FREE MINI SHOWGUIDE INSIDE

LONDON MODEL ENGINEERING EXHIBITION

THE MAGAZINE FOR MODEL ENGINEERS

ENGINEERING in Miniature

MIDLANDS MAGIC

MMEE Competition Winners Inside!

7 GREAT PROJECTS FOR MODEL ENGINEERS

LONDON MODEL ENGINEERING EXHIBITION

Proud sponsors of The London Model Engineering Exhibition
Great Hall, Alexandra Palace

January 20-22 2017

STUMPF UNIFLOW STEAM | KEW BRIDGE MUSEUM

JANUARY 2017 | £3.50
01
9 770955 764166 >

Come and meet us at the London Model Engineering Exhibition at Alexandra Palace, Stand 58/59

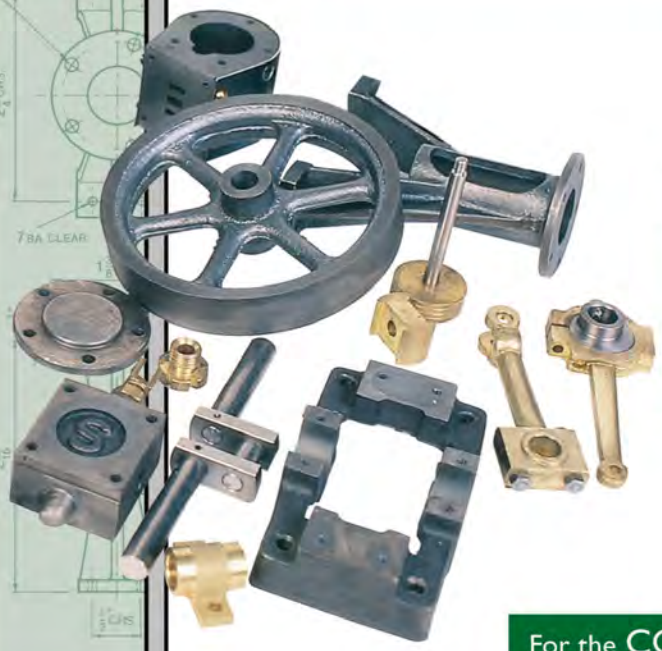
STUART MODELS

FOUNDED 1898

For the MODEL ENGINEER

SETS OF CASTINGS

We offer Sets of Castings suitable for both those starting out in model engineering as well as those looking for a new and challenging project.



For the ENTHUSIAST

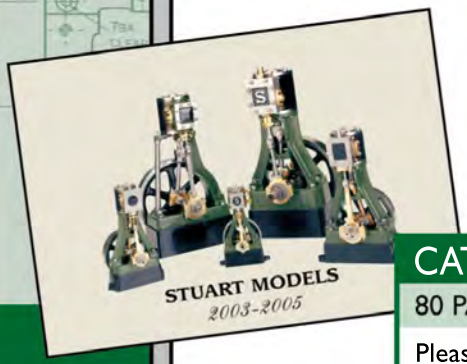
PRE-MACHINED KITS

Many of our engines are available as Pre-Machined Kits allowing you to finish the model with a set of spanners and simple hand tools.

For the COLLECTOR

READY TO RUN MODELS

The perfect choice for anyone who has an interest in steam. These models are assembled, painted and thoroughly tested in our workshop.



CATALOGUE - £6.00

80 PAGE FULL COLOUR

Please send £6 for our eighty page comprehensive full colour catalogue which covers our entire range of models and accessories.

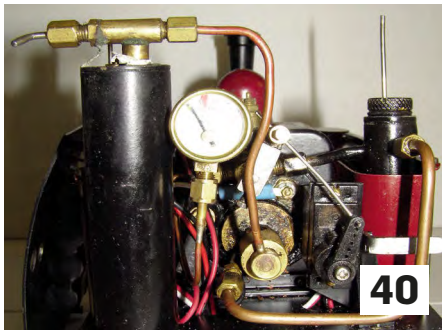
STUART MODELS

GROVE WORKS, WEST ROAD, BRIDPORT, DORSET, DT6 5JT

• TEL 01308 456859 • FAX 01308 458295 • www.stuartmodels.com •

CONTENTS

JANUARY 2017 Volume 38 Number 7



FRONT COVER

Our front cover shows Chris Robinson demonstrating helical gear cutting on his Jacobs gear cutting machine at the Midlands Exhibition. *Photograph: John Arrowsmith*

EDITORIAL

LONDON MODEL ENGINEERING EXHIBITION'S 21ST ANNIVERSARY

The London Model Engineering Exhibition sponsored by this magazine will be returning to Alexandra Palace for its 21st Anniversary commencing on Friday 20th through to Sunday 22nd January.

Make sure you take the opportunity to attend and see the wide spectrum of modelling on display from traditional model engineering, steam locomotives, stationary, IC and road engines through to radio control trucks, boats, aeroplanes, helicopters and much, much more. As we go to press there are 54 clubs and societies participating displaying a full range of their members' work and competing to win the prestigious Society Shield. In total nearly 2000 models will be on display.

For those amongst us needing to purchase tools, machines or materials it's a great shopping opportunity as there are well over 50 leading suppliers present under one roof. This gives visitors an excellent opportunity to see and compare products and to purchase almost anything needed at one fell swoop. To help you plan your shopping in advance you will find a mini show guide for the exhibition in the centrefold of this issue which details all the companies attending and lists all the clubs and societies participating.

It's an important exhibition being the only major modelling exhibition in the capital and the south-east and showcases model engineering and many other modelling hobbies to a far far wider audience than most exhibitions. Each year many thousands of members of the general public have the opportunity, which they would not otherwise have, to see all types of modelling and many take up or return to a hobby after a visit to Alexandra Palace.

I will be there also so I look forward to meeting many of our readers on our Engineering In Miniature stand.

So don't forget the date – 20th to 22nd January – and give your support to this important exhibition.

TICKETS ARE AVAILABLE IN ADVANCE AT DISCOUNTED PRICES AT www.londonmodelengineering.co.uk.

AN APOLOGY

I owe Dave Ball an apology for mispelling his name last month (page 210). This error crept in during the editing process. What's worse is that this is the second time it has happened. I shall do my best to ensure it doesn't happen again.

Finally, I hope everyone is enjoying the Christmas season and that you will all have a happy and productive new year!

Martin Evans
Editor

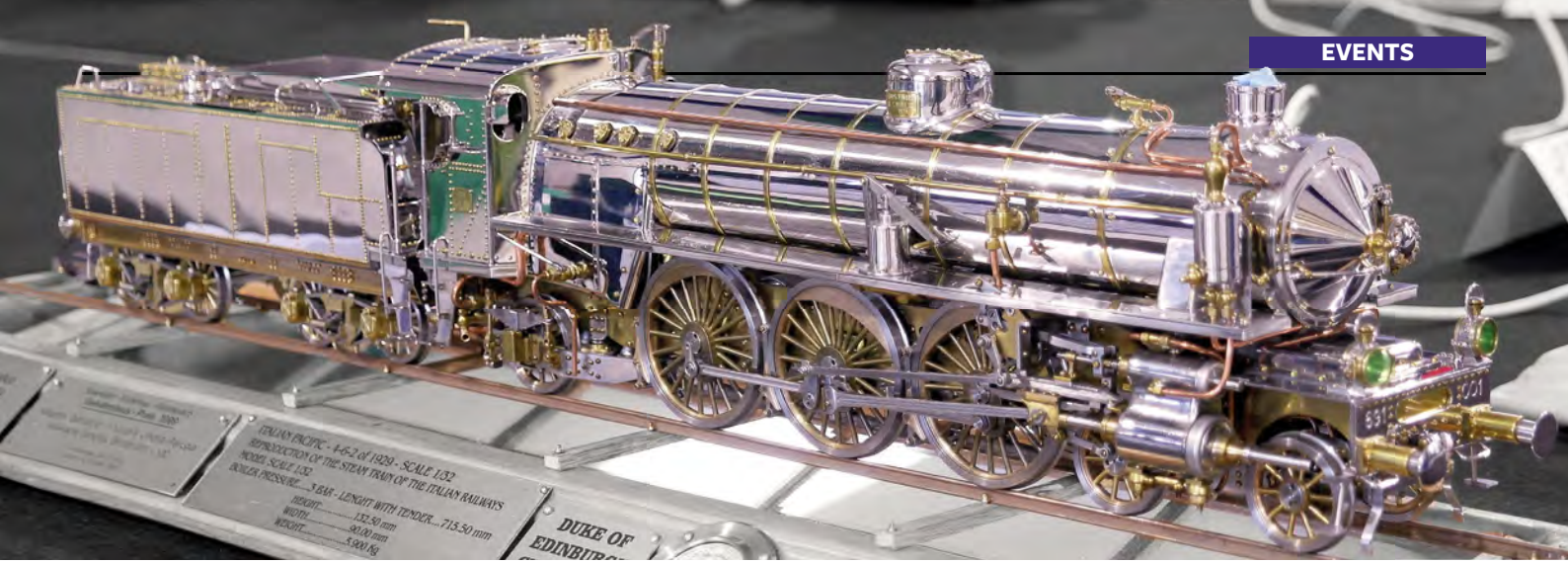
The February issue will be on sale on January 19th

Editor: Martin R. Evans
Email: editor@engineeringinminiature.co.uk
Publisher: Steve Cole
Email: stevec@warnersgroup.co.uk
Advertising manager: Bev Machin
Tel: 01778 392055
Email: bevm@warnersgroup.co.uk
Sales executive: Emma Hill
Tel: 01778 395002
Email: emma.hill@warnersgroup.co.uk
Advertising design: Amie Carter
Email: amiec@warnersgroup.co.uk
Ad production: Pat Price
Tel: 01778 391115
Email: patp@warnersgroup.co.uk

Published by Warners Group Publications Plc, The Maltings, West Street, Bourne, Lincolnshire PE10 9PH
www.facebook.com/engineeringinminiature

Articles: The Editor is pleased to consider contributions for publication in Engineering in Miniature. Please contact us to discuss your work.

Engineering in Miniature (ISSN 0955 7644) is published monthly by Warners Group Publications Plc.



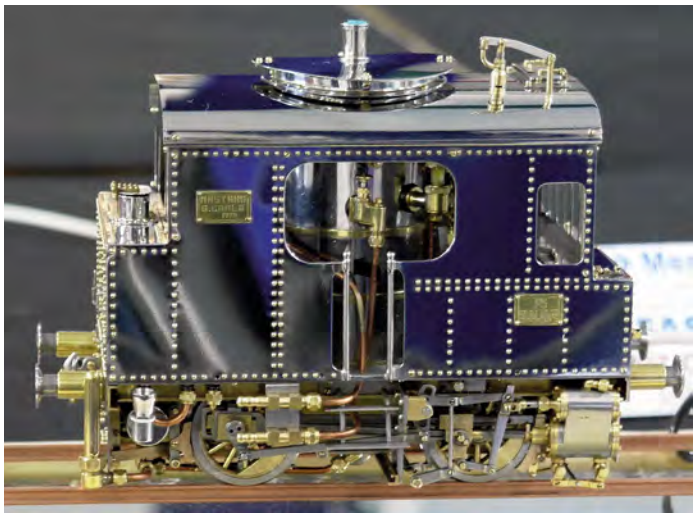
39th Midlands Model Engineering Exhibition Competition Report

John Arrowsmith reports on the competition results and gives his view of the display classes

BY **JOHN ARROWSMITH**

The Annual Midlands Exhibition took place from Thursday 13th October until Sunday 16th October at the Warwickshire Exhibition Centre. This year the exhibition celebrated its 39th year and put on show a wide range of models and prototypes to be perused by a large crowd of model engineers and other visitors. Some other notable anniversaries were also marked in the main hall. The bicentennial anniversary of Robert Stirling's patent for the Heat Economiser and the 80th anniversary of the Supermarine Spitfire prototype K5054 captured the attention of many with some interesting presentations. A Baldwin Locomotive that was built in 1891 for the Phillips & Rangeley Railway to operate on the 2 foot gauge railway in the State of Maine was displayed by the Echills Wood Railway as a 1/3rd scale, 7¼" gauge model. This was a quite a centre of attention because in this scale it is an extremely large model.

The competition classes provided some nice examples for the judges to consider and made sure they had plenty to talk about. It was disappointing that two of the locomotive classes did not have a single entry and that is the first time since I have been reporting that this has happened. However there were some excellent examples in other classes and it was particularly pleasing to see the contributions made by younger people both in the competition and the display classes.



CLASS 1 – LOCOMOTIVES UP TO AND INCLUDING GAUGE 1

Two entries in this class were presented by Giacario Mastrini from Italy and were certainly rather eye catching. The 4-6-2 Italian Pacific was an outstanding model and, being unpainted, showed off its immaculate platework and fittings. It was awarded a 1st Prize. Giacario's other entry, a Cubo 0-4-0 800-001 was an equally eye-catching offering. It was obviously much smaller but superb workmanship ensured a well deserved 2nd Prize.

CLASS 2 – LOCOMOTIVES IN 2½" AND 3½" GAUGES

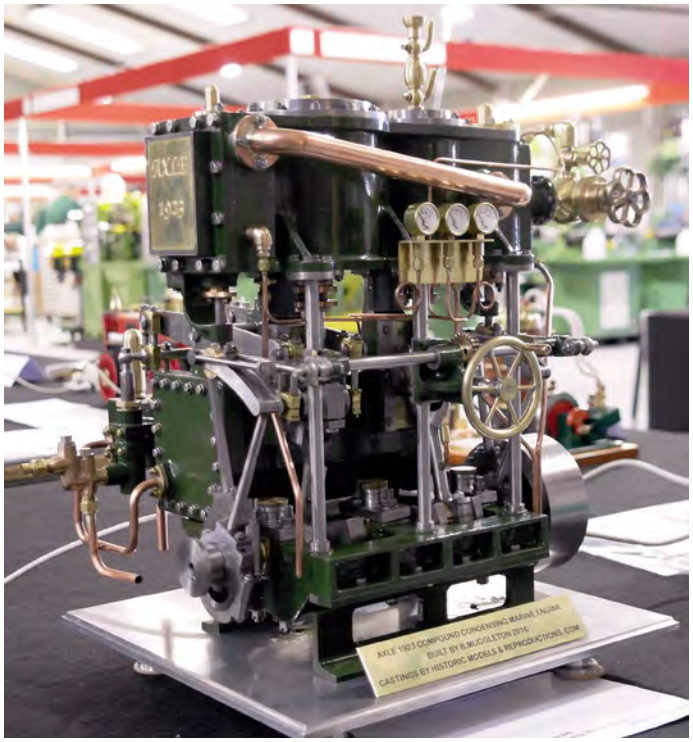
There was just one entry here in the shape of a 3½" gauge 'Tich' to the LBSC design. Well made and finished, the entry gained a Commended certificate for its builder D Lee.

There were no entries in either Class 3 or Class 4.

TOP
Class 1 winner was this superb example by G Mastrini of an Italian 4-8-2 locomotive.

LEFT
2nd Prize in Class 2 was also won by G Mastrini with this Cubo 0-4-0 shunter.

BELOW
In Class 2 a little 'Tich' locomotive built by D Lee was Commended.



ABOVE
Brian Muggleton's excellent Compound Condensing Engine won 1st Prize in Class 5.

CLASS 5 – STATIONARY ENGINES

A good competitive entry in this class with five models receiving awards.

1st Prize and the Phoenix Paints Trophy went to Brian Muggleton for his Compound Condensing Steam Engine. Excellent workmanship and finish ensured that this was a worthy winner. 2nd Prize was awarded to the Triple Expansion Marine Engine to the OB Bolton design and built by B Newbound. A Very Highly Commended certificate was awarded to Linda Gearing for her example of a Model Steam Plant. A couple of Commended certificates were awarded to P Kempe for his examples of a James Coombes Beam Engine and a Half Beam Engine.

CLASS 6 – STEAM ROAD VEHICLES (static)

The single entry in this class was a very well-made example of a 1908 Merryweather Fire King which had been built by B Newbound. The model was awarded a 1st Prize and the Staffordshire Joinery Cup.

BELOW
B Newbound's model of a 1908 Merryweather fire engine.

ABOVE
A Very Highly Commended certificate was awarded to Linda Gearing for this example of the EIM Steam Plant. Another example was presented by Martin Gearing in the display class.

CLASS 7 – MACHINE TOOLS AND WORKSHOP EQUIPMENT

The single entry in this class was an impressive CAD/CAM Accessory constructed by 16-year-old Andrew French which was awarded a Very Highly Commended certificate.

There were no entries in Class 8 for Internal Combustion Engines.

CLASS 9 – HOROLOGICAL, SCIENTIFIC AND AUTOMATA

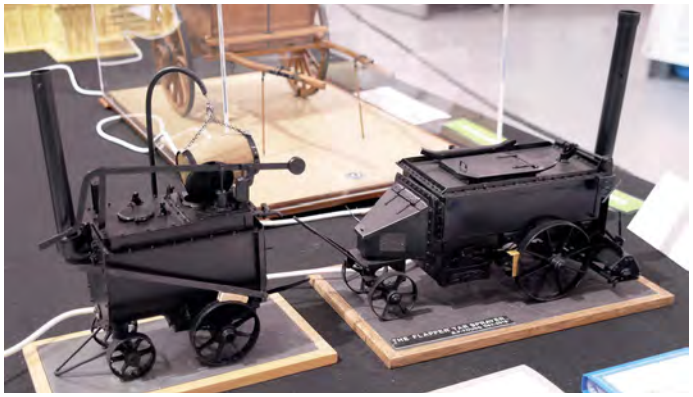
There was an absolute gem in this class in the shape of an English Regulator Clock built by Jake Sutton which was rewarded with a 1st Prize and the Clockmaker Trophy. As well as the very fine mechanical work Jake had constructed the case and veneer work.

CLASS 10 – MARINE MODELS – SCALE (over 50% scratch built)

A good competitive class here with some excellent models for the judges to weigh up. An impressive example of an Ulstein 4/1 Reduction Gearbox built by F McCafferty was awarded a 1st Prize and the Marine Challenge Cup. 2nd Prize was presented to M Nicholson for his CMB4 Coastal Motorboat. 3rd Prize went to B Rose for his model of lake steamer 'Josephine'. Two Very Highly Commended certificates for Pat Hendra and D Reynolds completed the awards in this class.

BELOW
The CBM4 coastal motorboat from M Nicholson.

ABOVE
A fine lake steamer gained 3rd Prize for Brian Rose in Class 10.



ABOVE
1st Prize in Class 15 went to this pair of tarsprayers by Brian Young.

CLASS 11 – MARINE MODELS – KIT (standard or modified)

There were two commendations in this class. A Highly Commended certificate was presented to T Gorin for his Brittany Sloop 'Coquiller' circa 1920 and a Commended certificate was gained by his Fishing Boat circa 1890.

CLASS 12 – MODEL HORSE DRAWN VEHICLES

There were two well-made models in this class both of which received Very Highly Commended Certificates. Philip Antrobus entered a nice example of a Tip Cart and Bob Fawcett entered his model of a 1894 Shand Mason Steam Fire Engine.

CLASS 13 – SCALE AIRCRAFT MODELS

There was just one superb example in this class in the shape of AW Johnston's Avro 504K Biplane. With excellent workmanship on the wings and fuselage fully complemented by the superb 9-cylinder rotary engine and propeller, it fully deserved its 1st Prize and the Variscale Cup.

