thought that the traditional design of magneto, with fixed horseshoe magnets, was partly copied from the low-tension type. Also, at that time, the only material from which a permanent magnet could be made was high-carbon steel. Because of its limited capacity to retain magnetism, a magnet made of common-or-garden steel had, of necessity, to be bulky. From about 1920 onwards greatly improved materials for permanent magnets were developed, for example, 'Alnico', containing aluminium, nickel, and cobalt. It then became practicable to incorporate the magnet into the rotor, and for all the other components to be static. This was a far better arrangement. The British Lighting and Ignition Corporation (BLIC) magneto was a good example.

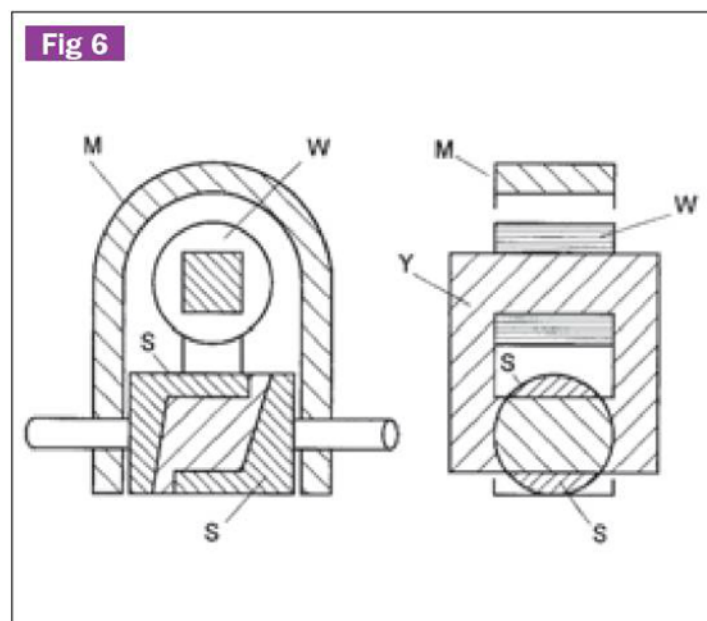
'Dixie'

Another sort of magneto was known as the 'inductor type' - one make of which was called 'Dixie'. It had a horseshoe magnet but, unlike the traditional kind of magneto, the magnet of the Dixie did not embrace the armature, but was positioned so that its poles faced the two ends of the rotor. It is about 75 years since I last saw the inside of a Dixie, but this will give you a general idea of how it worked:

Figure 6 shows sections through the magneto. The rotor contains two soft-iron sectors S, the rest of the rotor being nonmagnetic material. The iron sectors in effect extend the poles of the magnet, so that as the rotor rotates they reverse the direction of the lines of magnetic flux in the laminated soft iron yoke Y. This carries the primary and secondary windings W. The contact-breaker and condenser operated in the usual way.

This was the type of magneto used on the Douglas motorcycle - could the Dixie have also solved Scott's problems?

Your affectionate Grandpa.



KEITH'S COLUMN

Keith Wilson begins a discussion of the finer points of cleating or cleading on boilers.

1. Complete cleading on a 7½in. GWR 'King'.

2. Cleading and water delivery pipe cover leading to the top-feed.

I am by no means certain that cleating or cleading (the outside metal sheets covering a boiler) has not been much written about before, but I cannot recall it being dealt with in this way. Insulation (lagging) certainly has been. I have seen this outside cover called cleating as well as cleading depending on which source is read.

It is no light matter, for it is almost impossible to draw. There are several points to be considered that for us are possibly more important than in full-size. I do not know how often a full-size steel boiler needs optical inspection, i.e., removal of all exterior covering so that actual boiler could be inspected as distinct from a pressure testing. I may be wrong here, but at Swindon there were spare boilers of every class, so for a 'heavy general' a 'fresh' boiler was ready and waiting.

This system did not apply to the *Great Bear*, for it was

unique and only one boiler was made, even though it was titled Standard No. 6. For Standard No. 7, there was only one spare boiler for the whole class (the famous Churchward masterpiece, the GWR 47xx class of 2-8-0s). So, some care had to be taken to have only one locomotive in shops at a time for 'heavy general' overhaul. It raises a question that I mentioned several years ago.

What's original now?

There is no doubt that *King George V* (KGV) went to America in the 1920s, or that *City of Truro* (CoT) did the 'ton' in 1904, but due to the boiler-change mentioned above it is quite unlikely that the present KGV and CoT are still all the same bits of metal that originally 'earned their keep'. Bogies and tenders were interchangeable, as were many other parts. Many 'expendable' parts were renewed over the years, and there was an 'odd one out' in the case of King bogies; one of which was built

with a long slot in the front crossbeam - to give some additional cooling to the rear bogie axleboxes - at one time or another it was seen under most of the Kings.

KGV's first bogie was modified in the States, details being telegraphed from Swindon for this to be done, but was not identical to the Swindon modifications. Later it was 'Swindonized'. The reason for this alteration to the bogie springing was the fact that 6001's bogie derailed at Midgham. On running tests to try to resolve matters, it was found that a drop in rail height of only 1½in. relieved the front bogie wheels of all load. The King bogie springing was softened by the addition of a coil spring at each end of the leaf springs. Incidentally, the coil springs were not of round section, but square. This cured that matter, but later the Kings' rear driving-wheel springs were made more flexible by the use of more and thinner leaves. Memory may well be at fault here, but I think that 12 leaves ½in. thick were replaced by 16 at ¾in. These two modifications generally made the Kings amongst the best riding locomotives on record. The first Kings had bogies already different from the drawings thereof and while some alterations to the locomotives were re-drawn, some weren't.

It is a minor source of pleasure to me that the collective noun for several Kings (locomotives) is a 'Keith' of Kings, or so Ted Martin decided in about 1985. The only other collective noun for Kings (this time the flesh-and-blood ones) was a 'bevy' by Dornford Yates. Since I have built 10 Kings in total (nine in 7½in. gauge and one in 5in.), I suppose it was not an illogical choice.