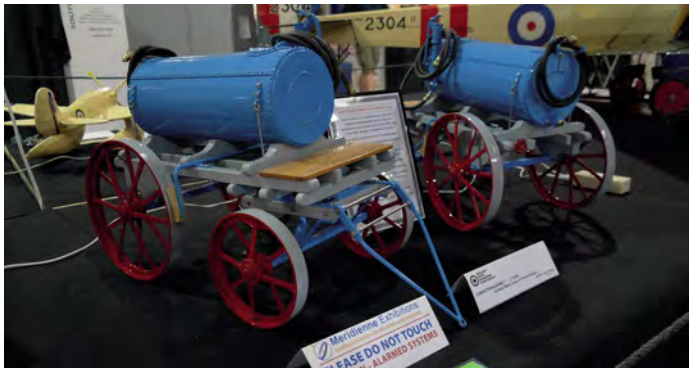
CLASS 14 – YOUNG ENGINEERS AWARD (under 20 years old)

It was very pleasing to see that this class had six high quality entries to be considered. One was an excellent piece of work and looked very professional. This was the self designed 3D Printer built by 16-year-old Angus French which was awarded the 1st Prize and the Stuart Shield. The judges awarded joint 2nd Prizes to Ryan Philo for his Morgan Three Wheeler and to Zahra Webb for her Fire Boat. Three Very Highly Commended certificates were awarded to P Turner for a Catamaran, R Turner for a Governess Jeep and to Z Lavers for a Pink Jeep. All these young people are to be congratulated for their work and for entering it in this exhibition.

CLASS 15 – MISCELLANEOUS

Two excellent entries in this class demonstrated some fine workmanship. Brian Young was awarded a First Prize for his pair of 'Tarsprayers' in 1/12 scale. A Highly Commended certificate was presented to Harry Williams for a pair of 4-Wheel Water Carts to the Fowler design.

ABOVE
This superb Avro 504K biplane from AW Johnston won the Variscale Cup.



ABOVE
A pair of 4-Wheel Water Carts to the Fowler design by Harry Williams gained a Highly Commended certificate in Class 15.

CLASS 16 – HOT AIR ENGINES

There was only one entry in this class, Keith Wright being awarded a Very Highly Commended certificate for his Robinson's 'Stirling Motor' Hot Air Engine.

MIDLANDS EXHIBITION DISPLAY CLASSES

There was a wide range of exhibits entered into the display classes and this was also reflected in the Club Stand displays which complemented these very well.

One of the outstanding models on display was the 7¼" Gauge Model B 3 Cylinder Shay locomotive exhibited by Mike Williams. Superbly finished and full of detail it attracted a lot of attention. Part of the Echills Wood Railway display but located on its own was another superb 7¼" gauge locomotive in the shape of a Baldwin 2 foot gauge locomotive built for the Phillips and Rangely Railway. It was the first 2 foot gauge 2-6-0 tender locomotive built by Baldwins and was unusual in having the steam dome ahead of the sand dome. Built to 1/3rd scale to run on 7¼" gauge made it a very large locomotive. In addition to these two narrow gauge locomotives no-one could miss the excellent example of a standard gauge locomotive in the shape of Dave Ball's GWR 47XX 2-8-0. This model embodies all that is achievable in a

BELOW
Mike WIlliams's 3-cylinder Shay locomotive.

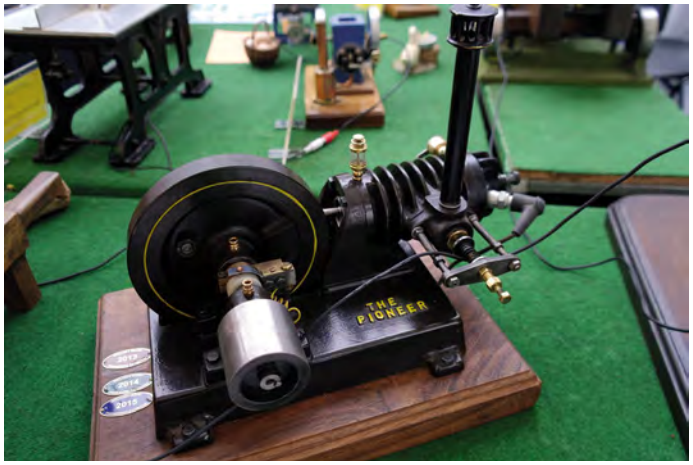
ABOVE
A nicely made vertical boilered narrow gauge locomotive from DK Morris.

ABOVE
BR 9F 2-10-0 locomotive under construction by Bob Shephard.

model and in this scale. Dave has produced a wonderful model to complement the full-size locomotive currently under construction by the preservation group. Another very fine locomotive chassis in this D3 Class was the BR 9F 2-10-0 under construction by Bob Shephard. It has been on display here in past exhibitions but it is always good to see progress being made. A very well made 5" gauge Vertical Boilered Narrow Gauge locomotive was displayed by DK Morris. The many details and fittings made for a very interesting exhibit. Tim and Neil Bottle added a little glamour to the display classess with their elegant and colourful SE & CR Wainwright D Class 4-4-0 locomotive in Gauge 1.

A wide range of exhibits ranging from old style farm implements to marine models and tooling are included in the exhibition and Keith Wright, who is a regular contributor to the

BELOW
Tim and Neil Bottle's beautifully turned out Wainwright D Class locomotive.



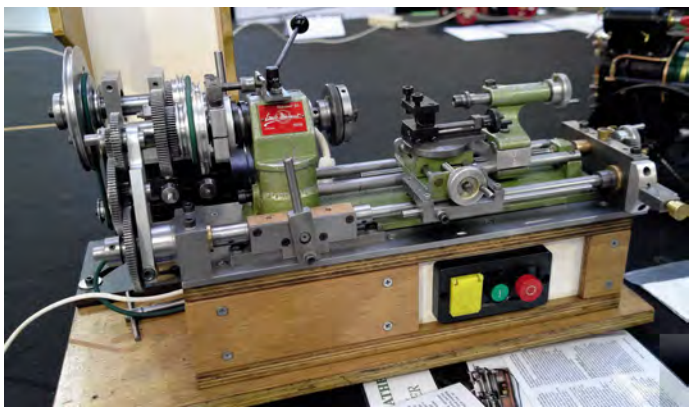
ABOVE
The 'Pioneer' two-stroke petrol engine from Keith Wright.

ABOVE
A pair of contrasting portable engines from Tony Webster.

show with his range of Miniature Farm Implements, showed how many of today's tasks were handled in the 1920's period. His example of a ¼ scale model of a 'Pioneer' two-stroke petrol engine with an unusual spark ignition was a well made model. A couple of interesting Portable Engines built by Tony Webster illustrated different aspects of old-time motive power. The Barrett, Exall and Andrews Portable Engine was displayed alongside his Lampitt Portable Engine, which enabled the differences to be seen easily.

There were two very nice small centre lathes on display which had been modified and built to show how small lathes can be adapted if required. The Unimat SL1000 Lathe presented by Terence Gorin demonstrated the addition of what looked like quite a complex gear box which has probably extended the capacity of the lathe considerably. Brian Newbound displayed his

BELOW
A view of the complex gearbox that Terence Gorin has added to his Unimat SL1000 lathe.



ABOVE
Chris Meyer's fine example of a MkV Panther G Tank.

ABOVE
Noel Shelley shows the crowd how to make their own castings.

1/10 scale Stuart Lathe which was a good example of how small lathes used to be.

The new series in EIM by Martin Gearing featuring a simple Steam Plant was illustrated to perfection with the prototype on display. Inspecting this model makes clear the excellent simplicity of this plant that anyone can construct. Martin also presented the EIM Hot Air Engine which again showed off the simple design of the engine.

In complete contrast to the previous exhibits Chris Meyer showed off his example of a MkV Panther G Tank; nicely made it captured the profile of these machines very nicely. Two excellent marine models were presented by Terence Orton. His model of a Belfast-built freighter 'Douro' circa 1864 was full of detail and good workmanship. His other entry was 'Waterwich', a wooden barquentine rigged sailing ship built at Poole circa 1870 – again lots of detail and fine fittings.

There were a couple of special displays this year which covered the Bicentenary of Robert Stirling and his patent for the Heat Economiser and the 80th Anniversary of the Supermarine Spitfire. The Robert Stirling display covered his patent designs and went on to show how they can be used in modern day applications like the modern commercial Stirling Engines used by the electronics industry. Here the machines are used to cool superconducting appliances down to -196 degrees Celsius. There are about 6000 currently in use running 24/7 which have clocked up over 230 million hours of operation. Not bad for an idea patented in 1816 is it! The Spitfire Anniversary display charted the history of this amazing aeroplane all the way from its inaugural flight in 1936. The very first prototype K5054 took to the air from Southampton Airport in1936 and the rest is history, as they say. Ian Peacock's display conveyed this history very well and no doubt brought back many memories for some of the visitors to the exhibition.

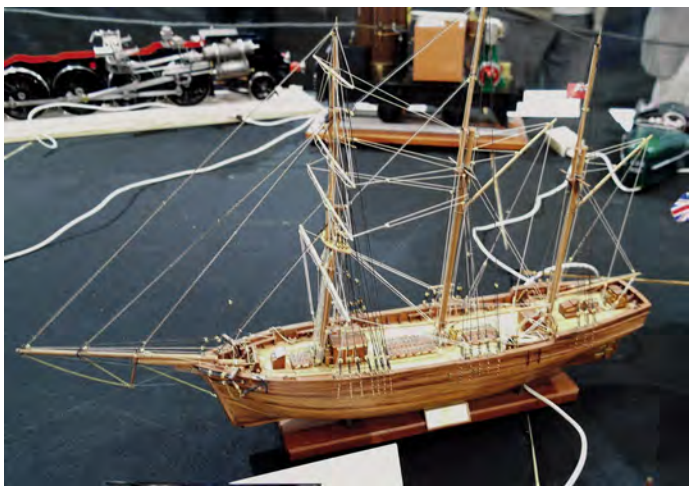
Some practical demonstration displays made another good contribution to the show. Noel Shelley is well known for his Ringstead Foundry and again his contribution drew large crowds to see how the production of castings from his own made up patterns is done. Peter Stevenson presented some of his part finished sheet metal components to accompany his lectures which, combined with his experience in this field, made for a very useful and practical demonstration.

A new demonstration on Gear Hobbing in the home workshop was presented by Chris Robinson who, having built a Jacobs Gear Cutting machine, has developed the process to enable the machine to cut helical gears. Explaining this, and the various complications associated with it, made for a very interesting talk. An Excel spreadsheet has been developed to determine the correct index and feed trains for helical gears and worm wheels – all clever details ably presented by Chris.

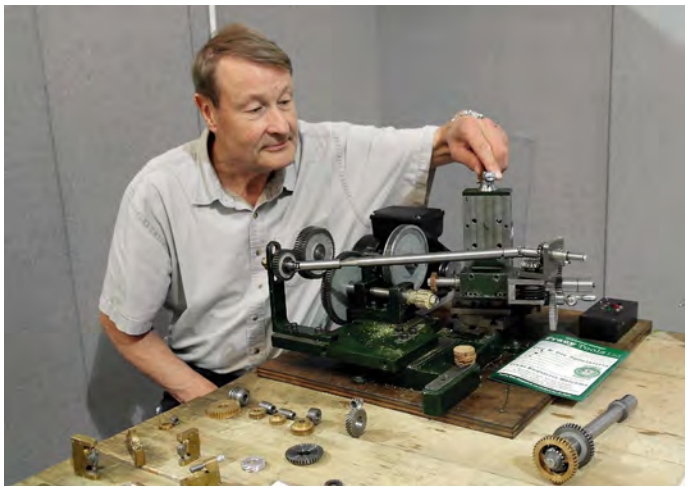
The Coventry Society of Model Engineers were also busy in the workshop demonstrating everyday skills for model engineers which enabled anyone contemplating starting in model engineering to get some idea of what is involved. All in all, a very good selection of skills and knowledge was on show which enabled visitors to find answers to all the awkward questions relating to the hobby.

This concludes my notes on two of the main sections of the exhibition. In my next contribution I will look at the superb contribution made by the club stands and also look at the activities of the Fosseway Steamers, which are always a source of pleasure and enjoyment for many visitors. ■

BELOW
Terence Orton's model of wooden barquentine 'Waterwich'.



BELOW
Chris Robinson demonstrates the cutting of helical gears on his Jacobs gear cutting machine.



The Atkinson Steam Wagon

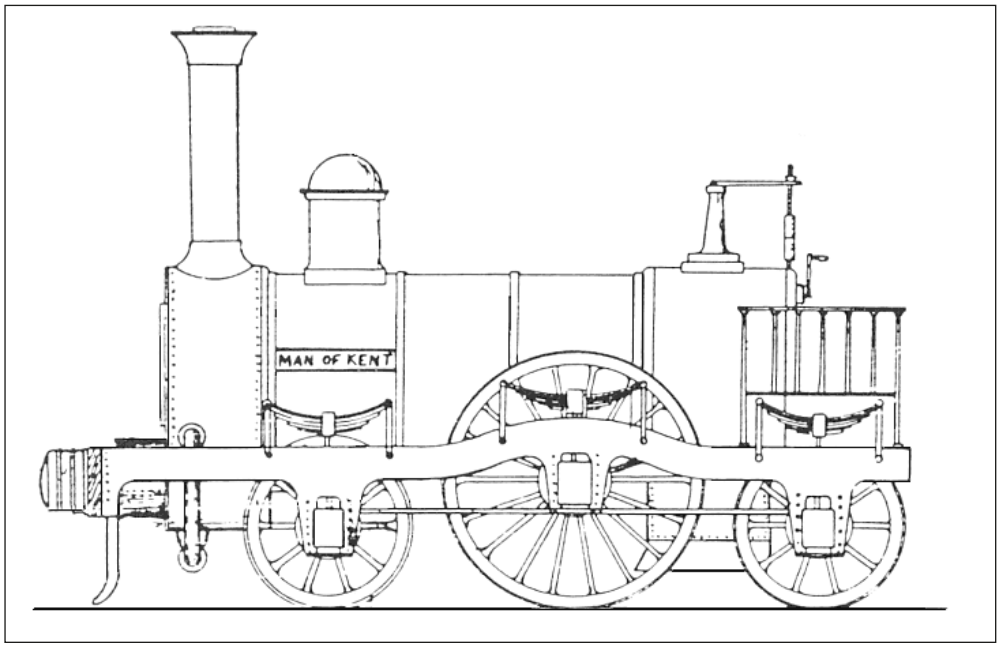
Graham introduces us to the Stumpf Una-Flow System and discusses its application in steam locomotives and the problems faced when scaling down to our sizes

BY **GRAHAM SADLER** CONTINUED FROM PAGE 189 DECEMBER 2016

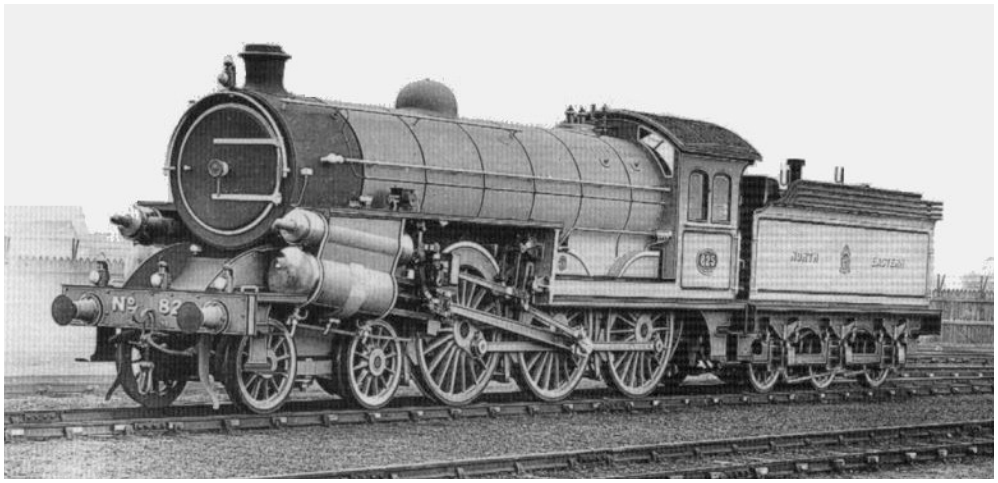
Now we come to the more unusual part of the Atkinson Uniflow Tractor engine, the pistons, but firstly we will consider the uniflow principle and the problems associated with using it in non-stationary situations.

The uniflow principle was developed by Professor Johann Stumpf and popularised in his book of 1909. The first mobile uniflow engine was 'The Man of Kent', an SER engine converted in 1849 but it was reconverted to normal arrangements 3 years later (see figure 1). Others were built as development engines notably the NER No. 825 built in 1913 (see photograph 1), later rebuilt with normal cylinders (in 1924) but it must have been sufficiently successful for the commissioning of another three cylinder version. Sir Vincent Raven built a Z Class Atlantic uniflow with 3 cylinders but it was 2½ tons heavier at the front with almost all the weight being taken on the front bogie compared with a normal cylinder arrangement. It was rebuilt with Lenz poppet valve cylinders in 1934 – more experimentation!

The Stumpf Una-Flow System (as he called it) adopted a cylinder twice the length of the stroke and a piston the same as the stroke (plus/minus clearances) and did away with the exhaust valve altogether. Inlet valves were placed as close as possible to the cylinder bore to keep passageways short, often directly against the bore ends thus keeping it hot all the time. Exhaust was at the centre of the elongated cylinder in a series of holes connected to an annular passageway and discharging below the cylinder into a condenser. His main work can be condensed into a simple axiom of engine design: keep the hot end hot and the cool end cool while minimising clearance space and leakage. The principal way in which Stumpf did this was to mount the condenser as close to the cylinder as possible with minimal resistance to steam movement. At the same time the inlet end of the cylinder is warmed by jacketing which is extended for up to 1/3 of the cylinder stroke. Figure 2 shows a typical vertical uniflow cylinder designed by him – do note the tiny clearance volume.



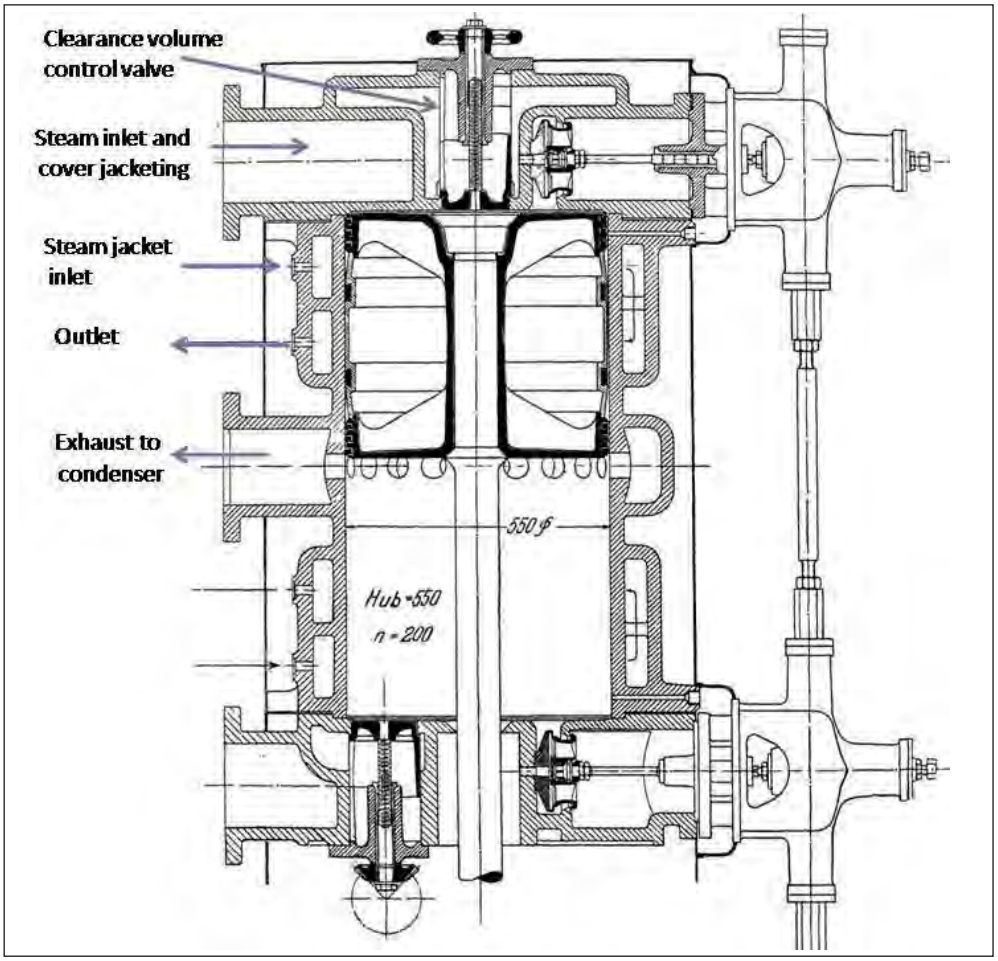
ABOVE FIGURE 1
'The Man of Kent' uniflow locomotive.



BELOW PHOTOGRAPH 1
NER No.825 uniflow locomotive.

THE CONDENSER

The condenser does two jobs. Firstly it reduces the temperature of the cold sink, giving a larger operating temperature range but, more importantly, it provides a near total vacuum. As soon as the piston travels back towards the end of the stroke the exhaust port is exposed. The pressure tries to stabilise and thus the waste low pressure and temperature steam is rapidly evacuated (not sucked out) so there is no 'waste steam' obstruction for the piston returning to the end of the cylinder. With this uniflow system, and the use of mainly drop beat or, to a lesser extent, rotary valves the cutoff could be reduced to low levels giving a massive efficiency boost incorporating high expansion ratios thus making compounding unnecessary. Don't forget, there's a total lack of mechanical loss from any exhaust valve driving arrangement.



ABOVE FIGURE 2
A typical vertical uniflow cylinder.

Stumpf claimed that the high compression ratio, being usually set at 80-90% of the stroke with 10% lead, caused adiabatic compression heating and thus kept the pistons warmer, reducing the cooling effect in the cylinders and giving another gain in efficiency.

The normal means of getting the steam in and out of cylinders is through a single passageway working in a duplex fashion which is subject to vastly fluctuating temperatures of inlet and exhaust. These passageways are usually cast so have rough surfaces increasing heat transfer and resistance to gas flow.

CONDENSATION AND SUPERHEAT

The biggest enemy within the cylinders of any steam engine (disregarding any leakage past the piston plus the minimal loss from glands and valves) is condensation.

Because of this it is important to superheat the steam to ensure it is dry so making it more fluid and, in addition, increasing the hot end temperature. The steam becomes a good insulator further reducing the possibility of condensation. This is illustrated below showing that the heat transfer difference between superheated and saturated steam is considerable:

92W/m²K for superheated steam
1160W/m²K for saturated steam

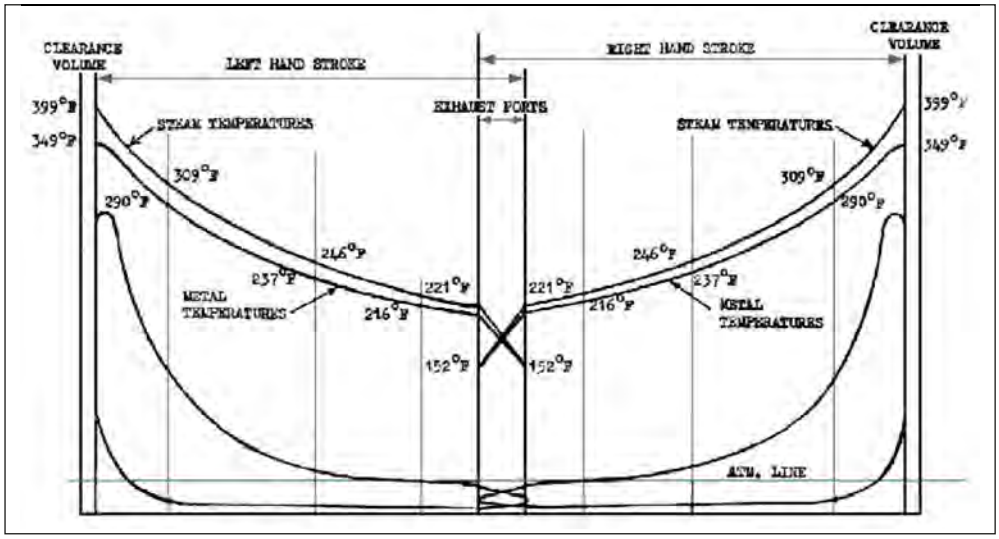
ie. about 12 times less heat loss in pipes and cylinder assembly (the units don't matter – it's the ratio which does).

With figures like this anybody who says superheating makes no difference must have found some magical way round these numbers.

UNIFLOW STEAM CYCLE

Figure 3 shows the indicator diagram of a Uniflow engine and the temperatures of both steam and cylinder (from a 1925 paper by Prof. Charnock).

BELOW FIGURE 3
The indicator diagram for a uniflow engine.



Note that the steam temperature drops from 399°F to to 152°F (corresponding to 230 psi and 3.9psi absolute) along the length of the stroke. So here we can see the actual temperature acting on this cylinder. If this was a conventional cylinder, the cylinder end would have a lower temperature due to the duplex action and it will be obvious that heat and therefore energy will be lost.

One of the problems of the uniflow is also shown in the pressure diagram. The cut-off is very short and therefore the expansion ratio is massive (it can be as high as 35-40:1). Consequently, the area inside the pressure trace which is used to show and calculate the mean effective pressure within the cylinder and, from this, the work done is reduced. The result is that for the same power output the speed of the engine has to be up to 80% faster, forcing the need for a more massive construction to contain the speed.

The steam diagrams indicate an inlet pressure here of 122psi absolute. This would have a temperature of 342°F indicating a small degree of superheating at approximately 60°F – almost nothing at all. Many uniflow engines later worked at up to 1000psi with a high degree of superheat allowing very short cut-offs – 5% was not uncommon – but heavy flywheels were needed to even out the highly differing torque loading which was an inevitable consequence of the design.

THERMODYNAMIC EFFICIENCY

The efficiency of a heat engine i.e. a Carnot cycle engine depends on the difference between the temperature at the hot source and that at the cold sink. Here we are ignoring the considerable losses within the generation of the heat.

The maths runs thus:

$$\text{Efficiency } C = \frac{Ti - Te}{Ti} \times 100$$

where
Ti = Temperature at inlet and
Te = Temperature at exhaust
Temperatures are absolute, ie degrees Kelvin (0K = -273°C or -459°F)

From figure 3, the Carnot efficiency of this cylinder is :-

Ti = 399°F or 477K
Te = 152°F or 399K

$$C = \frac{477 - 399}{477} = 16.4\%$$

Not very good, but with 200°F of superheat at the cylinder the efficiency would rise to 41% but remember it is for the cylinder itself only not the entire system. There are massive losses within the boiler and from the mechanics of the engine itself, although Stumpf claims that mechanical efficiencies of over 90% are possible.

As a comparison a modern power station will have a Carnot efficiency of 57 to 63% with 450°C inlet and 32°C exhaust (723K and 309K) and an actual overall thermal efficiency of 42%. In order to improve efficiency then we need to increase the inlet temperature and/or reduce the exhaust temperature.

However, mobile uniflow engines can be surprisingly efficient. Steam Power Systems in San Diego built a bus to combat pollution laws and a test engine achieved 22% thermal efficiency, and it did 8 miles to the gallon.

It is impossible realistically to reduce the thermodynamic losses – it's just about the laws of thermodynamics and entropy. The jet engine and gas turbine using the Brayton Cycle use half of the power generated by the heated gasses to compress the air into the system! Incidentally, one of the reasons aircraft fly so high is to get up into the cold zones thus reducing the cold sink temperature which improves the efficiency of the engines, and that our cars work more efficiently in winter once they are up to full temperature.

KEEPING THINGS HOT

Stumpf kept his cylinders hot by jacketing and by experimentation found that only the cylinder ends and the first 25-30% of the stroke provided any real benefit, or the jacketing would warm the cold sink. It proved effective but led to the possibility of the piston seizing and so needing generous clearances; some were up to 4mm with the rings providing the seal. Seizing was a problem due to high cylinder temperatures but the danger could be reduced by turning the piston eccentrically after finishing to the bore dimension to provide a bearing land of 90-120°. The result of this meant that the piston rod was not always in the centre of the cylinder! Another way was to use barrel shaped cylinders to allow for the differing expansions of both piston and cylinder, a complex boring process which used water flowing through the exhaust belt and steam through the jacketing! Some engines were not condensing and in these the compression was reduced by 3 methods:

1) Auxiliary valves located in the cylinder ends, either under control or by the piston itself hitting them to open with return springs.
2) Increasing the clearance volume by dishing the ends of the piston inwards to a hemispherical shape.
3) Providing auxiliary controlled and driven exhaust valves (but that defeats the object somewhat!).

Examination of figure 2 shows the controls for a condensing engine with auxiliary valves used to enlarge the clearance volume, which were at times added to enable the engine to run should the condenser fail. The top shows a hand wheel while at the bottom there seems to be some form of bevel gear drive.

Stumpf designed Uniflow locomotives, the first for Russia then, learning from experience, for the Swiss, Northern Railway of France, and German State Railways. After the first examples here more were built indicating some measure of success. Interested parties should be able to download his book 'The Una-Flow Steam-Engine' (mine came via Hong Kong University!).

The situation within our cylinder is dire. The scale factor means the surface area of the cylinder is proportionately far greater than the full size version,

BELOW PHOTOGRAPH 2
A condenser air pump piston, illustrating the kind of relief valves that may be used in a uniflow piston.

increasing cooling, and our superheat is not so good (more of a steam drier) so figures similar to those above should be expected. Thus anything which will allow the cylinder average temperature to be increased is bound to increase the efficiency albeit a small improvement. This is where Watt scored with his separate condenser, which kept the cylinder hot, rather than undergo the constant heating and cooling of the Newcomen engine where the steam was condensed within the cylinder, enabling the atmospheric air pressure to act on the top of the piston to push it down on the power stroke.

INTRODUCING THE ATKINSON VERSION

It seems that Atkinson was quite impressed with the uniflow system and in about 1916 he began experimenting in order to assess the possibility of incorporating it into his lorry designs. However, there were a lot of problems to solve. The stationary uniflow only fully succeeds when it exhausts into a condenser, but in a moving engine a condenser, which by its very nature requires a vast amount of cooling water, is naturally quite impractical. So there's a real problem to solve. Early experimental engines were difficult to turn over particularly at low speeds with light loads. There was a simple reason for this. From Boyle's law we know that volume and pressure are in inverse proportion (when one goes down the other goes up). Suppose the residual pressure in the cylinder after the exhaust port has been opened and closed by the piston is 5psig (non condensing remember). When the piston has moved 50% of the stroke the pressure will double to 10psig. At 75% it is at 20psig, at 87% it's at 40psig, 80psig at 93% and 160psig at 96%! No wonder his engine wouldn't turn over!

In order to solve this problem Atkinson decided to employ a spring mounted relief valve in the piston head, but this caused problems with reliability. Photograph 2, which is of a condenser air pump piston at an exhibition, illustrates the way this must have worked but here the piston is short and the valves work in the opposite direction. Eventually, after a lot of experimentation the final system was adopted. This involved a hollow piston with loose piston ends. These were enlarged automotive type mushroom valves, with a 'V' seat into the piston itself which was guided by a large diameter bore within the piston. Both ends of the piston were connected by three bars passing through holes in it. The bars are longer than the closed length so the pistons opened by about 1/16".

« TO BE CONTINUED »

Building the LNER/BR Y4 in 5" Gauge

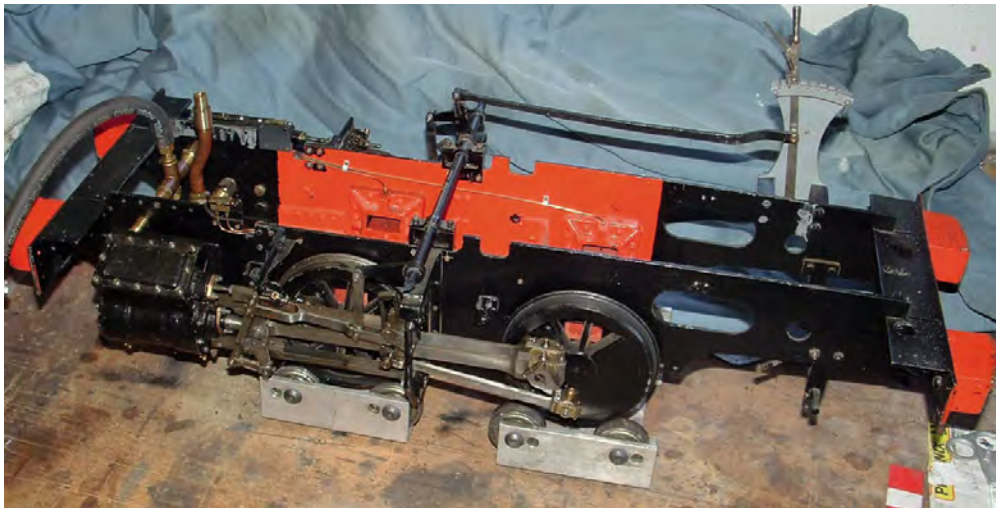
Doug Hewson attaches the smokebox to the boiler and fits the superheaters and the anti-vacuum valve

BY **DOUG HEWSON** CONTINUED FROM PAGE 184 DECEMBER 2016

For some time now I have been trying to catch up with the assembly of the Y4 so I could test it on air. I have finally achieved that goal and it has been sitting on the rolling road for a few days and every time I go in my second workshop I give it a good blast and run it for a while to get it run in a bit. I didn't think it was going to run at all for a start but then I turned the wick up a bit on the compressor and away it went. It took 100 PSI to get it started and I had already put a good slug of oil down the steam pipe. It was very stiff of course being all new but, as someone once said to me, it is no good building them already worn out! After about half an hour it started on 30psi so I was obviously heading in the right direction. I found that I could notch it right up to the slot next to mid gear in both directions so I thought "That will do me". Once it got to starting on 30lb it ticked over very nicely.

FITTING THE SMOKEBOX

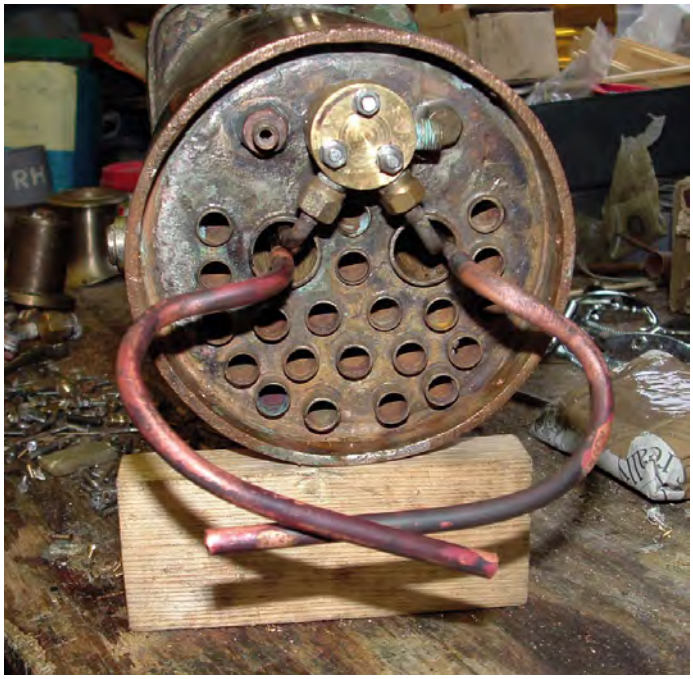
I then decided I would get the boiler ready for going on so I offered the smokebox up and marked around the ring on the rear of the smokebox and drilled eight No. 50 holes. However, after drilling the first hole I removed the smokebox and opened out the top hole to No.43 and then tapped the boiler 8BA so that I could pop in a temporary screw. I did the same at the bottom. I was not intending this smokebox to be interchangeable so I divided the rest up with a flexible steel rule as I thought that would be near enough. However, before I could mount the smokebox permanently, I lengthened the superheater elements with some 7/32" x 18swg copper and silver soldered those in place. It would be better to use ¼" tube of heavier wall thickness but I could not lay my hands on any. You might have to make little brass sleeves to make the pipes a good fit, one on to the other. I began with a 6" length on both elements and I already had a nylon former for making tight bends in the tube but steel, brass or anything solid will do, even wood. The grooves in the former need to be a very good fit for the tube of course. I had to anneal them three or four times before I was satisfied but you should be able to make the bends with thumb and finger. When you offer them up in the flues the tubes need bending so that the flues are not obstructed too much, to make cleaning easier later.



ABOVE
This shows the Y4 on my 'Smith' rolling road on air test.

BELOW LEFT
8BA screws around the smokebox ring to secure the boiler. Note the deep countersinks.

BELOW RIGHT
The copper tubes I used to extend the superheaters to connect to the steam tee in the bottom of the smokebox.



I made sure that the pipes went as near to the inside sides of the smokebox as possible so they were well out of the way. I have attached a photograph which I took after a mad rush but there is still quite a lot to do as pipes need shortening, positions need altering and re-routing to make things clearer but hopefully it will give an idea of what we are aiming for. I was intending to have a little lesson on mass producing union nuts and gland nuts (which are different) but that will have to wait until next time.

Just to enhance the job I decided that I would mount my fire hole doors on the back plate but then realised I had made them the wrong hand as the handle clashed with the regulator so I then had to set to and alter them so that the handle is on the left out of the way. I have included a drawing of how it should be.

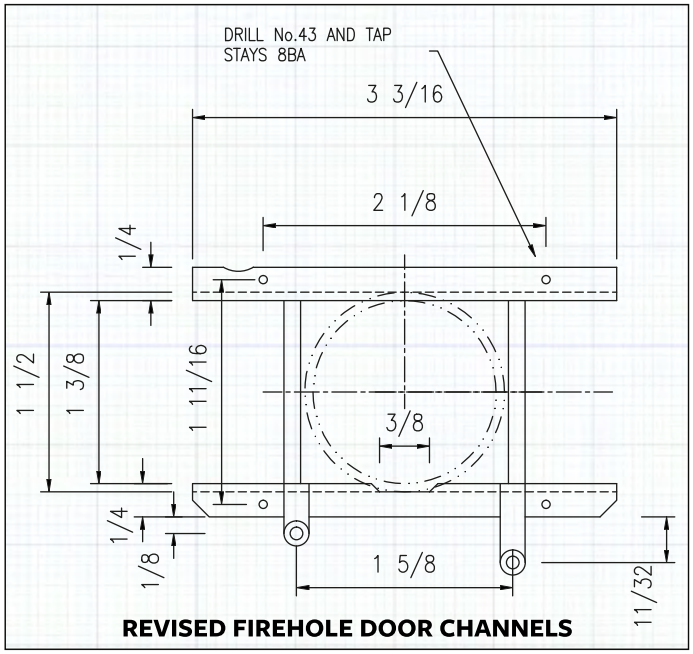
'SNIFTING' VALVE

Another little job I did was to make up what Model Engineers call the 'snifting' valve. The correct name is of course, the anti-vacuum valve. The problem that this little gadget addresses is that, when coasting, and you shut the regulator, ash will get sucked into the blast pipe along with any grit and then down into the cylinders. The anti-vacuum valve prevents this as, when steam is shut off, the valve automatically opens and allows air though the superheaters and into the cylinders. This, of course, also keeps the cylinders warm. When I was an apprentice draughtsman I used to sit on a pile of steel beams during my lunch hour and watch trains. There were no Diesels until the first 08 shunter arrived. Anyway, there was a regular procession of WDs, LNER 01s and 2s running by down the Trent Yard at Frodingham steelworks but what fascinated me was that they all went along going "plop, plop, plop" and I couldn't understand why. It was a bit later in life that I realised this was the valve in the anti-vacuum valve plopping up and down as they sucked air in with the movement

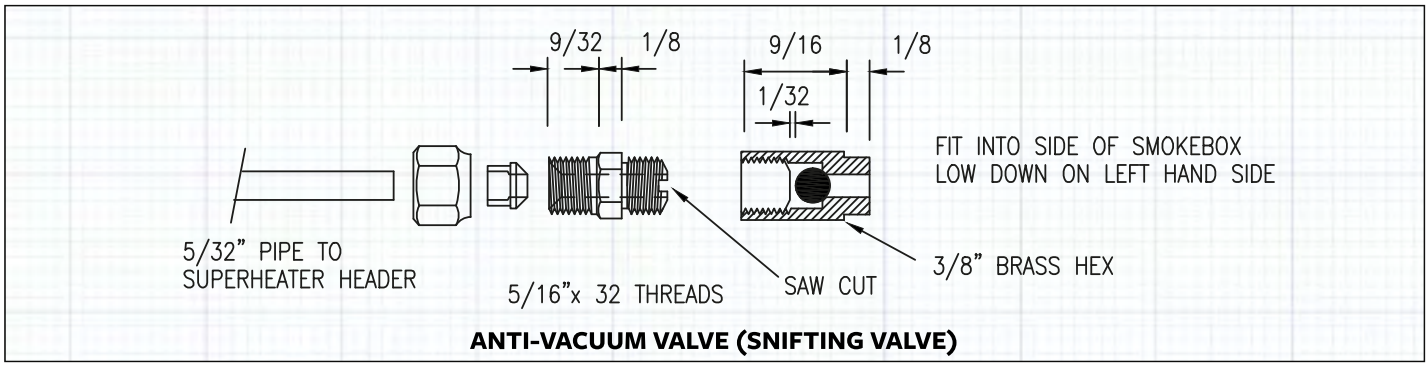
ABOVE LEFT
The tubes partly bent to fit around the inside of the smokebox to keep them out of the way of tube cleaning.