Scale cleading needs

But back to work. The standard of testing for 'our' size samovars are rather more stringent than full-size and so it might be needful to strip down the urn to aid inspection. Therefore cleading is better for us if removable without too





3. Cleating of the firebox side of the King boiler.

much trouble. It is not possible to make access quick and easy; fittings must be removed and the regulator bits allowed for. Some boilers are easy to clad (Simplex, Springbok), and boilers with parallel barrels and round-topped fireboxes are no problem, but generally the GWR kettles with Belpaire fireboxes and their part-parallel, part-tapered barrels can be right beasts to cover reasonably well (photos 1, 2 and 3).

Spacers

It is usually necessary to provide definite spacers between boiler shell and cleating plates, I use brass strips $\frac{3}{8} \times \frac{3}{16}$ in. rolled to fit the barrel and shaped for the firebox. These can be tacked in place with soft solder, either to boiler or inside the cladding. There should be one strip for each joint in the cleating. Due presumably to the handling of each piece, there were more joints full-size than we require, but try to arrange matters so that the cleating bands will be in the correct positions.

Cleating bands full-size had joints made by welding two bits of angle to the bands and drawing them together by a length of studding (nowadays known as allthread) and a couple of nuts.

The joints were underneath the boiler. Trouble is, access is not exactly easy for us and I put mine on top. In the case of the firebox bands, the joint has to be on top.

For the cleating plates, they can be steel or brass. I prefer the latter, for its no-rust properties. This used to be frowned upon for it was thought that no-way could it retain paint. However, this problem is completely solved nowadays, for good-quality etch-primers are now available. About the only way of getting this paint off is either a good paint stripper or a hammer-and-chisel. I don't know if this problem has been solved for stainless iron, but no doubt somebody does. I mention this because I know of one locomotive clad in stainless, and just where condensation drips onto the boiler, there the paint was - gone!

Due to the impossibility of heaving cleating plates about - especially the problem of getting a huge rolled cylinder

onto the barrel, plates were put on from both sides. There was of course a joint at the top, with plates just overlapping. I do not know whether it was right-over-left or vice versa.

I do not know any details of the fastening of this joint but I find that two or three rivets in the upper plate protruding through matching holes in the lower one but not closed meets the case. A wee drop of soft solder retains them in the top plate and clearance holes in the lower one and all is well. Incidentally, soft solder here mean the plumber's type, not the electrician's cored flux type. This latter is low melting point, whereas the plumber's variety only loses strength at about 150psi. John Short and I found out this the hard way.

Lessons learned: boilers

Making boilers for other people presents one or two problems. If there is a bush for the steam dome and if it is a screwed bush, it is easy to plug for testing purposes. If, however, it is one to which a fixture of some sort is bolted to, it is another matter, for it is common sense that the owner will want to fit the fixture himself, spotting through the holes

therein to get the bush holes dead right for tapping the bolt holes to correctly match. One obvious way is to soft-solder a piece of brass or copper to this bush. This is perfectly okay for air-testing (stethoscope with low-pressure air), hydraulic testing (water and pump), but definitely NOT for a steam test.

We were testing a Simplex boiler; it had passed air-test and hydraulic with flying colours so we left some water in the um and 'turned on the heat'. Incidentally, this is an interesting operation, if a few very tiny 'needle jets' manifest, if below the water level they 'freeze up' in a few seconds. It is also sensible to increase test-pressure in stages, say about 20psi at a time. At 140 all was going well, so we cooked up a bit more. The test pressure gauge (ex Star, King, and Hall) was screwed into the dome plate. Just near the 150 mark, there was an almighty whoosh (!) and gauge and plate disappeared, as did the water in the boiler. The plumbers' solder has obviously lost strength. It took quite a time to find the pressure gauge and plate. They were eventually found 'up in the rafters'!

I should think that this procedure would have been okay with 'Comsol', as this retains strength up to a higher temperature than plain plumbers' solder, but is no stronger. A bit of thinking-cap work produced a special cap for these large bushes that did not mark the samovar in any way, but was applied from outside being held down by a cross-beam that was part of the fitting; we made several for different sizes. This was in the mid-seventies, when steam-testing was generally expected.

Museum locomotive inspection

Very few have seen the top of an engine, or even photographs thereof. While it is easy enough to get a glimpse from an overbridge, there are very few such bridges where a locomotive is near enough and stationary. Many years ago, I was doing a big, detailed photographic tour

of *Caerphilly Castle*, then in the London Science Museum along with the first Deltic, and I was able to get some photos of the cleating over the firebox. These shots still left something to be desired, for the exact proportions of the trapezoidal shape on the very top are rather difficult to measure from a photograph that is not exactly flat-on (**photo 4**). This section is like a parallelogram, but with the two long sides tapering in towards each other. In spite of the tricky shape of a Swindon-type Belpaire boiler, the firebox side-plates are not quite as different from rectangles as might be expected. This is where cardboard, if not too thick, becomes virtually indispensable, for 'tis easier to cut than metal and somewhat cheaper too.

Unfortunately and understandably, I was not allowed to climb up onto the boiler. A friendly staff member fetched a ladder, but it was not tall enough to get the top-shots desired. This staff member was there all the time and I thought he was keeping an eye on me. I afterwards found that he was there to shoo all others away, for I was an honoured guest.

Beside the *Castle* was the original *Puffing Billy* or some similar locomotive (it was about 35 years ago) and I climbed up

onto its tender (taking shoes off first of course) to get more pix. Suddenly a stentorian voice rang out from a good distance away "What are you doing up there?" The tone of voice added much to the simple question. As it happened, the Transport Manager had walked across to see how I was getting on. So I replied "I'm talking to Mr. X." Distant voice apologised, clearly having realized that all was well.

It is probably not very well known, but close examination of museum exhibits is allowed; preferably avoiding school holidays and weekends. Make yourself known - previous to visit for preference - show that you know what you are doing and I have found officials being extremely helpful.

Whilst I was in the cab of the *Castle* taking shots of the backhead, I had not noticed that a certain lad - Alan by name - had climbed onto the running plates and was grinning through the cab-front window, 'twas not until I saw the prints that I realized his little antic. As far as memory goes, he drove his first steam locomotive before he could talk; he used to sit on the tender of my 5in. *King John* whilst I drove around the track at Harlington. I am not certain that he was not

watching the signals at the age of three months.

His first drive came a few weeks later. I had got off my seat in the station for some reason whilst we were queuing for passengers, then came a bang. He knew how to start, but not yet how to stop and bumped into the train in front. No harm done, but I am willing to bet that this was the youngest ever steam locomotive driver.

Backhead cleating

The matter of backhead cleating is not a light one. Mounting for the needed pressure and vacuum gauges must be found, clearances for water gauge, regulator, brake valve, firehole door(s), blower valve, fountain or turret units means rather a lot of holes all of which must match fairly closely with the fitting concerned. One method of locating these is to use the same former plate to locate all the holes, but if you are already past this stage then other methods must apply. The backhead cleating must be in two parts with a vertical joint exactly halfway across.

It is of course not possible to use the same formers as the backhead itself. I used to get three formers made (flame profiled), two

WILSON'S WORDS OF WISDOM

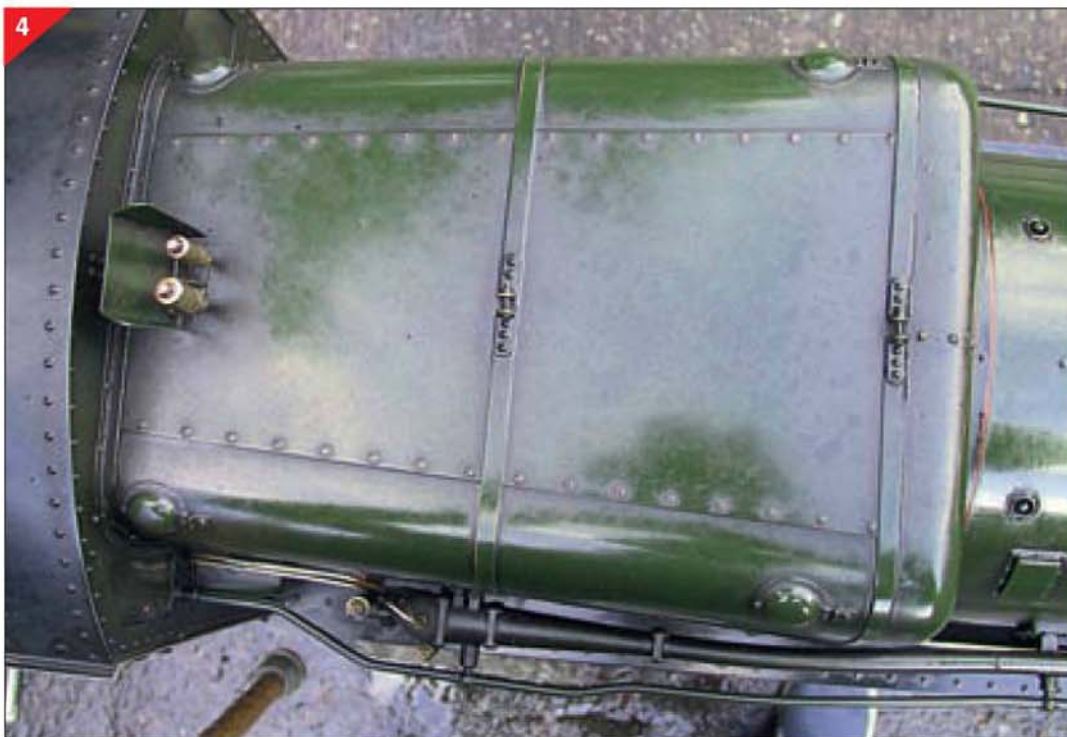
The most beautiful thing we can experience is the mysterious. It is the source of all true art and science. He to whom this emotion is a stranger, who can no longer pause to wonder and stand wrapt in awe, is as good as dead.

Albert Einstein

symmetrical. One each for backhead and throatplate and one asymmetrical for cleating plates. One side to suit half a backhead, other for half a throatplate. If you don't want the expense of this third plate, then an odd piece of 'prepared' wood will serve. Prepared? Plywood if thick enough, MDF, kitchen tops, chipboard come to mind. Ordinary tree-wood? No. For ordinary wood is anisotropic, like drawn or extruded metal. This merely means that its properties are different depending on which direction is chosen. Thus wood is very strong along the grain, but quite weak across the grain.

Whilst on the subject, deal with the smallest radii first when plate-bashing; re-anneal when plates get work-hardened. In the case of the thinner cleating plates, it is tricky for the stuff is quite springy. It is worth bashing with torch (oxy-acetylene or similar) in left hand to keep the material soft, hammer in right. Don't overdo it with brass for it is easy to melt the thin material; this would mean work later in the sense of car-dent repair material such as David's Isopon.

I plan to continue with more on backhead cleating next time. **ME**



4. A view of the firebox top shows the trapezoidal plate on 'our' size locomotive. It's the picture I couldn't quite manage in the Science Museum.



Malcolm Stride reports

Notices

Dobwalls Railway has new home

The unique collection of passenger-carrying miniature steam and diesel locomotives from Dobwall's Adventure Park has got a new home in Dorset. The collection of classic replica American miniature locomotives - which were built from the plans of the original locomotives - have been purchased by the Plowman family who own and run Plowman's Nursery and Plant Centre in Ferndown.

New owner Vic Plowman (photo 1) believes their arrival will not only help raise money for local charities but attract families, tourists and enthusiasts to the county from across the UK and further afield.

One of the first jobs for the collection will be to work alongside the Plowman's Santa Specials - trains which run through specially converted Poly-tunnels to create a winter wonderland for kids who can go and see Santa and which, since they were launched 10 years ago, have raised many thousands of pounds for local charities.

The sale of the locomotives attracted interest from around the World, but according to previous owner Malcolm Southern, he is delighted that the collection is being kept together in the UK where it will remain working. "Clearly the collection has been in the family for an incredibly long time and it was extremely important to us that they went to the right home - which we feel they have," said Malcolm.

For more information on the new trains and the times they



will be running, contact 01202 582169.