ABOVE RIGHT
These are the fire hole doors once I had re-handed them so that the handle is on the left as it should be.

BELOW
My simple jig for bending the superheater tubes. These were bent round just using hand pressure.



REVISED FIREHOLE DOOR CHANNELS



ANTI-VACUUM VALVE (SNIFTING VALVE)

of the pistons. The K3s and the B1s on the Grimsby Passenger Trains, and K1s all did the same. Wasn't life wonderful then? The problem is that I did not take enough photographs as I supposed they would still be there tomorrow but now they are not!

To make the valve I used a piece of ⅜" brass hexagon, faced the end, centred and drilled down to ½" depth with a No. 31 drill. I also turned the end down for about 3/16" to ¼" diameter and parted off at ¾" long. The valve was reversed in the chuck and the end was faced, centred and drilled down to 11/16" depth with a 7/32" drill. This should break into the first hole so you can then use a D-bit to face the bottom of the hole square. The rest of the hole should be reamed ⅛". You can now tap down to about ⅜" depth with a ¼" x 40 tap. The other half of the valve is made from the same bar so first you need to seat a 3/16" ball on your new seat in the fitting and then measure down to the ball and note the measurement. Turn the brass bar down to ¼" length for the length on your depth gauge, minus 1/32" and then thread it ¼" x 40. When you screw this into the bottom fitting the ball should rattle. You now need to make a saw cut across the end so that the ball will not seat on that part. Part this off at about ½" long. Reverse in the chuck, face the end, centre deeply to form a union and then turn down a ¼" length to 5/16" diameter and thread 5/16" x 32.

To mount the valve you need to drill a ¼" hole in the side of the smokebox about ¾" up from the frame plate top. The valve can be popped into the hole from inside the smokebox so that it protrudes about ⅛", in other words tight up to the inner wall. On the superheater header is a 5/16" x 32 union and this needs a 5/32" copper pipe making with an olive on each end and a couple of nuts of course and it should also run around the inside of the smokebox well out of the way and fix on to the valve. There is no other fixing necessary – it is just a good fit in the side of the smokebox. The inner end of the valve needs to slope down slightly so that the ball drops off the seat when steam is off. These are very distinctive on the GWR and BR Standard engines as there is always a wisp of steam coming up from the valves when the engines are standing in steam. On the BR locomotives the steam issues from just under the platforms above the cylinder blocks.

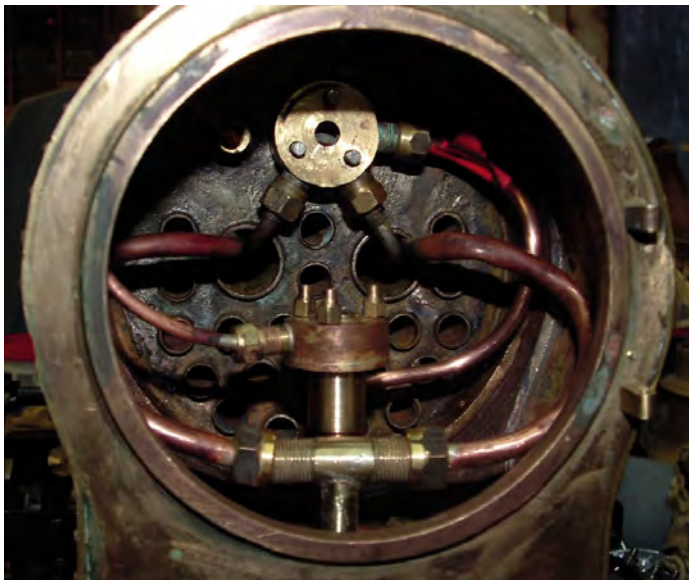
« TO BE CONTINUED »

RIGHT
The completed anti-vacuum valve ready for screwing together.

RIGHT
Fabricating the main steam pipe Tee piece.

BELOW LEFT
The superheaters now with the nuts and cones on ready for fitting.

BELOW RIGHT
The pipework in the smokebox roughly in place to see where things needed neatening up.



The Stumpf Goes Home

An old locomotive meets its maker and pays a nostalgic visit to its home shed

BY **JOHN SPOKES**

I didn't see him coming; preoccupied raising steam, I suppose. "I'll give you twenty shillings and sixpence" was what I heard. Old money, eh, and before I could formulate a witty riposte he followed up with "I'm Syd Bennett". Well, a Henry Morton Stanley meets David Livingstone moment in darkest West Yorkshire! Not so much a tracking down, more of a meeting-up that had eluded me in the eight years that had passed since I bought 'Old Stumpy' from the son of its original owner, the late Jack Pickup. There had been a few near misses during my annual visits to the Harrogate Show, but now forbearance was rewarded.

Jack Pickup envisaged the building of this eighth-scale model of Raven's twentieth Class S2 loco, No 825, in the mid 1980s but the bulk of the four years of intense effort to construct this unique model of a unique prototype was undeniably Mr Bennett's. The durability of the model, which is now a quarter century old, is attestation to Syd's engineering skills. The locomotive was first shown to a wider audience in the display section of the 1992 Midlands Model Engineering Exhibition at Stoneleigh and the challenges of building an engine with Stumpf Uniflow steam distribution were addressed by Jack in the November and December 1993 issues of Engineering in Miniature. There was a concluding article in April 2002 in which he further described the Stumpf, together with its sister model, a conventional S2 with Stephenson's gear. The Stumpf has Walschaerts. Again, Syd was the major participant in the construction of this second engine. Allegedly the two models were built with the objective of comparing performance.

ABOVE
Syd Bennett circa 1992 and the newly completed Stumpf.

BELOW
General View of Blackgates Station at the Summer Rally Weekend of the WRSLS.

I bought the Stumpf a few months after Jack's death. It was shedded, as was its sister, at the West Riding Small Locomotive Society (WRSLS) Blackgates track in Tingley near Wakefield. The paintwork was somewhat distressed and a complete repaint and lining was carried out by Giles Clarke of Lynx Model Engineering. Syd noticed immediately that the green was not exactly pre-WWI

NER and that the colour scheme of the tender framing is not prototypical but irrespective of that it is an impressive machine. In recent years I have added new, larger lubricators (it runs a bit dry, you know), new piston valves (it passes steam a bit, you know), a vacuum brake ejector and brake valve (you really should have some means of stopping, you know) and re-arranged the backhead fittings. Forthcoming work is the re-pinning and re-bushing of the valve gear this winter to recapture timing and hauling power.

The reunion of locomotive, builder and home shed took place at the WRSLS's Annual Rally during the summer. The Tingley track is not the longest the Stumpf has run but it appeals. There has been a very imaginative use of the local topography where there is a slope down across the site. To accommodate manageable gradients the station area, at the higher level, is in a cutting. Adjacent is the large clubhouse and road access to this is at one end of the station, over twin bore tunnels, and a lattice footbridge offers pedestrian access at the other end. The station cutting is intelligently terraced, affording an interesting prospect over the 7¼" ground level line and the raised mixed gauge line, while one can partake of the excellent food prepared in the extensive clubhouse kitchen. Northern hospitality at its best.

From the station the grade falls and swings left into a steepish downhill section that is slightly twisty with two sets of facing points at the bottom. It takes a few circuits to develop the confidence to take this at an appropriate speed because after the short level section, at the nethermost part, the line swings past the 7¼" turntable and steaming bays onto a steep bank which leads back up to the station tunnels. At times Old Stumpy can be a little light-footed and lack of momentum when starting the bank could be troublesome. A feature of the Stumpf system is the exhausting of steam to the blastpipe through a series of annular ports midway along the cylinder. Following the prototype there is an open cylinder drain at this point that bleeds a mixture of steam and lube oil, part of which ends up on the rails. Thus, as the running day progresses, this serves to worsen the problem. A small amount of fine sand applied to the rails was beneficial.

Over the weekend No. 825 ran for a total of 10 hours on public hauling (3 circuits per ride) with 5 different drivers, including Syd Bennett and John Lockwood, the owner of the sister S2. John, who has the experience and knowledge of the track, knew how to drive the locomotive to its optimal performance – no sand for him!

My thanks to WRSLS Chairman David Batty, Syd Bennett and all those at the Blackgates Club for making this such an enjoyable and memorable occasion. I shall definitely be inviting myself back this year. ■

Builder Syd Bennett with John Spokes, the current owner of the Stumpf S2.

Blackgates Station. Old Stumpy departs while on the 5" raised track a Deltic awaits the Right Away.

Syd Bennett prepares to leave Blackgates Station while John Lockwood, owner of the sister S2 locomotive looks on.

The EIM Steam Plant – The Engine

Martin Gearing continues by bringing the main bearing and the port block to size

BY **MARTIN GEARING – PART 2 –** CONTINUED FROM PAGE 203 DECEMBER 2016

MAIN BEARING – ITEM E2

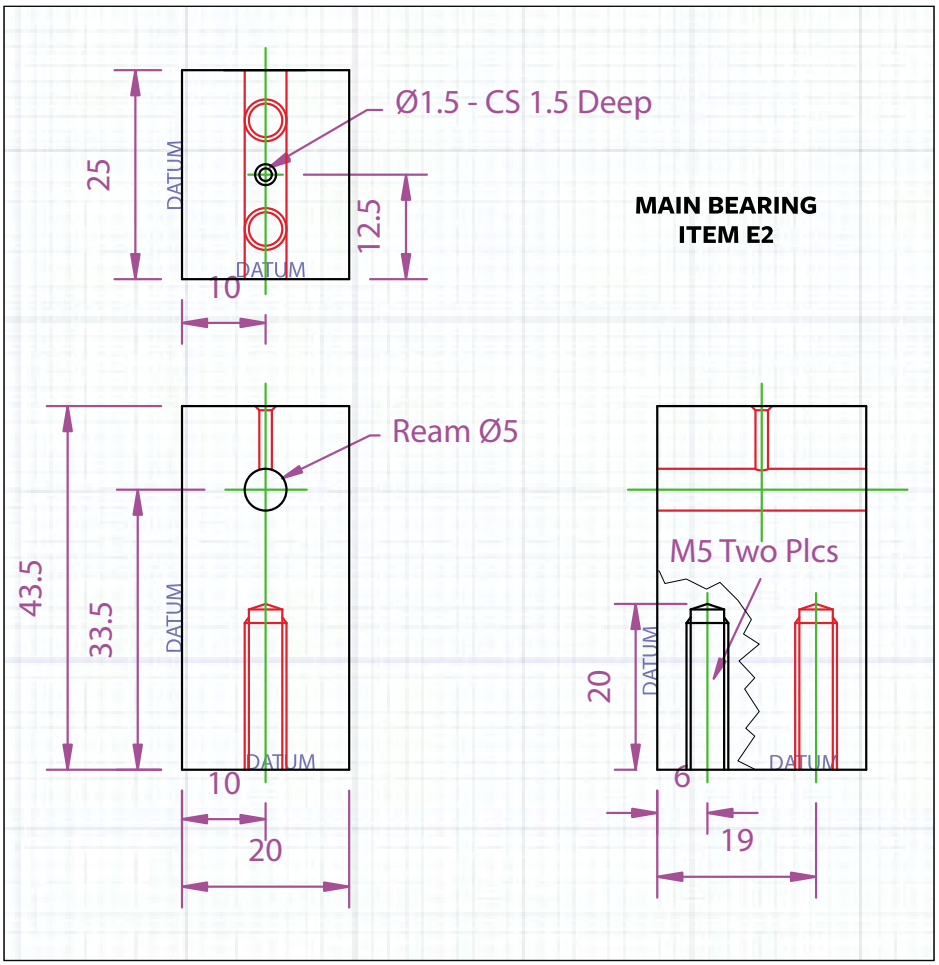
Cast Iron – 20 x 25 x 43.5
from Ø35 x 2"bar
Refer to – Drawing E2.

For this item the thickness dimension also needs machining which wasn't required for the previous blank. And because the material is in the form of a round bar section the circular diameter surface has to be converted into four flat surfaces. The blank is positioned on parallels sufficient to bring the top of the bar about 10mm above the vice jaws and after the vice is tightened the bar is tapped down onto the parallels.

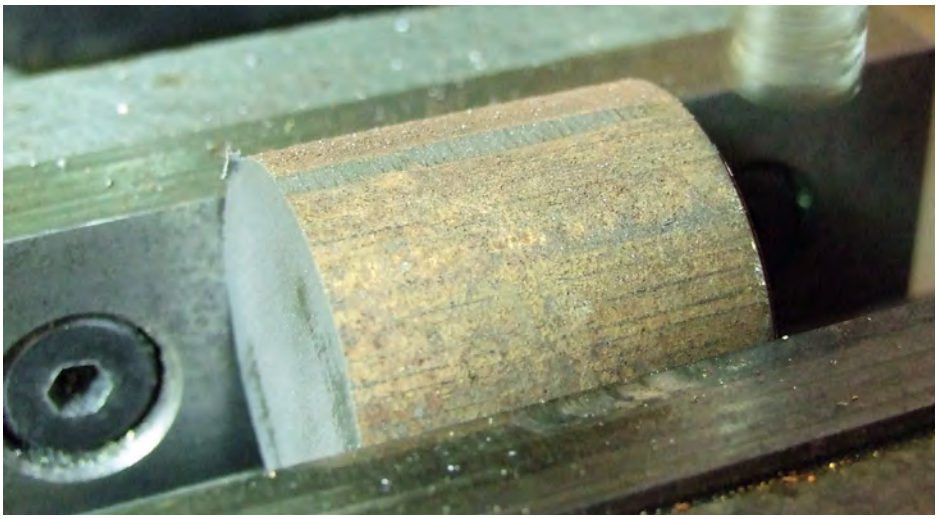
If you have a flycutter now's the time to use it! You can most likely cover the whole width in one pass – provided the head of the mill is set truly at right angles to the X and Y axis. This will mean that you can set the cutter in line with the middle of the blank and will only have to move along the X axis as the work is brought to size. If no flycutter is available then the largest end mill you have available will serve and each face will have to be machined in multiple passes.

Assuming a large end mill is being used, position the blank on the Y axis so that the cutter is central to the blank's diameter at the right hand end of the work. Set the cutter running. Raise the work and adjust its position carefully until the cutter just skims the highest part of the diameter. Zero the Z axis feed dial. See photograph E7.

Move the cutter clear and raise the work 2mm. Now position the rotating cutter on the Y axis so that it's nearer to



BELOW
PHOTOGRAPH E7 – Reference 'witness' mark.



BUILD NOTES

Tolerances for all parts in the article – unless stated otherwise:

- **Non-functional (ie parts not a fit or a match): ±0.1mm**
- **Functional (ie parts having to match): ±0.02mm**

All drawing labels start with the reference letter E.

DOUBLE ACTING OSCILLATING ENGINE – ITEM DESCRIPTION AND REFERENCE

All dimensions in millimetres unless otherwise stated

ITEM No	DESCRIPTION	(Suggested) MATERIAL and BLANK SIZE	No Off
01	Base	48 x 100 x 6.35 CZ121 Brass	1
02	Main Bearing	20 x 25 x 43.5 C. I. (Cast Iron)	1
03	Port Block	17 x 38 x 47 C.I.	1
04	Crank Shaft	Ø5 x 55 Silver Steel	1
05	Crank Pin	Ø4 x 16 Silver Steel	1
06	Piston Rod	Ø4 x 45 – 303 Stainless	1
07	Reverse Valve Lever	(From Ø6) Ø3 x 18 Brass	1
08	Reverse Valve Stud	Ø3 x 20 – 303 Stainless	1
09	Cylinder Pivot Stud	Ø4 x 30 - Silver Steel	1
10	Cyl Pivot Thrust Washer	Ø10 x 2 Brass	1
11	Reverse Valve	Ø17 x 25 Brass	1
12A	Bore Gauge	From Ø¾" Brass	1
12B	Cover Register/Gland Gauge	From Ø¾" Brass	1
12C	Gland Cover Gauge	From Ø10 Brass	1
12D	Fixture Bolt	From Ø10 Brass	1
12E	Captive Nut	From Ø¾" Brass	1
12F	Cover Fixture Body	Ø30 x 25 HE30 Aluminium	1
13	Cylinder Block	20 x 25 x 32 C.I.	1
14	Cylinder Top Cover	20 x 24 x 3.5 C.I.	1
15	Cylinder Rod End Cover	20 x 24 x 4.5 C.I.	1
16	Con Rod Gland Cover	20 x 20 x 4.5 C.I.	1
17	Flywheel	Ø75 x 15 C.I.	1
18	Crank Disc	(From Ø1 ½" x 1"- 303) Stainless Ø34 x 6mm	1
19	Big End	Ø12.7 x 25 LG2 (Leaded Gunmetal)	1
20	Piston	Ø14 x 6 C.I.	1
21	Cylinder Head Plug	M4 x 3.5 Set Screw	1
22	Ø1.5 x 8 Pin x 2	From Stainless 303 Ø1/16" Rod	2
23	Cyl Rod End Cover Bolt	M5 x 10 Bolt - Sundries	4
24	Cyl Head Cover Bolt	M5 x 8 Bolt - Sundries	4
25	Reverse Valve Nut	M3 Nylock Nut - Sundries	1
26	Cylinder Pivot Nut	M4 Nylock Nut - Sundries	1
27	Flywheel Securing Screw	M3 x 5 Grub Screw - Sundries	1
28	Piston O Ring	BS 013	1
29	Connecting Rod O Ring	BS 007	1
Not Shown	Base Securing Screws	M5 CS x 15 Set Screws - Sundries	4

the fixed jaw and cuts a radius of about half the cutter's diameter with its left hand side, so that the cutting forces will be pushing against the bar. Lock the Y axis. Slowly feed the work on the X axis past the cutter until it clears the end, moving from right to left.

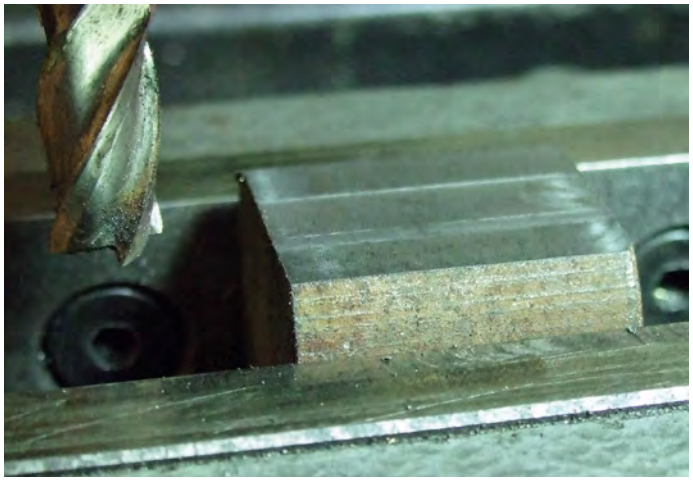
You now need to move the work on the Y axis to position the cutter in the same manner as before so that it is engaged in the work for half of the cutter's diameter on its left-hand side when facing the direction of travel, which will now be from left to right, after locking the Y axis. When the cutter clears the end raise the work another 2.25mm on the Z axis (4.2mm total), reposition the cutter on the fixed jaw side of the work, and repeat the process. This time you may have to take a third pass back down the middle to produce a flat surface.