(The above information was found at www.miniaturerailwayworld.co.uk and it and the photo are reproduced courtesy Mercury Public Relations)

The Miniature Railway Museum Trust

A new group has been launched with the aim of telling the story and preserving the heritage of Britain's miniature pleasure railways, "The Miniature Railway Museum Trust hopes to act as a focal point to keep as much as possible safe for future generations." The Trust will concentrate on the area of railway heritage between model and narrow gauge railways. It is hoped that the museum will be based near the Cleethorpes Coast Railway, a 15in. gauge heritage miniature railway in Lincolnshire. Further information can be obtained from the trust website at <http://miniaturerailwaymuseum.co.uk/>

Goonvean beam engine to be moved

One of the few remaining china clay industry pumping engines in Cornwall is in the process of being moved to another site before being re-erected and restored to working order. In September a team from the Kew Bridge Museum dismantled the 50in. beam engine at Goonvean in Cornwall in readiness for transport to a new site at Hayle for erection by the Harvey's Foundry Trust. The 20-ton beam was lifted out on 9 September followed by the 50in. cylinder

and other parts some ten days later. This process of moving engines was common during the height of the industry but today is a unique occasion, particularly since the engine and building was grade II listed and it is unusual for permission to be given in such circumstances. The move will preserve the engine and also allow the Goonvean and Rostowrack China Clay Co. to extract more clay from the pit. A full report can be found at <http://www.oldglory.co.uk/>

UK club news

The Forest of Dean Historic Car Club visited the **Birmingham SME** track at Ilsham Heath in June with a splendid collection of vintage vehicles from several well-known (once) British manufacturers including Jaguar, MG, Triumph, Daimler and Singer. The members enjoyed seeing the cars and the visitors enjoyed rides on the track.

In spite of the generally variable weather, members of **Bristol SMEE** still managed to exceed a figure 2,000 passengers carried in one day twice during the summer running season. On one occasion over 2,400 passengers were carried. Plans are being made for continuing work on the raised track replacement during the winter months. The section to be updated next includes several odd length track panels and so will be less straightforward than the previous sections. It is intended to have the track completed in time for next years running because it is the

1. Vic Plowman and the Mayor of Ferndown with one of the former Dobwalls Railway locomotives.

In Memoriam

It is with the deepest regret that we record the passing of the following members of model engineering societies. The sympathy of staff at *Model Engineer* is extended to the family and friends they leave behind.

Andy Daniluk
Martin Rogers
Dennis White

British Columbia SME
British Columbia SME
Leeds SMEE

society centenary year and also it will be hosting IMLEC. Further progress has been made on plans for the new tunnel and toilet facilities. Members were treated to a practical foundry demonstration by Noel Shelley from Ringstead Foundry in July. Noel fired up his portable furnace *The Baby* (photo 2) and produced a nameplate for the society. (For those who have not seen Noel's demonstration, I can thoroughly recommend it - MLS).

Crawley Model Engineers entertained a local Beaver Cub group in July and the seven members involved kept the 25 visitors busy teaching them to drive the *Simplicity* with the *Warship* and petrol Hunslett carrying five or six passengers at a time.

Eleven members of **Fylde SME** recently visited the Edisford Bridge track of the **Ribble Valley Live Steamers** for "a day's running, chatting, eating and drinking." The weather forecast was bad but in fact the improved at lunch time with warm humid weather until a heavy shower halted proceedings at about 3:30pm after which the weather was very warm sunshine. The society hosted a rally for the Northern Area of the **National 2½" Gauge Association** in August when six locomotives

and 17 visitors turned up to run on what proved to be a dry sunny day. A hose reel has been mounted just inside the station building and can reach all parts of the steaming bays to make watering of locomotives easier. Several broken welds on the anti-tip rails have been repaired by a working party.

The new clubhouse extension at **Guildford MES** was officially opened on 1 June this year by Councillor Hodges from Guildford Borough Council who screwed the commemorative plaque to the wall. This was followed by a barbecue lunch for the members and guests (over 100) who attended. Some of the guests also took rides behind trains on the track.

The **Kinver & West Midlands SME** 5in. gauge *Catch Me Who Can* locomotive was completed in time to be at the 'Trevithick 200' bicentenary celebrations held in July at Severn Park in Bridgnorth, just by the spot where Trevithick's original historic locomotive was actually built two centuries ago. The circular raised track was also completed (many thanks to Roger Bryan) and displayed, then the unique engine was put on it, and actually steamed. There was an air of excited anticipation among the public,

eagerly crowded around the display area, all watching and waiting for the great moment of this first public display. Society members were present in force, all looking resplendent in a matching regalia of 'Kinver - Trevithick 200' polo shirts which helped to make the spectacle look every bit the team effort that it was. Allan Bellamy conducted the event. Looking to the entire assembled multitude like the Ringmaster in a circus of steam, he reverently applied his lighted taper to the charcoal in a manner of sacred, solemn ritual! Within minutes, *Catch Me Who Can* was alive and in steam, whisking around the track with her elegant, period Landau in tow. Congratulations to the society for success with this special club project. The locomotive was also run at the open weekend the following week.

The new station building at **Leeds SMEE** is making progress with the framework in place at the time of the report. Rumour has it that when civilisation expires, existence of life on this planet will be evidenced by the Great Wall of China, the Great Pyramid at Giza and the Leeds SMEE station building.

The August summer evening steam up at **Melton Mowbray DMES** had a smaller crowd than usual but four steam locomotives, two electric and a traction engine meant that those present had a pleasant evening. The 'Railway Cafe girls' provided an excellent spread, "not just burgers and hot dogs but a choice of puddings, too." The new carriage shed has proved its worth at recent events.

The Model Engineers Society (NI) was entertained with a visit to a local company which makes pumps of various types recently. The group saw various manufacturing processes and had an instructive tour in the company of member Eddie Gilmore who is technical manager of the company.

Some tips for lubrication of machines appeared in *Coupling Rod* the newsletter of the National 2½" Gauge Association. The following is suggested, "on any bright item, use chain-saw oil, it is sticky and does not fly off; Neat cutting oil applied by brush gets spread around the table and protects it; and Rocol Sapphire high pressure grease is recommended for lead screws and slide-ways". (My only reservation is that I have found that some varieties of neat cutting oil can cause staining of the surface). The general comment is that if the manufacturers recommendations are followed, users will not go far wrong.

Work on the ground level track at **North London SME** has included the correction of some track movement due to (one of the few) hot days during the summer. The expansion caused the track to lift and this was cured "after the formula for the coefficient of expansion of metric/inch steel had been discussed" by removing "an amount equal to a small sliver" by stealthy use of the cutter grinder along the offending



2. The Baby, Noel Shelley's portable furnace at full blast at Bristol.



sections of the track. The stairs for the bridge have been installed and two new carriage shed doors, built by Michael Dear have been installed.

The construction of the lean-to at **North Norfolk MEC** will continue when the shed area is cleared. The track is getting more attention in an effort to keep the expansion gaps more constant. Investigation is under way into automating the point in order to reduce the number of people needed to operate on running days. Members and their guests had a great time at the barbecue in July in spite of the weather being "grey and a little damp." The HS125 was going to have a run that evening but the controller went up in smoke and is waiting repairs.

Good progress has been made on the construction of the ground level track at **Tyneside SMEE**. In the eight months since December, when the first section of concrete track bed was poured, almost seven sections of the bed have been poured. The routine has been established and it is possible to pour one section a week given good weather and enough helpers. The weather in fact has caused some working sessions to be abandoned. Further work on the rest of the under track drainage will be planned. Some track components have also been manufactured and it is hoped to start track laying at the end of the year.

A suggestion that **York City DSME** constructs a garden railway has met with sufficient interest to warrant carrying out a feasibility study. The current idea is to build a permanent outdoor layout with tracks at waist height.

The local golf club has donated several surplus trees to **Ascot Locomotive Society** which together with several shrubs provided by members have been planted in the west

loop or in the nursery bed by the signal box at the track site. Work has started on six long railings and posts for a safety barrier between the Up main line and the through station. The through station water tower has been installed together with the three terminus water tanks. Various infrastructure tasks are being planned for 2009.

Work on the level access at **Worthing DSME** has recommenced. The low level has been cut and hinged and new rail and sleepers laid. After great debate and much consultation about the angle to cut, members ended up using a piece of string! The work for the project has been spread over three days to accommodate the cutting of the track, the painting of new parts and the final fitting and signal work. *Worsfold*, the new Nigel Gresley locomotive awaits its first fire.

World club news

Canada

The traction engine at **British Columbia SME** seemed to be going down hill with less resistance than usual, it has suffered a broken piston. The 80th anniversary celebration Trainfest at the society was a very successful weekend with a good selection of visitors and locomotives enjoying a "nice relaxed day" in fine weather. A local television crew filmed the activities and a short segment was broadcast on the following Monday which provided some nice publicity. The number of passengers riding the trains has increased by about 30% this year making for a busy summer.

New Zealand

The August meeting at **Hutt Valley MES** was a presentation by Peter Anderson on his journey into photography up to the present. Peter started recording his impressions of

locomotives as a young lad using pencil and paper before progressing into photography with a Box Brownie and hence via 120 and 35mm film cameras to his current Canon digital single lens reflex. Peter had brought all the cameras to the meeting as well as a vast selection of photographs for members to look at.

Members of **Maidstone MES** have put a temporary hold on their work programme at present due to some uncertainty that the current lease will be extended beyond 2011. This is because the local council is waiting the outcome of studies into the use and future development of the park.

The **Auckland SME** is preparing to celebrate its 50th anniversary in 2009 and has booked a venue for a celebration and exhibition in early October next year. A booklet on the society history is also being prepared to mark the occasion.

United States

Washakum Live Steamers (Massachusetts) reports another successful steaming season. Major events were the completion of Page Station, finishing of the high-line signal system, installation of an extensive water system for fire fighting, and several large improvement/maintenance operations on club installations. The major event during the year was the annual meet (**photo 3**). For this three-day event, there were over 400 visitors, as well as 60-plus locomotives in attendance. Visiting engines came from the Adirondacks, Pioneer Valley, Montreal, Long Island, Finger Lakes, Niagara Frontier, Pennsylvania, Golden Horseshoe, New Jersey live steam clubs, and a few more. The steaming bays were loaded and there was lots of activity all day long. Steam ruled both the high-line and ground-line (which was dominated by diesels and electrics in prior years). Weather was perfect, and the newly finished Page Station provided the perfect place deep in the woods for watching and socializing. At night it is especially enjoyable to



watch the firebox-glow and the operation of the signal lights as steamers passed, otherwise unseen, through the woods.

The **Bay Area Engine Modellers** October meeting included a new engine being constructed by Dwight Giles. Dwight has started work on a 4-cylinder in-line OHV engine (**photo 4**) with 1½in. bore and a 1in. stroke. The engine features a very nice cast aluminium oil pan. The castings are one half of the Black Widow engine: patterns by John Viavianos and castings from Del Vecchio Foundry. The valve gear will be exposed. At the same meeting, were some cams (for a Wall 4) ground on Ken Hurst's grinder (**photo 5**).

Humour time

The final instalment of history from the **Model Steam Road Vehicle Society**:

"Those with money had plates made of pewter. Food with high acid content caused some of the lead to leak onto the food, causing lead poisoning death. This happened most often with tomatoes, so for the next 400 years or so, tomatoes were considered poisonous.

"Bread was divided according to status. Workers got the burnt bottom of the loaf, the family got the middle, and guests got the top, or the upper crust.

"Lead cups were used to drink ale or whisky. The combination would sometimes knock the imbibers out for a couple of days. Someone walking along the road would

3. A scene from the annual meet at Washakum Live Steamers.

4. Dwight Giles' new 4-cylinder OHV engine under construction.

5. The Wall 4 cams were ground on Ken Hurst's cam grinder.



take them for dead and prepare them for burial. They were laid out on the kitchen table for a couple of days and the family would gather around and eat and drink and wait and see if they would wake up, hence the custom of holding a wake.