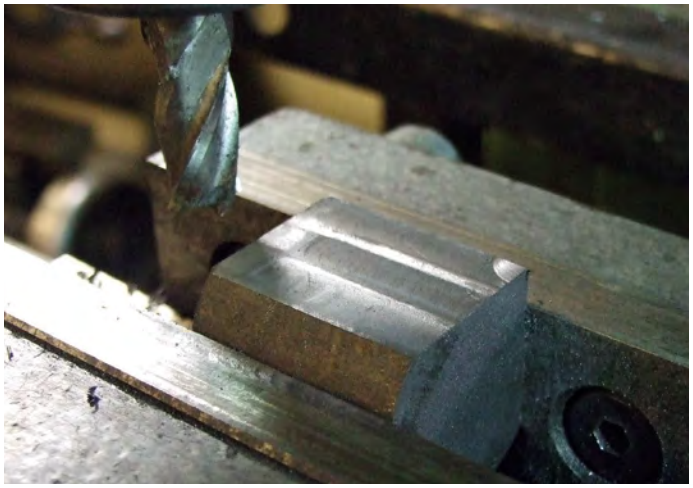
Just remember that in this application for the cutter not to grab the work, the cutting forces must ALWAYS be on the left-hand side of the rotating cutter when looking in the direction of travel. Also, for the cutter to be able to clear the chips easily it should not cut on its side more than three quarters of its diameter or for most purposes be asked to cut more than three quarters of its diameter deep. This usage results in a semi-circular pattern appearing in rows on the work as a surface is produced when it is wider than the cutter being used.

Raise the work a further 2.25mm (6.5mm total). This time, because the surface is now considerably wider than the cutter, you will have to take several passes but provided the work is kept to the left of the rotating cutter at all times no problems will result.

Finally raise the work 0.5mm (7mm total) and remove that amount but feeding slowly so as to produce an improved surface finish. Stop the cutter, remove the work and remove any burrs from the ends with a fine file. This is the first DATUM FACE and should be marked "1" with a permanent marker. See photograph E8.

Clean the vice, parallels and work. Position the blank with the datum face just





produced against the fixed jaw and tighten up - tapping down to hold the parallel. Repeat the process as described for the first face, removing a total of 4.5mm after skimming the top circular surface, in cuts of 2, 2, and 0.5mm. Stop the cutter, remove the work and remove any burrs from the ends with a fine file. This is the second DATUM EDGE and should be marked "2" with a permanent marker. See photograph E9.

After cleaning the vice and work, position the blank in the vice with the first FACE (1) against the fixed jaw slightly right of centre and the second face on the left. Using a try square with its stock held on the bed of the vice pull the EDGE (2) firmly against the blade and tighten the vice. After the vice is tightened carefully check that, as the try square stock is slid across the bed of the vice, the blade contacts the vertical surface of the blank along its whole length; if not, un-clamp the vice and repeat until this is the case.

Start the cutter and position the work by adjusting its position carefully until the cutter just skims the end of the blank. Because the surface area being gripped between the vice jaws is comparatively small, and because of the length of material protruding above the jaws, only small depths of cut should be taken to reduce the risk of moving the blank. Bring the cutter clear of the work, raise the work 0.5mm, and repeat the process used for the previous two surfaces, and machine the end surface. If this cut did not remove all of the saw marks raise the work 0.5mm and repeat machining the end surface until all saw marks are removed, feeding slowly to achieve a good finish. Stop the cutter, remove the work and remove any burrs from the ends with a fine file. Check with a square that this surface is square to the datum FACE (1) and the datum EDGE (2). This is the third DATUM END and should be marked "3" with a permanent marker. See photograph E10.

Clean the vice and work, position the blank in the vice with the FACE (1) against the fixed jaw and the EDGE (2) on the bed of the vice, using suitably sized parallels to raise the work so that between 10 – 12mm is protruding above the vice jaws. Tighten the vice and tap down to the hold parallels.

Skim the cylindrical surface, zero the Z axis dial, raise the work 2mm and machine as before. Stop the machine, remove the work and measure the dimension achieved, subtract 25mm and note the result. Clean the vice, parallels and work, and replace as before. By raising the work remove the amount calculated in steps of 2mm, adjusting the last to leave 0.5mm for a finishing cut. See photograph E11.

Remove the work and measure the width, which should be 25 ±0.1mm, which means any figure between 24.9 to 25.1mm is acceptable. Take off any burrs with a fine file.

Repeat for the thickness dimension of 20mm for which the blank will have to protrude above the vice jaws between 12 and 15mm, with the EDGE (2) against the fixed jaw and the FACE (1) on the bed of the vice using parallels as required. See photograph E12.

Remove the work and measure the thickness, which should be 20 ±0.1mm, which means any figure between 19.9 to 20.1mm is acceptable. Take off any burrs with a fine file.

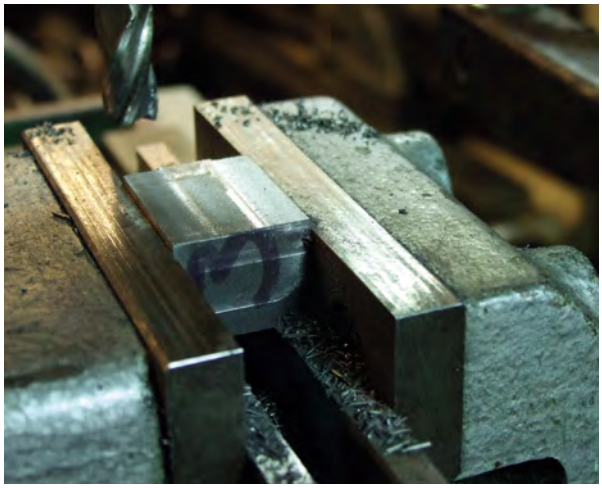
Repeat for the length with the datum FACE (1) against the fixed jaw, and the datum END (3) on the bed of the vice using suitable parallels if necessary. Use a square on the bed of the vice as before to double check the edge datum is vertical before bringing to length. See photograph E13.

ABOVE LEFT PHOTOGRAPH E8
1st Datum – The FACE.

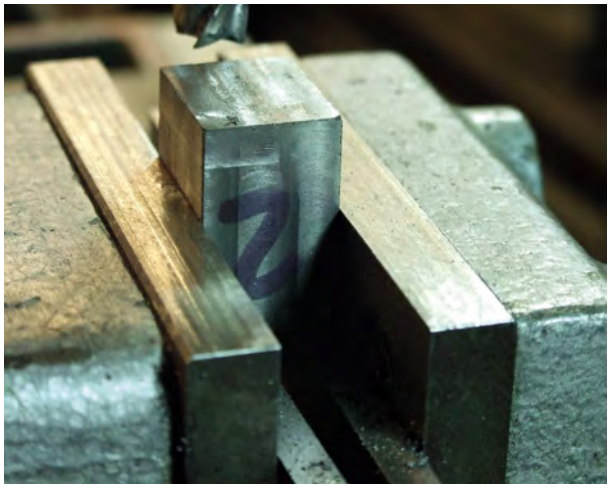
ABOVE RIGHT PHOTOGRAPH E9
2nd Datum – The EDGE.

BELOW LEFT PHOTOGRAPH E10
Setting up to machine 3rd Datum – The END.

BELOW RIGHT PHOTOGRAPH E11
Machining the WIDTH.



LEFT PHOTOGRAPH E12
Machining the THICKNESS.



RIGHT PHOTOGRAPH E13
Machining the LENGTH.

Remove the work and measure the length, which should be 43.5 ±0.1mm, which means any figure between 43.4 to 43.6mm is acceptable. Take off any burrs with a fine file.

PORT BLOCK – ITEM E3

Cast Iron – 17 x 37 x 47
from 50 x 50 x 1"
Refer to – Drawing E3.

All of the stages described previously for preparing the main bearing blank apply to the Port Block, the only difference being that the material supplied is square, to reduce the amount of waste. You might not succeed in holding both parallels firmly when tapping down because of the rough sawn/cast surfaces, but accept the best you can achieve initially.

As before start using suitable parallels by machining the largest face, which will be one of the sawn 50 x 50mm faces, with one of the 50mm x 25mm faces against the fixed jaw, giving you the DATUM FACE mark as ("1")

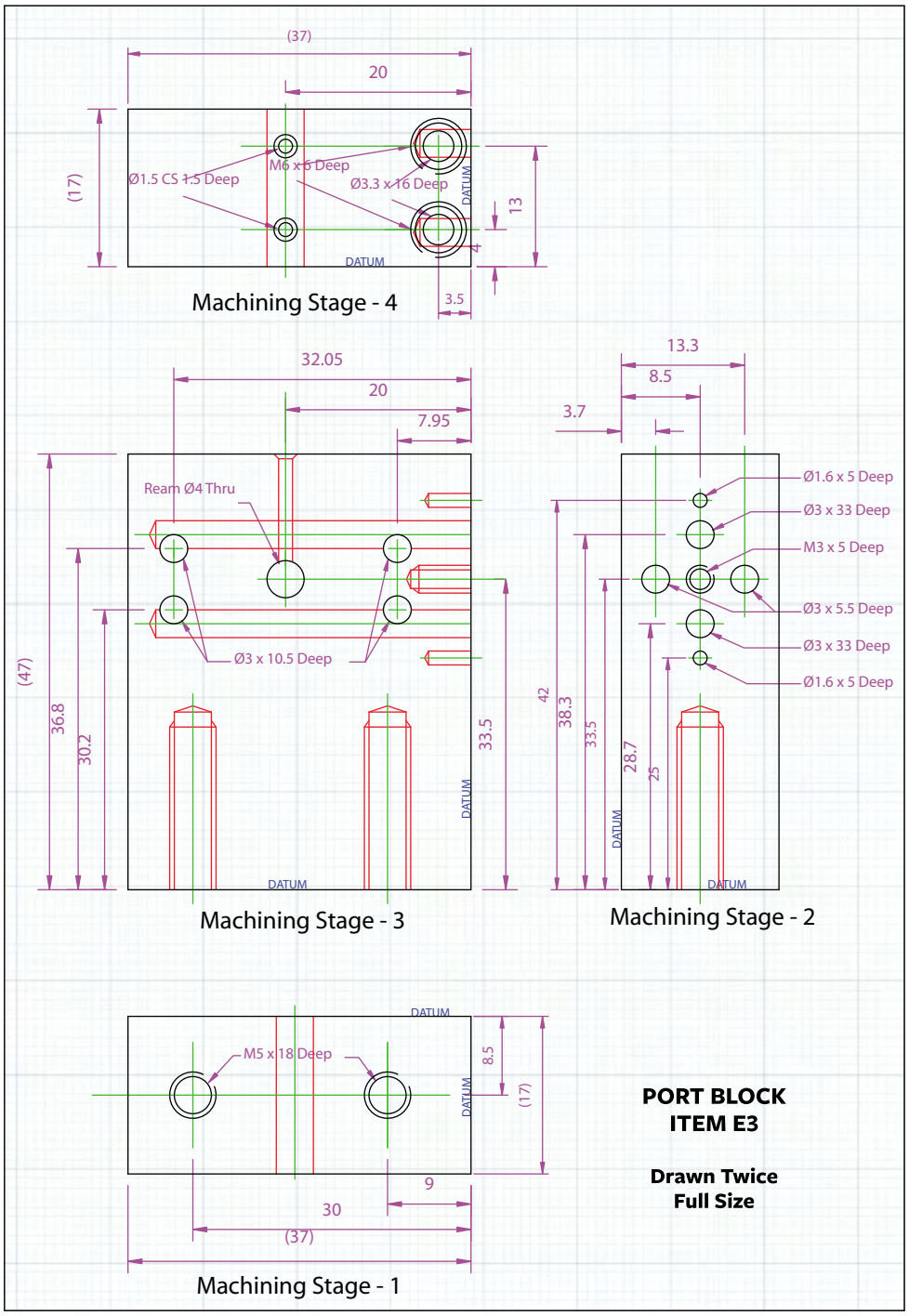
Datum FACE ("1") is then placed against the fixed jaw, and one of the 50mm x 1" faces against the vice bed on suitable parallels to allow machining of the 50mm x 1" face opposite, creating the DATUM EDGE (mark as "2").

Datum FACE ("1") is then placed against the fixed jaw and datum EDGE ("2") checked vertical with a square set against the vice bed, to allow machining of the 50mm x 1" face adjacent, creating the DATUM END (mark as "3").

Having obtained your three datum faces, machine the 17mm thickness, 37mm width and 47mm length. Check each dimension is within tolerance ±0.1mm, and that everything is deburred and cleaned between each machining procedure.

Next time we will tackle the cylinder and cylinder cover.

« TO BE CONTINUED »



YOU CAN SEE THE EIM STEAM PLANT ON OUR STAND AT THE LONDON MODEL ENGINEERING EXHIBITION THIS MONTH

The 21st London Model Engineering Exhibition

John Arrowsmith offers us a preview of this years exhibition at Alexandra Palace

BY **JOHN ARROWSMITH**

With over 50 Clubs and Societies attending this exhibition, combined with over 50 specialist suppliers, the exhibition will provide a complete overall picture of model engineering in the 21st century. Modern technology mixing with the traditional methods of model building will ensure that the 2017 event is packed with hundreds of displays to keep the whole family entertained for hours. Traditional model engineering, steam locomotives and traction engines with collections of scale model ships, through to the more modern equipment and boys' toys including remote control trucks, boats, aeroplanes and helicopters – as previously featured on BBC 'The One Show' – will satisfy that wonderful mix of interests. Visitors to the exhibition can move between the show's different zones, trying out different activities and watching fascinating and varied technical demonstrations.

All the leading suppliers will be present, giving model engineers and hobbyists an excellent opportunity to see and compare many products under one roof. You will be able to purchase virtually anything you need for your next model or project or to get you started in the hobby. The traders appreciate the support they get at this exhibition and are always willing to share information about their products and to offer advice on the suitability of any product for whatever job you have in mind.

LONDON MODEL ENGINEERING EXHIBITION

FRIDAY 20th - SUNDAY 22nd JANUARY 2017

www.londonmodelengineering.co.uk

MINI SHOW GUIDE 2017

Sponsored by
THE MAGAZINE FOR MODEL ENGINEERS
ENGINEERING in Miniature

Presented by
Meridienne Exhibitions

GREAT HALL, ALEXANDRA PALACE, LONDON

PREVIEW OF THE LONDON MODEL ENGINEERING EXHIBITION 2017

We look forward to welcoming you to one of the largest exhibitions of its kind with over 50 clubs and societies present displaying nearly 2,000 different exhibits covering a wide range of modelling interests. In addition to all the displays there will be lots of activity taking place in the Model Active Zone with the extensive Tamiya RC trucks display, Aircraft and Helicopters in the flying zone and other working models.

If you are a modeller yourself you will find over 55 leading specialist suppliers present offering all the items needed for your hobby and you'll be able to purchase virtually anything you need.

This unique display is a result of a tremendous amount of effort from the many hundreds of modellers. Without their very hard work there would be no exhibition and our thanks go to individuals, clubs and societies whose unstinting efforts and generous support this exhibition.

We hope that you enjoy your visit to the exhibition and that you will find something amongst the wide range of models on display to admire. If you're not already a modeller hopefully your visit to this exhibition will fire your imagination to build something yourself and to enjoy one of these satisfying hobbies.

Chris Deith, Exhibition Director

Tickets are available until 12th January via our website or at Alexandra Palace on the day of your visit. See back page for more information.

For all the latest information follow us on Facebook!

10am-5pm Fri & Sat 10am-4.30pm Sun

Last entry Friday & Saturday 4.00pm Sunday 3.00pm.
The Model Active Zone will close at 3.30pm on Sunday.

London Model Engineering Exhibition
@MeridienneEx

SPECIALIST SUPPLIERS

Abbots Model Engineering
Unit D7 Haybrook Industrial Estate,
Halesfield 9, Telford, Shropshire, TF7 4QW
Tel: 01952 879607
Email: peter@ametrains.co.uk
Web: www.ametrains.co.uk
Stand: 73

Allendale Electronics Ltd
43 Hoddesdon Industrial Estate, Pindar Road, Hoddesdon, Hertfordshire, EN11 0FF
Tel: 01992 455921
Email: sales@machine-dro.co.uk
Web: www.machine-dro.co.uk
Stand: 41

BB Engineering Supplies
VMB 18 Bretton Street Enterprise Centre,
Bretfield Court, Bretton Street,
Dewsbury, WF12 9DB
Tel: 07976 539675
Email: bbeng@btinternet.com
Web: www.bbengineeringsupplies.co.uk
Stands: 74 + 75

Beugler Paint Pinstriping Tools (S.Gerber Ltd)
PO Box 183, East Grinstead,
W Sussex, RH19 1DA
Tel: 01342 317363
Email:info@beuglereurope.com
Web: www.beuglereurope.com
Stand: E2

Blackgates Engineering
Unit 1 Victory Court, Flagship Square,
Shawcross Business Park, Dewsbury,
West Yorkshire, WF12 7TH
Tel: 01924 466000
Email: sales@blackgates.co.uk
Web: www.blackgates.co.uk
Stands: 78 + 83

Chalk Garden Rail
4 Brewhouse Yard, Gravesend,
Kent, DA12 2EJ
Tel: 01474 351672
Email: petercgr@btinternet.com
Web: www.chalkgardenrail.co.uk
Stand: 23

Chester Machine Tools
Clwyd Close, Hawarden Industrial Park
Hawarden, Chester, CH5 3PZ
Tel: 01244 531631
Email: sales@chestermachinetools.com
Web: www.chestermachinetools.com
Stands: 32 + 33

Chiltern Model Steam
6 The Pingle, Slitting Mill, Rugeley,
Staffs, WS15 2UR
Tel: 07941 800103
Email: modelsteam@btinternet.com
Web: www.chilternmodelsteam.co.uk
Stands: E3

College Engineering Supply
Barnfield Industrial Estate, Speed Road,
Tipton, West Midlands, DY4 9DY
Tel: 01902 842284
Email: sales@collegeengineering.co.uk
Web: www.collegeengineering.co.uk
Stands: 19 + 20

Component-Shop.co.uk Ltd.
1 Llwyn Bleddyn, Llanllechid,
Bangor, LL57 3EF
Tel: 0845 1309967
Email: info@component-shop.co.uk
Web: www.component-shop.co.uk
Stands: 112 - 114

CuP Alloys (Metal Joining) Ltd.
Unit 36 Matrix Business Centre
Dinnington, South Yorkshire, S25 3QB
Tel: 01909 547248
Email: sales@cupalloys.co.uk
Web: www.cupalloys.co.uk
Stand: 5

DA & BE Murkin
81 Northumbria Road,
Maidenhead, SL6 3DQ
Tel: 01628 548840
Email: mail@letonkinoisvarnish.co.uk
Web: www.letonkinoisvarnish.co.uk
Stand: 80

EMS (International) Ltd
Unit 7, Kingsley Business Park,
New Road, Kibworth, LE8 0LE
Tel: 01162 793035
Email: info@ems-i.co.uk
Web: www.ems-i.co.uk
Stand: 76

Engineering in Miniature
Warners Group Publications Plc,
The Maltings, West Street, Bourne,
Lincolnshire, PE10 9PH
Tel: 01778 392484
Web: www.engineeringinminiature.co.uk
Stands: 6

Greenwood Tools Ltd.
2a Middlefield Road, Bromsgrove
Worcestershire, B60 2PW
Tel: 01527 877576
Email: greenwtool@aol.com
Web: www.greenwood-tools.co.uk
Stand: 12