"England is old and small and the local folks started running out of places to bury people. So they would dig up coffins and would take the bones to a bone-house, and re-use the grave. When re-opening these coffins, 1

out of 25 coffins were found to have scratch marks on the inside and they realized they had been burying people alive. So they would tie a string on the wrist of the corpse, lead it through the coffin and up through the ground and tie

it to a bell. Someone would have to sit out in the graveyard all night (the graveyard shift) to listen for the bell; thus, someone could be 'saved by the bell' or was considered a 'dead ringer'."

Who said History was boring?

DIARY

NOVEMBER

- 21 **East Somerset SMEE.** Bob Alderman: A1 'Tornado'. Contact Roger Davis: 01749 677195.
- 21 **Rochdale SMEE.** Bits & Pieces. Contact Bob Denyer: 0161 959 1818.
- 21 **Romford MEC.** Photo Talk. Contact Colin Hunt: 01708 709302.
- 22 **Chesterfield & District MES.** Public Running. Contact Mike Rhodes: 01623 648676.
- 22 **SM&EE.** Rummage Sale. Contact Maurice Fagg: 020 8669 1480.
- 22 **York City & DSME.** Mike Waters: Steam Powered Motorcycles. Contact Pat Martindale: 01262 676291.
- 23 **Edinburgh SME.** Track Running Day. Contact Robert McLucke: 01506 655270.
- 23 **MELSA.** Bracken Ridge. Contact Graham Chadbone: 07 4121 4341.
- 23 **Adelaide Miniature SRS.** Public Field Day. Contact Peter Cooper: 8264 3471.
- 24 **Bedford MES.** Slips, Seals & Sliders. Contact Ted Jolliffe: 01234 327791.
- 24 **Canterbury & District MES (UK).** Bits & Pieces. Contact Gina Pearson: 01227 830081.
- 25 **Furness MRC.** AGM. Contact Colin Burns: 01229 837079.
- 25 **Stafford DMES.** Derek Tweed & Frank Beech: Hells Bells. Contact Chris Dobbs: 01889 270533.
- 26 **Birmingham SME.** An Evening with Non-Steam Models. Contact John Walker: 01789 266065.
- 26 **Chingford DMEC.** David Bowker: The Scene in China. Contact Ron Manning: 020 8360 6144.
- 26 **Harrow & Wembley SME.** Philip Crouch: Railway Films. Contact Roy Goddard: E. RSGwatford@aol.com
- 26 **Hull DSME.** Chairman's Evening. Contact Tony Finn: 01482 898434.
- 27 **Cardiff MES.** Forum. Contact Don Norman: 01656 784530.
- 27 **Sutton MEC.** John Downs: How I survived a plane crash. Contact Bob Wood: 020 8641 6258.

- 28 **Hereford SME.** Chris Raywood and his newest project. Contact Nigel Linwood: 01432 880649.
- 28 **Malden DSME.** Rummage Sale. Contact John Mottram: 01483 473786.
- 28 **Newton Abbot & District MES.** Quiz Night. Contact Graham Day: 01626 772739.
- 30 **Edinburgh SME.** Track Running Day. Contact Robert McLucke: 01506 655270.
- 30 **MELSA.** Sunday in the Park. Contact Graham Chadbone: 07 4121 4341.

DECEMBER

- 1 **Peterborough SME.** Bits & Pieces. Contact Lee Nicholls: 01406 540263.
- 2 **Oxford (City of) SME.** Bits & Pieces. Contact Chris Kelland: 01235 770836.
- 2 **Stamford MES.** Workshop Machining Tricks. Contact Derek Brown: 01780 753162.
- 2 **Taunton ME.** David Hartland: Every picture tells a story. Contact Nick Nicholls: 01404 891238.
- 3 **Birmingham SME.** Library & Chat Evening. Contact John Walker: 01789 266065.
- 3 **Bristol SMEE.** History of the Severn Ferries. Contact Trevor Chambers: 0145 441 5085.
- 3 **Chingford DMEC.** Bits & Pieces. Contact Ron Manning: 020 8360 6144.
- 3 **Guildford MES.** White Elephant Sale. Contact Dave Longhurst: 01428 605424.
- 3 **Leeds SMEE.** Christmas Dinner. Contact Geoff Shackleton: 01977 798138.
- 4 **Bournemouth DSME.** Tech-Chat. Contact Dave Finn: 01202 474599.
- 4 **Leyland SME.** Memorabilia Evening. Contact A. P. Bibby: 01254 812049.
- 4 **South Lakeland MES.** AGM. Contact Adrian Dixon: 01229 869915.
- 4 **Sutton MEC.** Bits & Pieces. Contact Bob Wood: 020 8641 6258.

- 4 **Westland & Yeovil DMES.** Meeting. Contact Gerald Martyn: 01935 434126.
- 5 **Rochdale SMEE.** Phil Jervis: Jinties & other Obsessions. Contact Bob Denyer: 0161 959 1818.
- 5 **Romford MEC.** Competition Night. Contact Colin Hunt: 01708 709302.
- 6 **Bradford MES.** BMES Competition & Display. Contact John Mills: 01943 467844.
- 6 **Cardiff MES.** Carl Pickstone: More Engineering Topics 6. Contact Don Norman: 01656 784530.
- 6 **Ickenham DSME.** Public Running. Contact Ian Mortimer: 01895 635596.
- 6/7 **Nottingham SMEE.** Santa Specials. Contact Pete Towle: 0115 987 9865.
- 6 **SM&EE.** Competition Day & Christmas Party. Contact Maurice Fagg: 020 8669 1480.
- 6 **Sutton MEC.** Christmas Party. Contact Bob Wood: 020 8641 6258.
- 6 **York City & DSME.** AGM. Contact Pat Martindale: 01262 676291.
- 7 **Cardiff MES.** Santa Special. Contact Don Norman: 01656 784530.
- 7 **Chichester DSME.** Santa Specials. Contact Ian Simpson: 01243 544 021.
- 7 **Malden DSME.** Santa Special. Contact John Mottram: 01483 473786.
- 7 **Pinewood MRS.** Santa Specials. Contact Paul Archer: 0118 989 4516.
- 7 **Reading SME.** Public Running. Contact Brian Joslyn: 01491 873393.
- 7 **Westland & Yeovil DMES.** Track Running Day. Contact Gerald Martyn: 01935 434126.
- 8 **Bedford MES.** Quiz Night. Contact Ted Jolliffe: 01234 327791.
- 8 **Melton Mowbray DMES.** Derek Brown: Loco design using CAD. Contact Phil Tansley: 0116 2673646.