HJH Tooling Ltd
Unit D2 Southgate, Commerce Park,
Frome, Somerset, BA11 2RY
Tel: 01373 832756
Email: info@hjhtooling.co.uk
Stand: 18

Hafixs Professional Glue
Unit 5, 1000 North Circular Road,
London, NW2 7JP
Tel: 0208 969 3034
Email: sales@hafixs.co.uk
Web: www.hafixs.co.uk
Stand: 17

Home & Workshop Machinery
144 Maidstone Road, Foots Cray
Sidcup, Kent, DA14 5HS
Tel: 020 83009070
Email: sales@homeandworkshop.co.uk
Web: www.homeandworkshop.co.uk
Stands: 72 + 77

Howes Models Ltd.
Unit 16B Station Field Industrial Estate
Rowles Way, Kidlington, Oxon, OX5 1JD
Tel: 01865 848000
Email: radiocontrol@howesmodels.co.uk
Web: www.howesmodels.co.uk
Stands: 8 + 9

JB Cutting Tools
8 Avon Close, Dronfield,
Sheffield, S18 2FL
Tel: 01246 418110
Email: Jenny@JBCuttingTools.Com
Web: www.jbcuttingtools.com
Stands: 24-26

MA Tooling
565-571 Attercliffe Road,
Sheffield, S9 3RA
Tel: 07973 843142
Email: faz-888@hotmail.co.uk
Stands: 100 + 101

Microaces Ltd
14 Alder Hills, Poole, Dorset, BH12 4AS
Email: support@microaces.com
Web: www.microaces.com
Stand: 89

Myford Ltd.
Rockwood House, Caldene Business Park
Mytholmroyd, West Yorkshire, HX7 5QJ
Tel: 01422 885766
Email: myfordinfo@aol.com
Web: www.myford.co.uk
Stands: 66 + 67

Noggin End Metals
83 Peascroft Road, Norton
Stoke on Trent, ST6 8HG
Tel: 01782 865428
Email: mike@nogginend.com
Web: www.nogginend.com
Stand: 90

Organise My Car
2 Avondale Road, Clacton on Sea,
Essex, CO15 6ER
Tel: 01255 318011
Email: info@organisemycar.com
Web: www.organisemycar.com
Stand: 27

Perma-Grit Tools Ltd/Alutight
The Old Forge, Osbournby, Sleaford,
Lincolnshire, NG34 0DN
Tel: 01529 455034
Email: sales@permagrit.com
Web: www.permagrit.com
Stand: 92

Phoenix Precision Paints Ltd.
13 Orwell Court, Wickford, Essex, SS11 8YJ
Tel: 01268 730549
Email: sales@phoenix-paints.co.uk
Web: www.phoenix-paints.co.uk
Stands: 13+14

Pitch Stars Limited
PO BOX 123, Ware, Hertfordshire, SG12 9WG
Tel: 01279 600006
Email: info@pitchstars.com
Web: www.pitchstars.com
Stand: 84

Polly Model Engineering Ltd.
Atlas Mills, Birchwood Avenue
Long Eaton, Nottinghamshire, NG10 3ND
Tel: 0115 9736700
Email: sales@pollymodelengineering.co.uk
Web: www.pollymodelengineering.co.uk
Stands: 46-48

Pop Pop Steam Boats
Blennerhasset Watermill, Blennerhasset
Nr Aspatria, Carlise, Cumbria, CA7 3QQ
Tel: 01697 323523
Stand: E8

Portsonachan Hotel
Portsonachan, Dalmally, PA33 1BJ
Tel: 01866 833224
Email: portsonachan8@aol.com.
Web: www.portsonachanhotel.co.uk
Stands: 16

Power Capacitors Ltd
30 Redfern Road, Tyseley, Birmingham, B11 2BH
Tel: 0121 708 4522
Email: transwave@powercapacitors.co.uk
Web: www.powercapacitors.co.uk
Stand: E1

Process Flows
Sheridan House, 40-43 Jewry Street,
Winchester Hampshire, SO23 8RY
Tel: 01962 835081
Email: ptracey@processflows.co.uk
Web: www.paulthecad.co.uk
Stand: 85

RDG Tools Ltd.
Grosvenor House, Caldene Business Park,
Mytholmroyd, West Yorkshire, HX7 5QJ
Tel: 01422 885069
Email: rdgtools@aol.com
Web: www.rdgtools.co.uk
Stands: 36-39,40+ 45

RSPB
Web: www.rspb.org.uk
Stand: 55

S & M Tools
57 Leather Lane, Hatton Garden
London, EC1N 7TJ
Tel: 0207 831 8366
Email: smtools@hotmail.co.uk
Web: www.smtools.co.uk
Stands: 10 + 11

Solder Connection
Unit 5, Severn Link Distribution Centre
Chepstow, Monmouthshire, NP16 6UN
Tel: 01291 624400
Email: Sales@solderconnection.co.uk
Web: www.solderconnection.com
Stand: E5

Stuart Models (UK) Ltd.
Grove Works, West Road
Bridport, Dorset, DT6 5JT
Tel: 01308 456859
Email: sales@stuartmodels.com
Web: www.stuartmodels.com
Stands: 58 + 59

TEE Publishing Ltd.
The Fosse, Fosse Way,
Leamington Spa, CV31 1XN
Tel: 01926 614101
Email: info@teepublishing.co.uk
Web: www.teepublishing.co.uk
Stands: 1 + 2

The Craftlight Company Ltd
32 Gunton Church Lane, Lowestoft,
Suffolk, NR32 4LF
Tel: 01502 587598
Email: info@craftlights.co.uk
Web: www.craftlights.co.uk
Stand: E4

The LMS-Patriot Project
The Hub, 17 Eastgate Street,
Stafford, ST16 2LZ
Tel: 01785 244156
Email: sales@lms-patriot.org.uk
Web: www.lms-patriot.org.uk
Stand: 68

The Surplus Trader
Stand: 44

Threedy 3d Printers
Puzzle Shed Ltd, 130 Wilbury Road,
Letchworth, Herts, SG6 4JG
Tel: 01462 684648
Email: sales@puzzleshed.com
Web: www.threedyprinters.com
Stand: 52

Tools 2000
Dumblehoe, Lower Letton
Bucknell, Shropshire, SY7 0DS
Tel: 07535 461559
Stands: 21 + 22

Toolstop
16 Great Holland Square
Bracknell, Berkshire, RG12 8UX
Tel: 01344 421718
Email: toolstopsales@aol.com
Stands: 122-125

Tracy Tools Ltd.
Unit 1, Parkfield Ind. Estate
Barton Hill Way, Torquay, TQ2 8JG
Tel: 01803 328603
Email: info@tracytools.com
Web: www.tracytools.com
Stands: 96-98

Traplet Publications Ltd.
Traplet House, Willow End Park,
Blackmore Park Road, Malvern,
Worcestershire, WR13 6NN
Tel: 01684 588500
Email: hello@traplet.com
Web: www.traplet.com
Stands: 49+50

Triple X Trading
Unit 104, 91 Mayflower Street,
Plymouth, Devon, PL1 1SB
Email: triplextrading@gmx.com
Stands: 99

TurboTradeUK
10 Kenmore Road, Wibsey,
Bradford, West Yorkshire BD6 3JH
Tel: 07926 256551
Email: turbotradeuk@tesco.net
Web: www.turbotradeuk.co.uk
Stand: 60

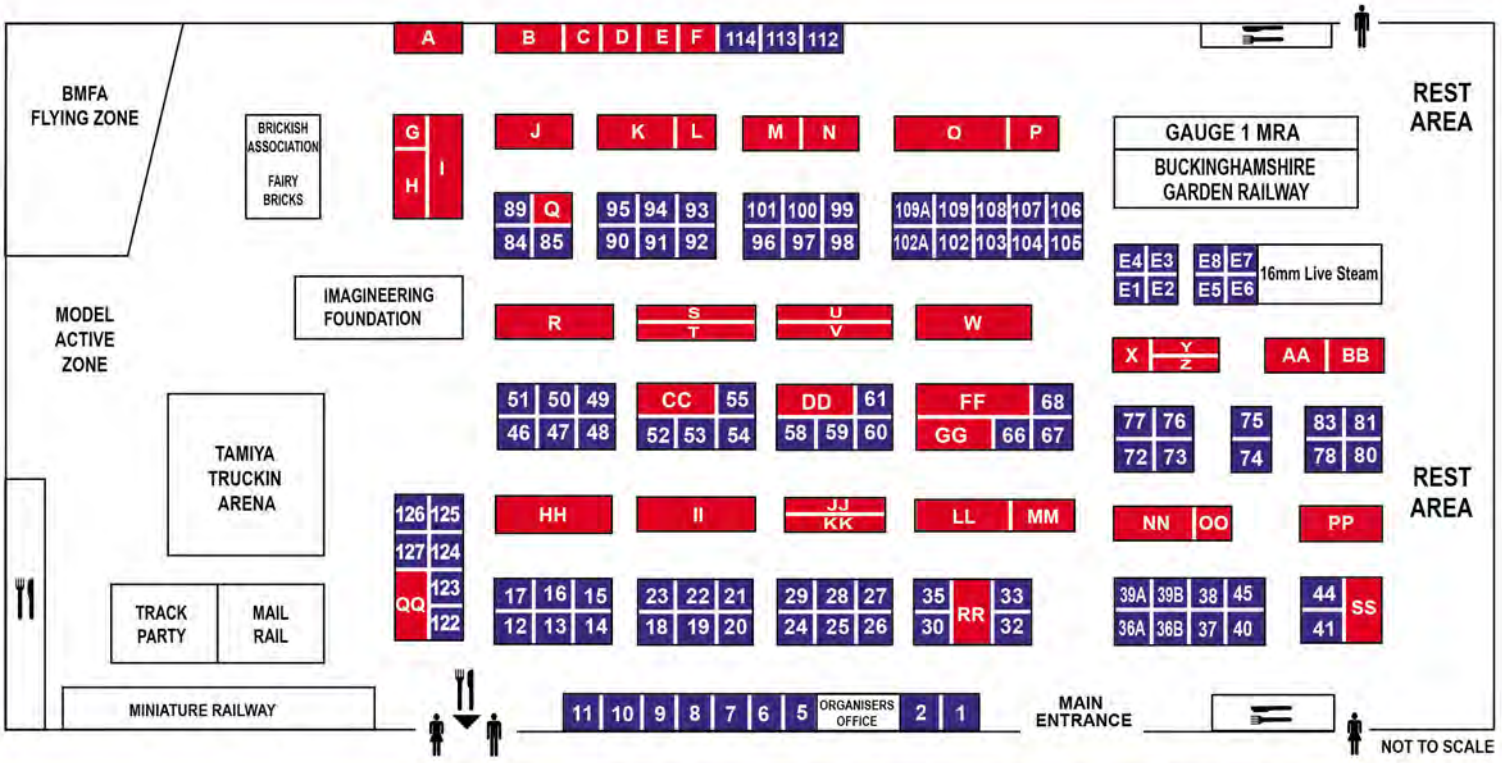
Walker Midgley Insurance Brokers Ltd.
The Balance, Pinfold Street,
Sheffield, S1 2GU
Tel: 0114 2502770
Email: enquiries@walkermidgley.co.uk
Web: www.walkermidgley.co.uk
Stand: 91

Warren Machine Tools Ltd. (Warco)
Warco House, Fisher Lane
Chiddingfold, Surrey, GU8 4TD
Tel: 01428 682929
Email: sales@warco.co.uk
Web: www.warco.co.uk
Stands: 102-109

All information correct @ 08.11.16 but subject to change due to circumstances beyond our control.

We expected more exhibitors to be confirmed over the coming weeks so please check our website for the latest information.

2017 FLOOR PLAN



SOCIETY STANDS, CLUBS & DEMONSTRATIONS

7¼" Gauge Society H
www.sevenandaquarter.org

10¼" Gauge Society R
www.tenquarter.org

Association of London Modellers F
www.londonmodellers.co.uk

Association of Model Barge Owners J
www.modelbarge.info

Blackheath Model Power Boat Club M

Brickish Association MAZ
www.brickish.org

British Model Flying Association MAZ
www.bmfa.org

Broomfield Model Boat Club NN
www.friendsofbroomfieldpark.org/modelboatclub

Buckinghamshire Garden Railway Society "Whiteleaf Light Railway"
www.bgrs.org.uk

Chelmsford Society of Model Engineers I
www.chelmsfordsocietyofmodelengineers.org.uk

Chingford & District Model Engineering Club S
www.chingford-model-engineering.com

East Surrey 16mm Group - Prayle Grove
www.eastsurrey16mmgroup.webs.com

Eastleigh & District Model Boat Club - Junior Section L
www.edmbc.net

Epping Forest Horology Club PP
www.efhc.org.uk

Fairy Bricks MAZ
www.fairybricks.org

Gauge 1 Model Railway Association
www.g1mra.com

Gauge 3 Society X
www.gauge3.org.uk

Hanwell & District Model Society W

Harlington Locomotive Society U
www.harlingtonlocomotivesociety.org.uk

Harrow & Wembley Society of Model Engineers V& DD
www.hwsme.org

Ickenham & District Society of Model Engineers BB
www.idsme.co.uk

Imagineering Foundation MAZ
www.imagineering.org.uk

IPMS Barnet Model Club C
www.ipmsbarnet.co.uk

IPMS Hornchurch E
www.sticky-fingers.org.uk

Kent Model Boat Display Team A
www.kentmbdt.co.uk

Malden & District Society of Model Engineers II
www.malden-dsme.co.uk

Model Hydroplane Club SS

Moorhen Model Boat Club O
www.mmbc.webplus.net

Northern Association of Model Engineers KK
www.normodeng.org.uk

Northolt Model Railway Club T
www.northolt-mrc.org.uk

Old Locomotive Committee (OLCO) OO

OO Live Steam Club B
www.oolivesteam.com

Phoenix Marine Model Club Q
www.phoenixmarinemodelclub.co.uk

Polly Owners Group (Miniature Railway)
www.pollyownersgroup.org.uk

REMAP Y
www.remap.org.uk

Romford MEC AA
www.romfordmec.com

Royal Spithead Review & Keel Historic Harbour CC

Society of Model & Experimental Engineers (SMEE) FF
www.sm-ee.co.uk

Southern Federation of Model Engineering Societies Z
www.sfmes.co.uk

St Albans & District Model Engineering Society LL
www.stalbansmes.com

Steam Apprentice Club (SAC) G
www.ntet.co.uk/sac

Surface Warship Association K
www.surface-warships.org.uk

Sussex Miniature Locomotive Society JJ

Tamiya Truckin MAZ
www.tamiyatruckin.org.uk

The Model Railway Club P
www.themodelrailwayclub.org

The Society of Ornamental Turners MM
www.the-sot.com

UK Tank Club QQ
www.uktank.org

Victoria Model Steam Boat Club N

Welwyn Garden City Society of Model Engineers HH
www.wgcsme.wordpress.com

West London Meccano Society GG
www.wlms.org.uk

West Middlesex Scale Model Club D
www.middlesexmodellers.co.uk

SPECIALS

Mail Rail at The Postal Museum MAZ
www.postalmuseum.org.uk

Bluebird Supporters Group RR
www.bluebirdsupportersclub.com

Track Party MAZ
www.trackparty.co.uk

MAZ = Model Active Zone

follow us @MeridienneEx

join us London Model Engineering Exhibition

Travel Information

Alexandra Palace is located in North London and is easily accessible by car and public transport. Alexandra Palace is in the middle of a park; a beautiful location with wonderful views across the city.

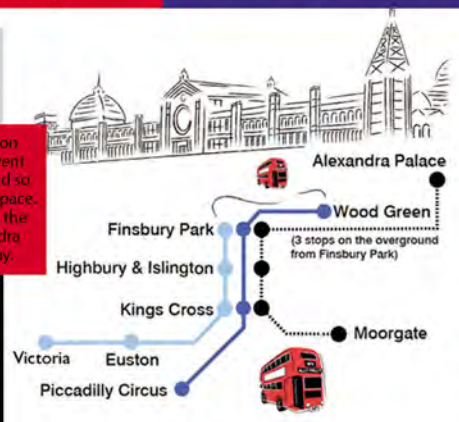
Venue:
Alexandra Palace Way,
Wood Green,
London, N22 7AY

BY CAR

There is free parking at Alexandra Palace offered on a first-come-first-served basis. However, these car parks do get full very quickly. We strongly advise that where possible you visit the show by public transport.

Alexandra Palace is situated:
1 mile from the North Circular Road (A406)
5 miles from the M1 (Junction 2)
8 miles from the M25 (Junction 25)
Major roads are signposted to Alexandra Palace.
Enter postcode N22 7AY into your SATNAV.

There is an increased provision for disabled spaces for this event however this is in high demand so please arrive early to secure a space. A courtesy bus operates from the paddocks car park at Alexandra Palace from 8.15am each day.



BY BUS

The W3 bus runs from Wood Green and Finsbury Park Station & will take you to the Alexandra Palace Palm Court entrance.
The W3 runs every 5-8 minutes on Friday, 6-10 minutes on Saturday and 9-12 minutes on Sunday.
If you are travelling from North London the 184 towards Turnpike Lane Station stops at Alexandra Palace Station.
The 184 runs every 7-11 minutes Monday to Friday, 6-10 minutes on Saturday & 10-12 minutes on Sundays.

BY UNDERGROUND

To plan your journey please visit www.tfl.gov.uk

Finsbury Park - on the Victoria Line & Piccadilly Line - When you arrive at Finsbury Park take the W3 bus towards Nothumberland Park. Get off at Alexandra Palace Palm Court. This takes you directly to the main entrance of the show. The W3 runs every 5-8 minutes Monday to Friday, 6-10 minutes on Saturday and 9-12 minutes on Sunday.

Wood Green – on the Piccadilly Line - is the nearest underground station. When you arrive at Wood Green take the W3 bus towards Finsbury Park Station. Alternatively take the free shuttle bus service to the show. The W3 bus runs every 4-7 minutes Monday to Friday,
12 minutes on Saturday & 9-12 minutes every Sunday.

BY SHUTTLE BUS

Free Shuttle Bus from Wood Green Station & Alexandra Palace Station
This bus is on a constant loop and takes you directly to the show.

BY RAIL

Alexandra Palace has its own British Rail Station (Alexandra Palace Station). A regular train service runs direct from Moorgate (weekdays only) or from Kings Cross, changing at Finsbury Park.

Once you get off at Alexandra Palace you can take the W3 bus or the free shuttle bus service to the show. Alternatively, you can walk (15-20 minutes) directly to the venue.

To plan your journey please visit www.nationalrail.co.uk

Please see our website for more detailed travel information or visit www.alexandrapalace.com

BOOK YOUR TICKETS NOW

TICKET	ONLINE TICKETS*	FULL PRICE TICKET**
Adult	£10.50	£12.00
Senior Citizen/Student	£9.50	£11.00
Child (5-14 yrs)	£3.00	£4.00

* Tickets are available via our website at discounted prices until 12th January 2017.
** Full price tickets are available on the day from the ticket office.
All advance ticket sales close on 12th January 2017. After this date tickets are available on the day you visit the exhibition. All tickets are sent via Royal Mail for this exhibition once your order is processed. All tickets are despatched by 13th January 2017 at the latest.

Cash Box opens at 9.00am each morning before the event opens at 10.00am
Last entry is 4.00pm Friday and Saturday and 3.00pm Sunday.
Model Active Zone closes at 3.30pm on the Sunday.

Essential Visitor Information

All exhibitors and attractions are subject to change but are correct as at date of printing for this magazine in mid November 2016.

Cash Machine
This is located in the Palm Court area by the main entrance to Alexandra Palace.

Cloakroom
This is situated in the Palm Court area.

Courtesy Buses
This service is in operation between the paddock car park and the main entrance as well as the two nearby railway stations.

First Aid
If you require first aid please see any member of our security staff who will contact the duty medic.

Lost Property
Please go to the TEE Publishing stand to report any lost or found property or contact any member of our security staff.

Organisers Office
Located with the TEE Publishing bookstand – stand numbers 1 & 2.

Parking
Parking is free to all visitors and disabled parking is available on a first come first served basis.

Location
Alexandra Palace, Alexandra Palace Way, Wood Green, London N22 7AY.

Places to Eat and Drink
Numerous restaurants and bars are available. The main bar is within the Palm Court area and the main seated restaurant is the Palace Suite which is located on the lower ground floor. There are also numerous outlets within the Great Hall to cater for all your needs.

Smoking
Alexandra Palace is strictly a no smoking venue in compliance with regulations. Please ensure you are outside of the building if you wish to smoke.

Toilets
Ladies and Gents facilities are located in the following areas: Palm Court, Great Hall and Palace Suite Restaurant area.

Book your tickets at www.londonmodelengineering.co.uk

All details correct at time of going to press. Subject to change. Please check website for up to date information. Errors and omissions excepted.

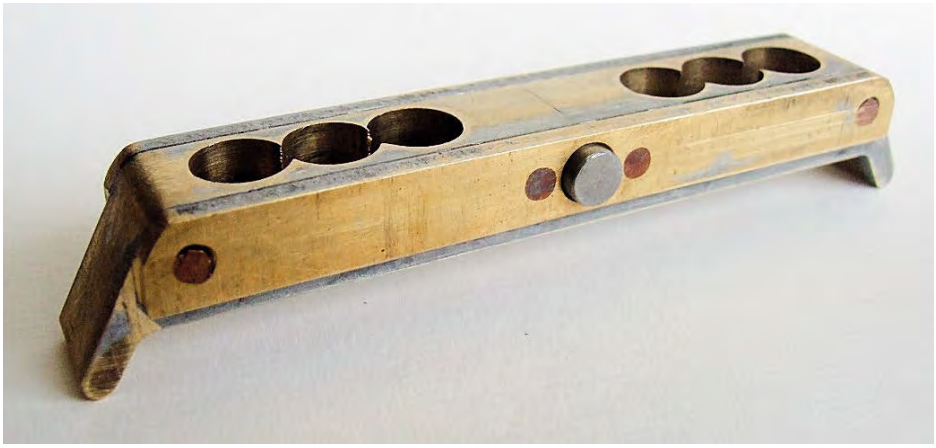
Building the LNWR Coal Engine in 5" Gauge

Hotspur describes the oil feeds to the rear axle

PART 11 – CONTINUED FROM PAGE 200 DECEMBER 2016

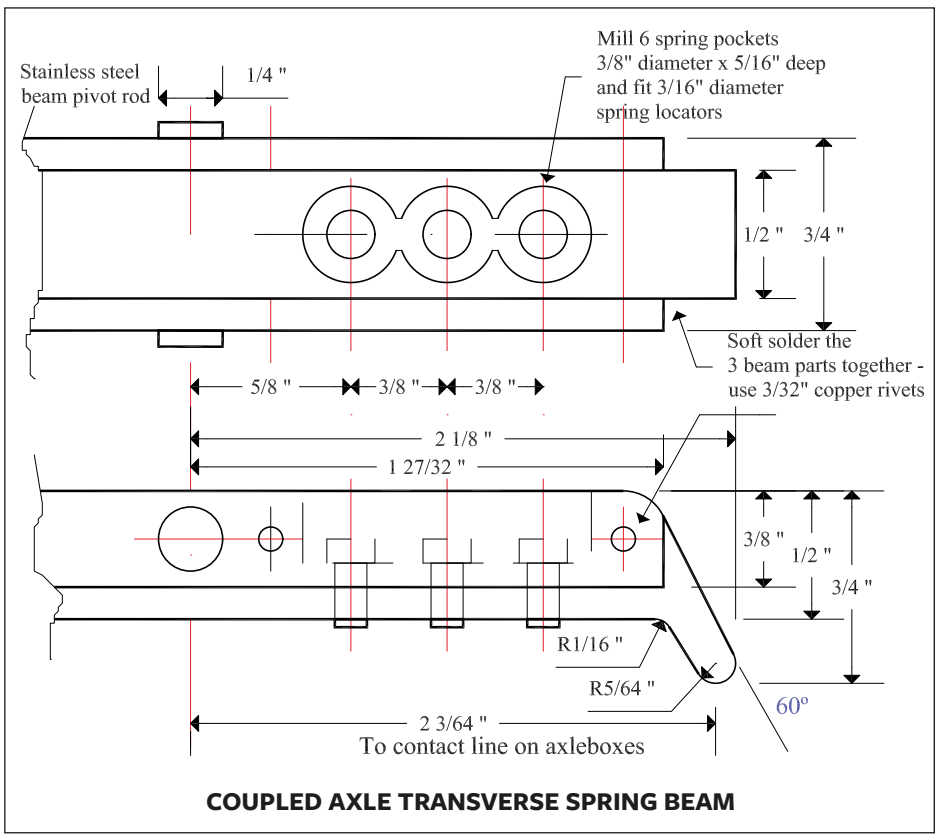
CHANGES TO THE SPRING BEAM

Followers of L&NWR locomotives will know that those built in the 19th century had a virtually flat cab floor which was unimpeded by the suspension parts for the rear axle. Many other railways had engines where all sorts of springs and plates were poking through the cab floor to hinder the driver and fireman. The L&NWR got around this problem by using a transverse stretcher between the frames which housed a beam, the ends of which rested on the axleboxes. Inside this beam there were pockets that held volute springs to give the axle its suspension. These springs were almost like pieces of rolled up strip in a conical outline and were not just simple coil springs which would not have been strong enough. This same design of spring was used on the buffers. All the early locomotives such as the Jumbo family, the Lady of the Lake Class and these Coal Engines had this arrangement.



ABOVE PHOTOGRAPH 1
The revised spring beam design that allows the fitting of the oil pipes.

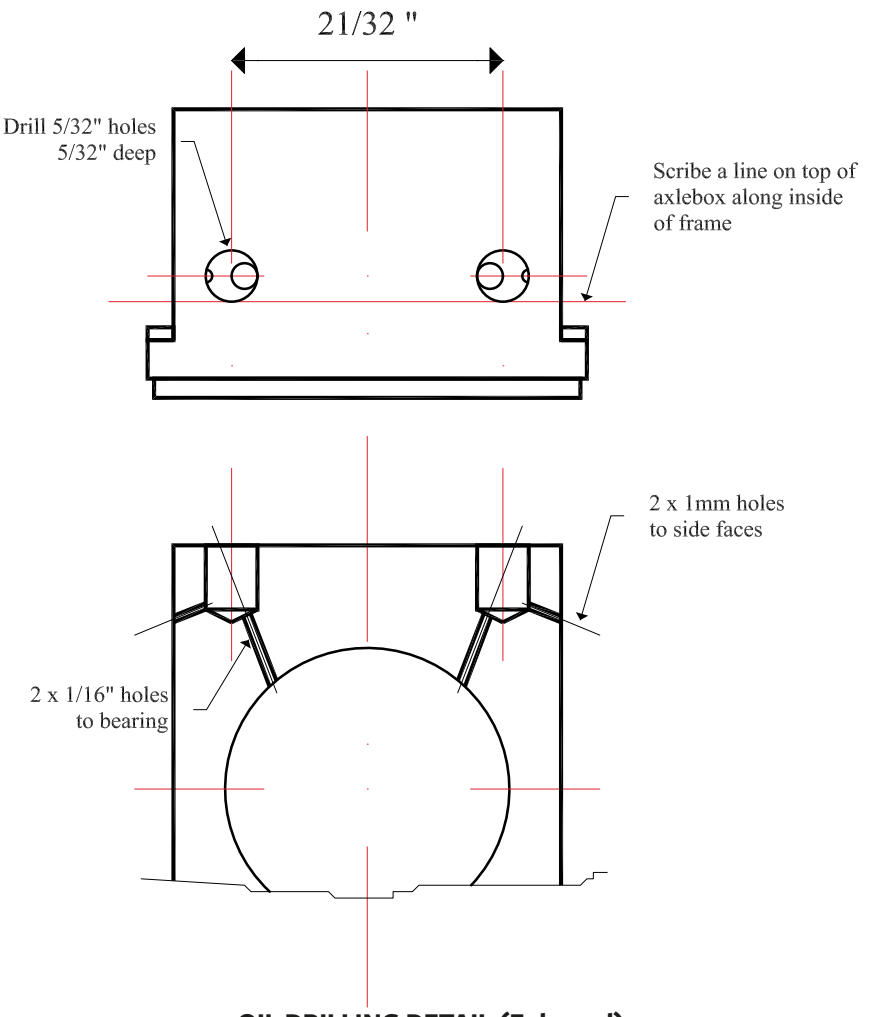
Readers from my original Coal Tank series may remember the way the rear coupled axle was also sprung using a transverse beam under the footplate to bear on the axleboxes. On my earlier model I shaped the tops of the rear coupled axleboxes and produced a curved land for the spring beam to sit on. This was not very helpful in offering proper lubrication for the shaft journal and the hornblock sides so I am now taking advantage of the addition of the oilboxes to suggest a modified design. The spring beam will sit directly on the flat top of the axlebox and the width of the beam that fits between the sides of the same design of rear stretcher is made up from a sandwich of brass parts. My drawing shows this arrangement and the shorter outside plates allow clearance at each end where we need the oil pipes from the cab oil boxes to pass down alongside the beam. The beam is easily made from a piece of 1" x ½" wide stock brass bar milled away to form the contact pads, with two strips of ⅛" material soft soldered to each side and held in place with ³⁄₃₂" copper rivets. There are six spring pockets shown but not all of them have to be used.



COUPLED AXLE TRANSVERSE SPRING BEAM

DRILLING FOR THE OIL PIPES

Positioning the oil boxes on the inside face of the cab side sheet is simple enough and the centre line can be gauged from that of the rear stretcher. Place the oil box on the inside of the cab side casing and mark off the two 10BA bolt holes with the oil box



OIL DRILLING DETAIL (Enlarged)

positioned level with the top face of the inside of the cab wheel splasher. Mark off the position for the oil pipes on the stretcher plate and centre drill the two holes at 2 1/32" centres. Remove the rear coupled axle stretcher frame and make two holes for the pipes at the pitch stated adjacent to the edge on each side. These just need to be clearance holes for the copper tubes and I have suggested using a number 40 drill. However, it is best to source your copper pipe and choose the drill size to suit. I find the small size copper pipe available from Polly Model Engineering in Nottingham to be ideal for these applications as it bends so easily (usual disclaimer).

Silver solder two lengths of copper pipe to the oil box unions. Here I use the smallest diameter silver solder wire. Do check that the solder has not blocked the pipe. If it has, it is a simple matter to hold the union in a 3-jaw chuck and re-drill the 1 mm hole. I found that the pipes needed to be about 2¼" long when straight, but a little extra to be sure initially is a good idea. Fitting the oil pipes needs care as we do not want the rise and fall of the rear axleboxes or the spring beam to distort them in service. To ensure the oil drips down effectively put a 45 degree angle on the bottom of each oil pipe and do clean off any soft copper burrs that are made both outside and inside. I tested the flow through from the oilbox and pipes before fitting them to the chassis and using normal thin lubricating oil worked well. Steam oil is not appropriate here.

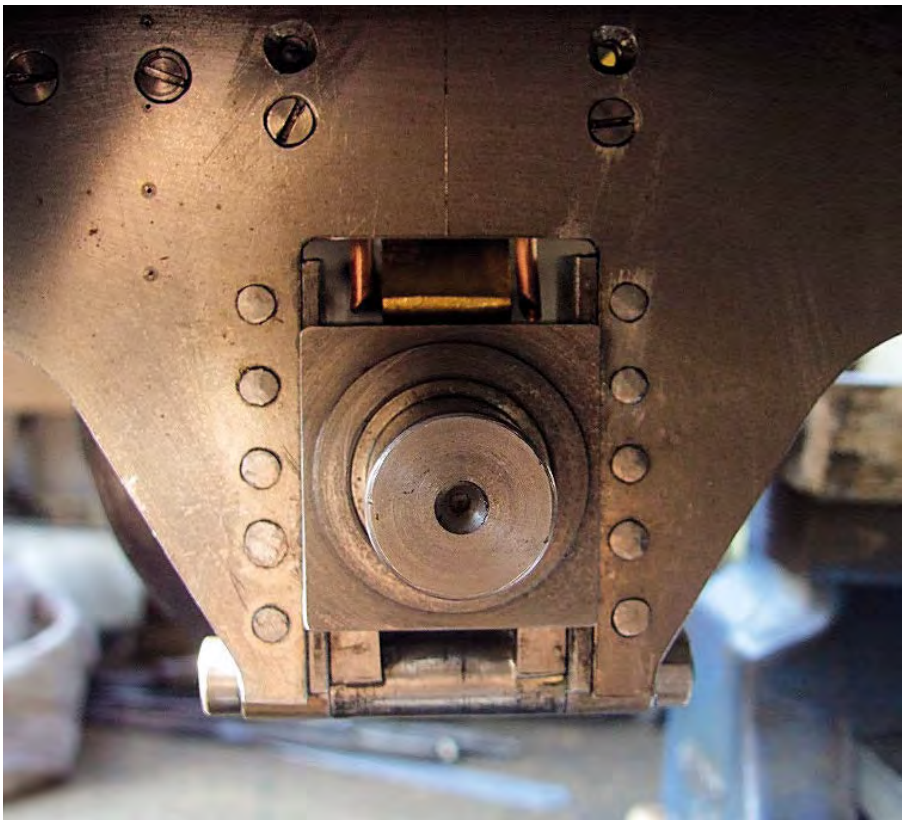
For the lubrication paths themselves I have shown how the oil feed holes should be made in the revised axlebox design. Start by marking out and drilling the shallow oil holes in the top face of each axlebox. The bearing supply hole is the larger drilling and a small centre mark for the oblique hole to the journal can be made on the drill point angle. Take care to clean off any burrs left in the axlebox bores. The drilling for the slideway lubrication is at a shallow angle and needs care when marking out and drilling through from the outside into the feed hole as the point of the small drill could jam. My drawing shows a nominal angle for these holes and I usually put some shallow oil grooves on the sides of my axleboxes to encourage the oil to disperse from the small hole. I did one axlebox and put some drops of oil into it from my 3-in-1 can. To my delight most of the oil reached the bearing and the rest came down the channels made in the side faces so I think I have got the angles and flow passages right.

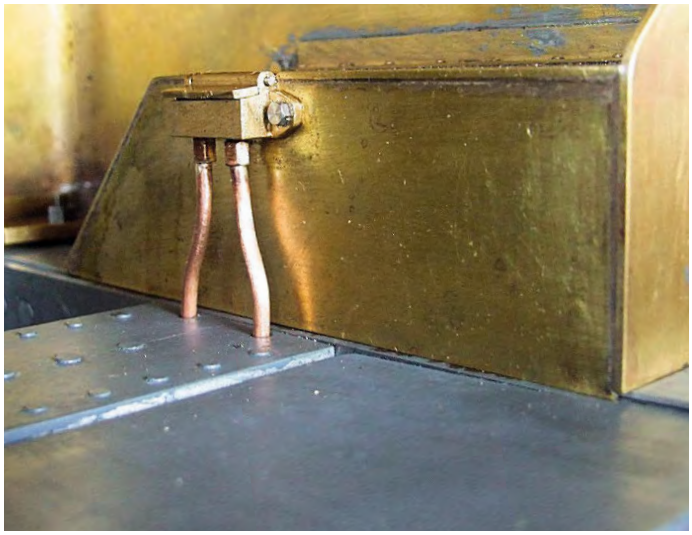
It follows that the two oil pipes will need to be splayed outwards to pass through the access holes in the stretcher before the oilbox is fitted to the cab side face. I used 10BA steel bolts with brass nuts on the inside to counteract any subsequent likelihood of corrosion. The axle assembly has about 5/16" total vertical movement and I would expect the axlebox to rise only half of this in service. So arrange for the angled end of the oil pipes to be say 3/16" above the top face of the axlebox when the wheels are right down.

Next time I will describe the final details for the cab sanding fittings.

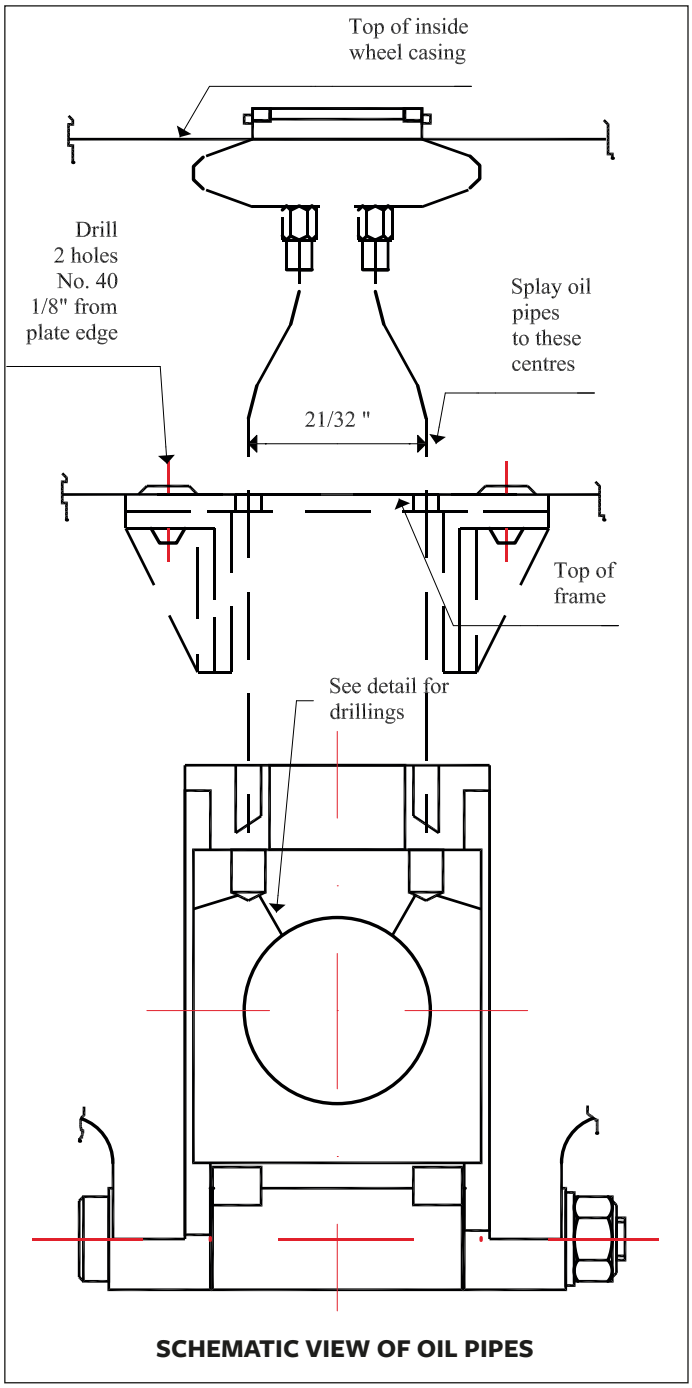
« TO BE CONTINUED »

BELOW
PHOTOGRAPH 2
The two oil pipes just visible either side of the transverse spring beam.





ABOVE
PHOTOGRAPH 3
The lubricating oil box with its pipes fitted to the right hand side splasher casing.



SCHEMATIC VIEW OF OIL PIPES

Dual Purpose Coaches

Jan-Eric goes on to complete the roofs and starts to add various details to his coaches

BY **JAN-ERIC NYSTRÖM – PART 2 –** CONTINUED FROM PAGE 197 DECEMBER 2016

FORMING COMPOUND CURVES

Perhaps one of the most distinguishing features of our railway coaches is the compound curving of the roofs above the vestibules. Such curves can be formed in metal by cutting narrow strips and then soldering or welding them together – something I contemplated only briefly. However a simpler solution was to use expanding urethane foam, of the type used for caulking in buildings, and shape that to the proper curve.