- 8 **Saffron Walden DSME.** Christmas Dinner. Contact Jack Setterfield: 01843 596822.
- 9 **Frimley & Ascot LC.** Meeting. Contact Bob Downman: 01252 835042.
- 9 **King's Lynn DSME.** Christmas Party. Contact Mike Coote: 01533 673728.
- 10 **Birmingham SME.** Presidents Evening. Contact John Walker: 01789 266065.
- 10 **Chingford DMEC.** Christmas Auction. Contact Ron Manning: 020 8360 6144.
- 10 **High Wycombe MEC.** Bomb Disposal: Julian Thompson. Contact Eric Stevens: 01494 438761.
- 10 **St Albans DMES.** Christmas Social Evening. Contact Roy Verden: 01923 220590.
- 11 **Cardiff MES.** Tony Bird: An Evening with Tony. Contact Don Norman: 01656 784530.
- 11 **Sutton MEC.** Quiz & mince pie night. Contact Bob Wood: 020 8641 6258.
- 12 **Bristol SMEE.** Santa Special. Contact Trevor Chambers: 0145 441 5085.
- 12 **Hereford SME.** Christmas Gathering. Contact Nigel Linwood: 01432 880649.
- 12 **Polegate & District MEC.** Ian Wright: West Somerset Railway. Contact D. F. Pratt: 01323 645872.
- 13 **Glasgow & S.W. Rly Ass'n.** Arnold Tortorella: G&SWR Wagonry. Contact Bruce Steven: 0141 810 3871.
- 13 **Guildford MES.** Christmas Social Evening. Contact Dave Longhurst: 01428 605424.
- 13/14 **Nottingham SMEE.** Santa Specials. Contact Pete Towle: 0115 987 9865.
- 13/14 **Reading SME.** Santa Specials. Contact Brian Joslyn: 01491 873393.
- 13 **SM&EE.** Training Seminar Day 1, Part 2. Contact Maurice Fagg: 020 8669 1480.
- 14 **Chichester DSME.** Santa Specials. Contact Ian Simpson: 01243 544 021.
- 14 **Edinburgh SME.** Track Running Day. Contact Robert McLucke: 01506 655270.

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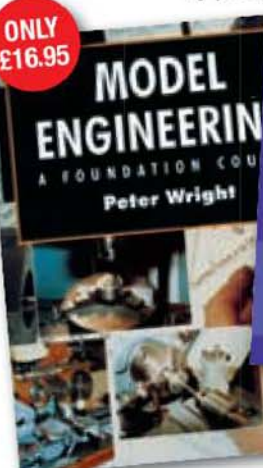
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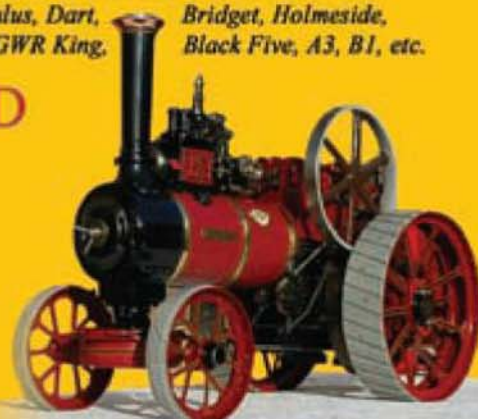
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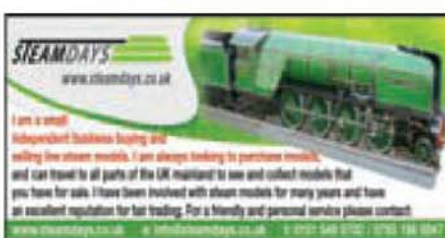
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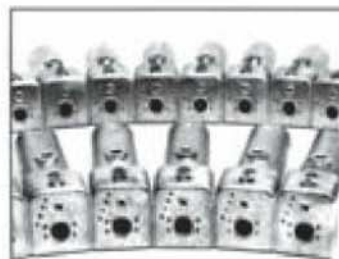
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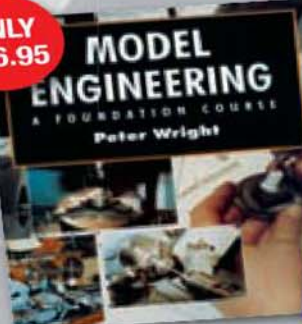
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£145

Kasenit Mini furnace



£3450

Colchester Master 2500 lathe + DRO



NEW £125

Milling/Drilling ground X-Y table



£2450-£3450

Bridgeport milling machine

JUST IN-choice

PLEASE PHONE 0208 300 9070 TO CHECK AVAILABILITY OR TO OBTAIN OUR LIST

DISTANCE NO PROBLEM!

DEFINITELY WORTH A VISIT

ALL PRICES EXCLUSIVE OF VAT

Just a small selection of our current stock photographed!

We have wood lathes, saw benches, bandsaws, morticers and Record vices etc - large selection!





£2450

Myford Super 7 lathe + power cross feed



£70

'100' face plate + we have loads more from Myford to Colchester Mascot



£1950

Boxford STS 1020 lathe



£1250

Colchester Chipmaster lathe



£345

Union (HME) quality balanced 8" bench grinder



Myford MA99E collet chuck collets



£1500

Warco lathe



£245

CEJ (Sweden) gauge blocks / slips



£40 & £50 each

Keyway broaches 7/16" 18mm



£345

Hofmann 10" rotary table



Just in £345

Q and S 6" power hacksaw + coolant



£345

Boxford 'Little Giant' toolpost grinder



£345

Axminster planer as new



Winter Reduction to £250

EMG tool grinder



£1250

Tom Senior M1



£425

Alexander Model 2CGD engraving type grinder



Winter Reduction to £550

Mastroy C210T lathe



£120

Clarkson 40INT collet chuck + collets (we have 2MT-5MT and 30INT to 50INT in stock!!)



£550

Boxford dividing head + two plates



£140

1CWT / 50 kilos anvil



£1200

Harrison L5 lathe



£950

Harrison Graduate wood lathe complete



£525

Viceroy 5" x 24" lathe



£2250

Startrite TA1250 12" full sliding table saw bench (240 volts)



New converters to order!



£245

Duplex D26 (240 volts) toolpost grinder



£875

Eagle surface grinder + magnetic chuck



£40

Harrison L5 travelling steady (LSA, L6, Student, Master also)



£345

Abwood 6" swivel / tilt machine vice



£425

Boxford 125 TCL



£950

Cowells miniature milling machine



£40 each

Dickson toolposts to suit Colchester Mascot (others available)



from £20

Eclipse angle plates



Winter Reduction to £250

Clarke Vacuum former 917 (up-graded) + stand



£345

Tom Senior slotting head



£145

Union pedestal grinder



£625

RJH vertical finisher + built in extractor



Winter Reduction to £1250

Van Norman 944 boring bar + tools



£225

Burnerd 'LO', D13 & D14 collet chucks



£245

Denford Viceroy buffer's

Special 'VAT FREE' Open Day's December 29th & 30th 2008 Back by popular demand!



SEE US AT
LONDON MODEL
ENGINEERING
EXHIBITION
16TH - 18TH
JAN 09

Chester Machine Tools

www.chestermachinetools.com



Model B 3in 1 Machining Centre

Swing	420mm
Distance Between Centres	520mm
Spindle Bore	20mm
Speeds	7
Thread Cutting	0.2-3mm Metric 8-120TPI Imperial
Motor	3/4hp
Power	240volt
Weight	190kgs

FEATURES
Large Swing 16" • All MT3 Tapers • Cast Iron Construction
Wide Range of Accessories • Taper Bearing Headstock

STANDARD ACCESSORIES
100mm 3-Jaw Chuck • Lathe Tools • Drill Chuck and Arbor
Change Gears • Drawbar • Manual and Parts List

£826

Crusader Lathe

Max Swing	300mm
Max Distance Between Centres	810mm
Motor	1.5hp
Net Weight	450kgs

STANDARD ACCESSORIES
• 3-Jaw Chuck • 4-Jaw Chuck • 2 Axis Digital
Readout • Face Plate • Fixed Steady • Travelling
Steady • Splash Guard • Machine Stand
• Quick Change Toolpost • Toolholders • Machine
Lamp • Coolant System.

FEATURES
• D1-4 Camlock Spindle • 2 Axis Digital Readout
• Hardened & Ground Bedways • Independent
Leadscrew and Feed Rod • Gap Bed • Taper
Roller Bearings • Cast Iron Bed



£2489

Craftsman Lathe

Max Swing	300mm
Max Distance between Centres	570mm
Motor	1.5hp
Net Weight	300kgs

FEATURES
• Engineered from High Grade Castings • Cuts Left and Right
Hand Threads • Bedways Hardened and Ground • Carriage
Mounted Spindle Control • Metric/Imperial Dial Graduations •
Back Gear Drive • Powered Cross Feed • "T" Slotted Crossslide

STANDARD ACCESSORIES
• 3-Jaw Self Centering Chuck 160mm • Independent 4-Jaw
Chuck • Machine Stand • Fixed Steady • Travelling Steady
• 4 Way Toolpost • 2 x MT3 Steel Centres • Centre Sleeve MT3-
MT3 • Face Plate • Thread Cutting Dial • Rear Splash Guard



£1549

Conquest Milling Machine

Table	90 x 404mm
End Mill Capacity	12mm
Motor	350watt
Net Weight	55kgs

STANDARD ACCESSORIES

- 1-13mm Drill
chuck
- MT3 Drill Chuck
Arbor
- Milling Drawbar
- Variable Speed
- Spacers
- Allen Keys
- Manual &
Parts list
- Quick Action Vice

FEATURES
• Dovetail Column
• Adjustable Depth Stop
• Fine Feed Hand Control
• Geared Drive
• Variable Speed
• Slideaway Covers
• Zero
Setting
Dials



£436

Super Lux Mill

Table Size	240 x 820mm
End Mill Capacity	28mm
Motor	1hp
Net Weight	278kgs

STANDARD ACCESSORIES

- Drill Chuck
- Drill Chuck Arbor
- Milling Drawbar
- Interlocked Chuck
Guard
- Manual and Parts List
- Stand
- Face Mill Cutter
- Reducing Sleeves
- Drill Drift

FEATURES
• Powered
Head
Elevation
• Large Table
• Dovetail Column
• Angle
Tilting
Head
• Wide Speed
Range



£1599

626 Milling Machine

End Mill Capacity	25mm
Table Size	156x745mm
Long Travel	380mm
Cross Travel	135mm
Head Tilt	45°
Speeds	9
Spindle Taper	MT3
Motor	240volt
Supply	410kgs

STANDARD ACCESSORIES

- Machine Work
Light
- Central
Lubrication
System
- Machine
Stand
- Manual
and Parts
List

FEATURES
• Head Swivels
80 degrees
• Head Tilts 45 degrees
• One Shot
Lubrication System
• Cast Iron Construction
• 1.5hp Motor



£1449

24" Multiformer



Bending Width	610mm
Shearing Thickness	0.5mm
Rolling Thickness	1mm
Net Weight	100kgs

stand optional

£276*

H80 BANDSAW

Max Cutting Capacity	Round 90mm Square 90 x 120mm
Max Cutting Capacity at 45°	Round 65mm Square 70 x 65mm
Motor	420w
Power	240volt
Net Weight	45kgs

FEATURES
Roller Bearing Guides • Cast Iron Construction
Angled Cutting • Supplied with Stand



£142

All prices include VAT unless otherwise stated Delivery Free to UK mainland – excluding certain Scottish postcodes.
Prices valid for duration of this issue only. * Delivery by quotation

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