So I bought a couple of cans of this material, which was not very expensive (about 5 pounds per can), and filled the spaces to be formed into the roof curves. The foam expanded and hardened rather slowly so I decided to leave it overnight. I was rather surprised in the morning to see how much it had expanded in twelve hours (photograph 13)! A lot less of the foam would have sufficed.

As I cut into the foam to form the roof curve I noted that it had not hardened completely, leaving voids (photograph 14), so I had to add more foam in the empty space. After another overnight wait I was able to start cutting the now sufficiently hardened foam to shape with a hand-held hacksaw blade (photograph 15).

RIGHT PHOTOGRAPH 13
A slight overdose of urethane foam resulted in these "monster poodles".

BELOW LEFT PHOTOGRAPH 14
The foam did not harden uniformly; there were voids which had to be patched with additional foam.

BELOW CENTRE PHOTOGRAPH 15
Cutting and shaping the foam with a hacksaw blade.

BELOW RIGHT PHOTOGRAPH 16
The heap of shavings which resulted from shaping the compound curves of the rooftops.

For anyone planning to make a compound curve roof like this one I'd suggest using foam board instead of foam from a can. Foam board pieces can be hot-glued together and shaped immediately, thereby eliminating the waiting time I experienced. Note, use urethane foam board, not styrofoam. The latter is not suitable because it is granular, crumbles easily, and is dissolved by many glues and paints.

Anyway, despite the slight setback, I was finally satisfied with the roof shape after shaving off quite a lot of the foam, as seen in photograph 16.

FIDDLING ON THE ROOF

The next task was to smooth out any irregularities in the foam and cover the screws in the sheet metal. A piece of non-woven, synthetic fabric, "geotextile", of the type used when growing strawberry plants in the garden, was spread over the roof and held in place with many pieces of masking tape. The material conformed well to the curves of the roof since it stretched easily in all directions. Using some old, leftover paint as a "glue", I attached the textile to the roof (photograph 17).

However, if you use paint as a glue I suggest you use a paint shade which is closer to the final roof colour than I did. A deep scratch on my black roof will cause the white undercoat to show through as an unsightly white gash. Instead of paint, you can of course use any type of glue that you find suitable for the purpose. The textile did wrinkle considerably when wetted by the paint so I had to fiddle with the masking tape for quite some time to re-stretch the fabric and get all the wrinkles out.

In order to avoid similar problems I would suggest that you make a test first with a piece of the textile and the adhesive of your choice.

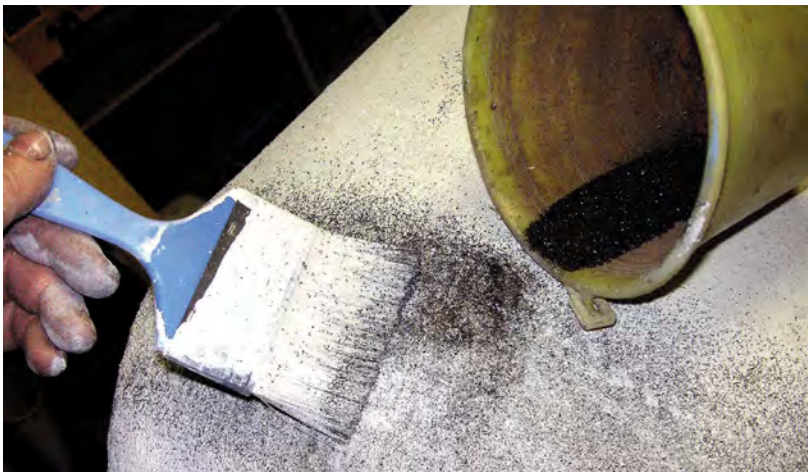
The next step was to simulate the sand – what better way than using real sand! I had a few pounds of fine blasting sand and noted it was pretty much in scale with the coarse sand of the prototype so I just brushed on some of that while the paint was still wet (photograph 18). The sand adhered nicely and evenly to the tacky paint. Additional coats of paint will still be needed, to firmly attach the sand grains to the roof.

THE SMALLER DETAILS

Now, it was time to do the window frames and sills. I chose simply to make them out of cardboard. For the thinnest, decorative moldings around the windows and doors I used strips cut from index cards (photograph 19) while thicker cardboard was used for the sills and door frames (photograph 20). If there is a possibility that your coaches may get wet it might be a good idea to choose a waterproof material instead of cardboard, for instance the type of plastic styrene sheet used by model builders in smaller scales. This material is often available in hobby shops catering for HO railway and aeroplane modelers. Since I only run my trains in fair weather, and the cardboard strips will all be painted with oil-based paint, I felt that cardboard would be satisfactory.

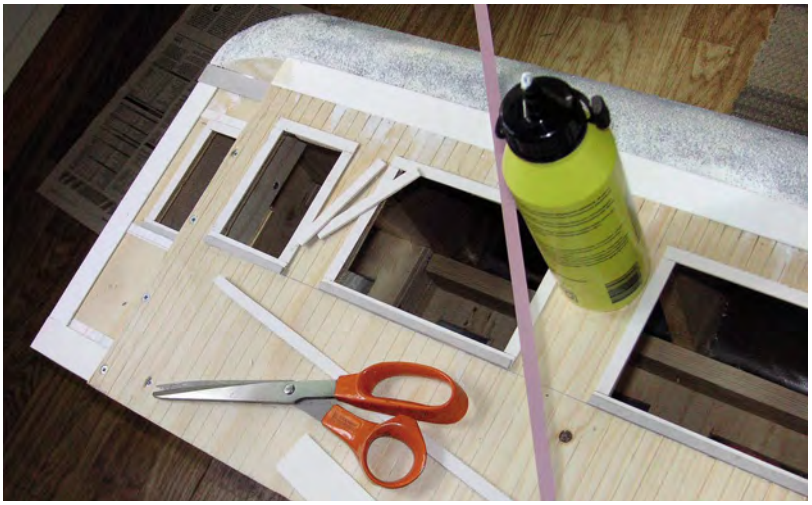
RIGHT PHOTOGRAPH 17 Stretching a piece of thin, non-woven fabric over the foam and sheet metal then gluing it in place with alkyd ("oil") paint.

RIGHT PHOTOGRAPH 18 Spreading sand evenly onto the still tacky paint with a brush.



RIGHT PHOTOGRAPH 19 Strips cut from an index card will be used to simulate the narrow mouldings around windows etc. Thicker cardboard is used for windowsills.

RIGHT PHOTOGRAPH 20 The cardboard strips were cut to length and attached with white glue.



ABOVE: PHOTOGRAPH 21
The overhead light accentuates the shape of the mouldings. The screw countersink holes have been filled with two-component filler.

The detailing shows up nicely under overhead lighting (photograph 21). The screws on the sheet metal roof edge have been covered with a strip cut from a bamboo mat. This strip was easy to bend and attach to the roof's curved edge with small nails. A strip of sheet metal, or some plastic material, could of course be used instead of bamboo. I also used some polystyrene filler to even out the seam between the bamboo strip and the sheet metal. The same filler was used to cover the countersunk screw holes in the coach walls.

After sanding everything smooth a couple of coats of paint were applied to the outside walls of the coach and to the sand covered roof. A can of semi-matte alkyd (oil base) paint was specially mixed to the same brown shade used for painting the prototype coaches. For the roof, I used matte black anti-rust primer which, because of its rather thick consistency, is ideal for bonding the sand grains to the roof. Photograph 22 shows the coaches drying in the workshop.

INSTALLING WINDOWS

Next, the window openings received glass, or actually 1/32" polycarbonate, window panes. This pliable material (which I bought by weight in smallish, surplus pieces) can be easily cut to shape by first scoring with a knife and then breaking it off over a table edge, or it can even be cut with sturdy scissors. It is a softer, much better material than acrylic ("plexiglass"), which is brittle and scratches more easily. The polycarbonate sheet comes covered in plastic film to avoid scratches during handling. This film should not be removed until the panes are ready to be installed. Note that the protective films may be of different color on each side of the sheet – in my case, one side had a clear film, which I nearly overlooked.

Since the cardboard strips, representing window frames, were glued to the outside of the walls and provide a stepped edge into which the window panes fit, I could use hot glue to hold the windows in position without the glue showing from the outside.

ABOVE: PHOTOGRAPH 22
Two coats of matt black paint are applied to the sand-covered roofs and two coats of semi-matt brown to the outside of the walls.

BELOW: PHOTOGRAPH 23
The finishing touch to the windows: sashes in the form of pre-painted cardboard strips.

There was one more thing to do – the dummy window sashes needed to be added. I had already painted long cardboard strips of the correct width and could now cut them to size and place them in the windows with a small amount of super glue (photograph 23), taking care not to smear any glue on the clear window area. Now, all the woodwork was finished (photograph 24).

« TO BE CONTINUED »

PHOTOGRAPH 24
The coach top at this stage, with all the woodwork finished, but many small details still to be added.

The London Museum of Water and Steam

Mark Smithers relates the story of the Kew Bridge steam museum

BY **MARK SMITHERS**

Conveniently situated close to Kew Bridge railway station, the London Museum of Water and Steam is a 'must visit' venue for anyone with an interest in steam technology, water distribution or engineering history more generally. The history of the site goes back to the year 1820 when the Grand Junction Water Works Company established a works at Chelsea where water was abstracted directly from the Thames. This original site utilized two Boulton & Watt beam engines for pumping purposes although it soon proved unsuitable owing to pollution concerns and a new site was chosen close to Kew Bridge.

Pumping at this Works commenced in 1838 with the aid of a new beam engine built by Maudslay Sons & Field of Lambeth, with the two Boulton & Watt engines being transferred from Chelsea during the ensuing four years. In 1844-6 a new reservoir and filter beds were constructed to assist in the supply of water to much of West London, including Ealing and Paddington, and two further engines, not now extant, were employed to pump water from the Thames into the reservoir. Soon afterwards, a 'standpipe tower' was constructed to regulate water distribution and as a safety measure to protect the pumping equipment from damage in the event of a pipe failure.

Concerns about pollution did not go away and, following legislation requiring water to be abstracted from the non-tidal part of the Thames in 1852, Kew Bridge became an 'intermediate' link in the supply chain with a new abstraction and treatment works being built at Hampton. This did not stop the entry into service of more pumping engines in 1846-7, the conversion of the Boulton & Watt and Maudslay engines to the 'Cornish' cycle and the renewal of the standpipe tower in 1867.

Ownership of the site later passed to the Metropolitan Water Board (MWB) and despite the introduction of four Allen three-cylinder Diesel engines in the mid-1930's, along with electric pumping equipment, the steam engines remained in ordinary service until 1944. Despite the wartime demands for scrap metal the MWB decided not to scrap most of the engines and to preserve most of them as museum exhibits with only one of the Boulton & Watt specimens being removed to provide display space.

ABOVE
The most immediately apparent sight to greet the casual visitor to the London Museum of Water and Steam is this Grade One Listed 1867 vintage Italianate tower built to house the standpipes through which the mains water passed prior to entering the main supply system. This tower replaced an earlier iron lattice structure which fell victim to frost damage.

In 1973 the Kew Bridge Engines Trust was formed with the objectives of restoring the five surviving original Kew Bridge pumping engines to working condition, acquire other important examples from other sites and establish a museum dedicated to the history of London's water supply. This museum was known for many years as the Kew Bridge Steam Museum until March 22nd 2014 when it was re-launched as the London Museum of Water and Steam following the two-year long Project Aquarius initiative which involved extensive fundraising efforts including a £1.8 million donation from the Heritage Lottery Fund.

The oldest survivor of the Kew Bridge engines is the remaining 1820 Boulton & Watt example and this was converted to the 'Cornish' cycle in 1848 in order to take advantage of the use of a higher steam pressure. No doubt the *modus operandi* of this system will be familiar to many readers but, for the benefit of those who are not familiar, the principle involves the use of a single acting cylinder in which live steam admitted above the piston depresses the 'cylinder' end of the beam, which raises a weight on the 'pump' end on the remote side of the fulcrum, admitting water to the pump body (by means of a suitable valve). While this operation is taking place the exhaust steam from the previous cycle passes from the cylinder below the piston into a separate condenser creating a partial vacuum, thereby assisting the operation. The 'live' steam is cut off before the piston reaches the bottom of its travel, thereby allowing expansive working, and at the bottom of the stroke the 'condenser' valve is closed and an equilibrium valve is opened to allow the steam to flow from above to below the piston. This allows the weight at the other end of the beam to descend, pushing down the 'pump' end of the beam and effecting the pump delivery stroke.

The Boulton & Watt engine has a cylinder bore of 64in and a stroke of 96in and is capable of delivering 2.5 million gallons of water per day at a rate of 130 gallons per stroke. It was returned to working order in 1975. The 1838 Maudslay Engine was another 1848 conversion to the Cornish principle and it has undergone much alteration during its working life, including the replacement of half of its main beam in 1888. Its performance is comparable with that of the Boulton & Watt engine and it has the same cylinder stroke but the bore is slightly larger at 65in.

ABOVE
A lovely piece of model engineering in its own right! This cutaway model Kew Bridge Waterworks as it would have been shortly before the outbreak of the Great War is currently to be found on display in the main Steam Hall.

The largest of the engines to have been installed during the period in which Kew Bridge was involved in abstracting water directly from the Thames is the '90 Inch' built by Sandys, Carne & Vivian of Hayle, Cornwall in 1846. As its name suggests, it has a cylinder bore of 90in and a stroke of 132 in and is today rated at a water delivery of 6.4 million gallons per day, or 472 gallons per stroke, although during the height of its career it was able to handle 7.5 million gallons per day with the aid of a 45 ton pump plunger increased to 38in diameter from the original dimension of 33in in 1863. The '90 Inch' was returned to working order, with a 32-ton pump plunger, in 1976 and it is the world's largest surviving beam engine in this condition.

Increasing demand placed upon the Kew Bridge Works during the 1850's dictated the need for an 'intermediate' engine with a higher performance than the Boulton & Watt and Maudsley specimens that would fit within the existing space and in 1856 a new engine, built on the principle laid down by Cornish engineer Edward Bull, was constructed by Harvey & Co. and it entered service three years later. Although working on a similar cycle to

BELOW
Not all water pumping engines in London were used in connection with the public mains supply and small pumping engines were often used by private owners to abstract their own supply from nearby wells. Although this single-cylinder horizontal engine with accompanying well pump was constructed in 1898 by Benham & Co for use at Mylees Workhouse in Salisbury for abstraction from a 100 ft. well, its design is typical of those which would have found use in London. This particular example remained in use until 1970 and is now on display in the 'Stokers Cafe' area of the Museum.

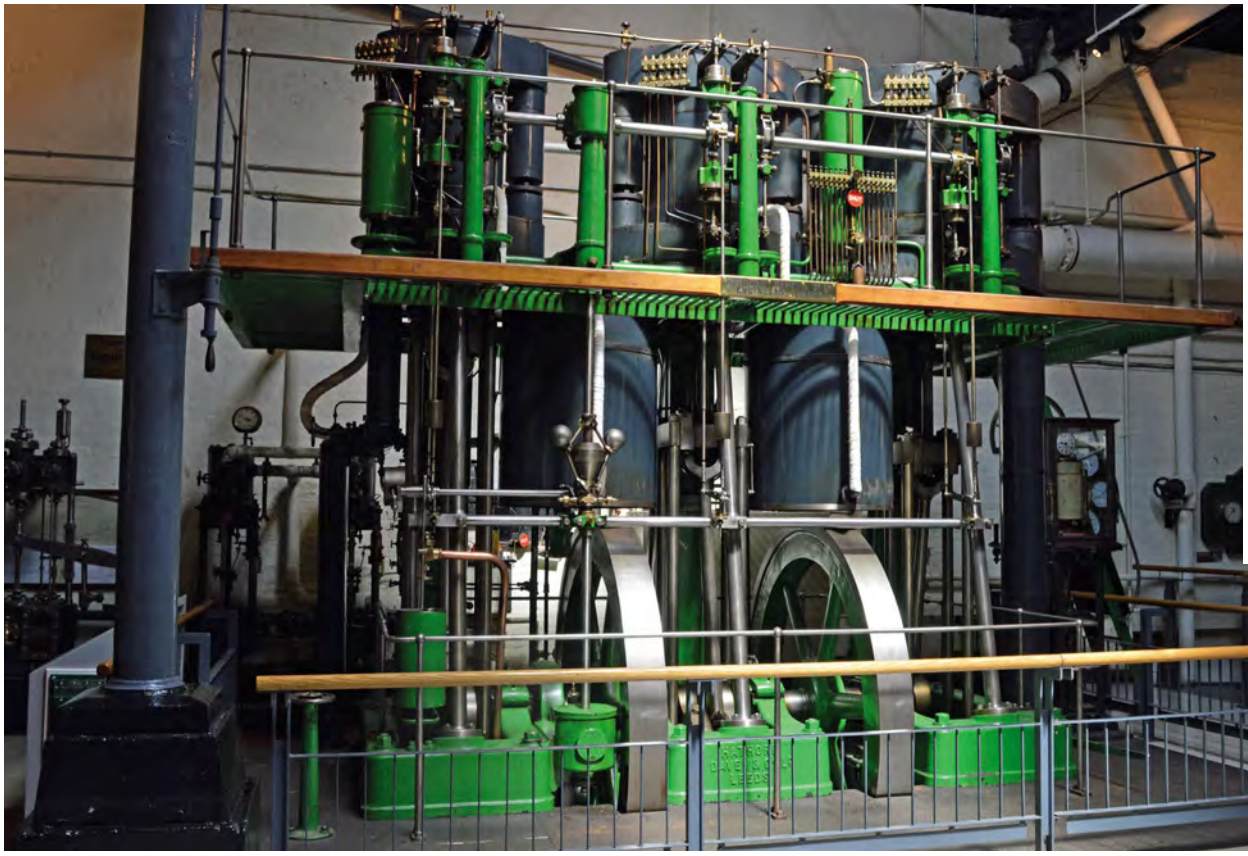
ABOVE
Early English water pipe technology is represented by this junction section of elm piping recovered in 1933. Such piping was in common use throughout most of the seventeenth and eighteenth centuries, and into the early part of the nineteenth.

its altered precursors at Kew Bridge, the Bull engine saved space by having a cylinder mounted directly above the pump (with live steam being admitted below the piston to raise the weight), thereby dispensing with the main beam. This engine has a cylinder bore of 70in, a stroke of 120in and a delivery capability of 3.4 million gallons per day, or 236 gallons per stroke. It worked for the first time as a museum exhibit on May 12th 2008 and is currently the only operable example of its design in the world.

The only one of Kew's 'Cornish' engines remaining to be returned to steam is the largest and most recently constructed example, the '100 Inch' which was built by Harvey & Co. of Hayle in 1869 and entered service two years later. This is the world's largest surviving single cylinder beam engine, with its cylinder dimensions of 100in bore and 132in stroke, and its performance was rated at 7.5 million gallons per day, or 717 gallons per stroke. Despite sustaining a cracked main beam and consequent repair, this engine remained in occasional standby use for some 14 years after its regular work ceased until 1958 when the original steam supply boilers were removed from the site. Steaming of the engines in the museum environment is now accomplished by means of a gas-fired Lancashire boiler acquired from the Battle Hospital, Reading in 1975.

The steam engines that have been acquired from other sites for display at Kew Bridge are all of the 'rotative' type, i.e. employing the transmission of power from the cylinder(s) to a rotating crank via a connecting rod. The cylinders on these engines are all of the double-acting variety and most are located in the Steam Hall part of the museum complex which formerly housed the boilers during the days of normal steam operation. The oldest of the 'rotative' engines was built by Easton & Amos in 1863 and operated at Cliftonville

BELOW
One of the smaller items on display in the 'Stokers Café' area adjacent to the Main Entrance is this single cylinder gas engine constructed by the National Gas Engine Co. of Ashton-under-Lyne.



By the latter part of the nineteenth century the beam pumping engine had been superseded as 'cutting edge' technology for water pumping, at least as far as steam power was concerned, by the vertical compound engine as represented by this triple expansion example built in 1910 by Hathorn Davy & Co. of Leeds. After a working life spent at Newmarket Water Works it was restored at Kew Bridge between 1978 and 1981.

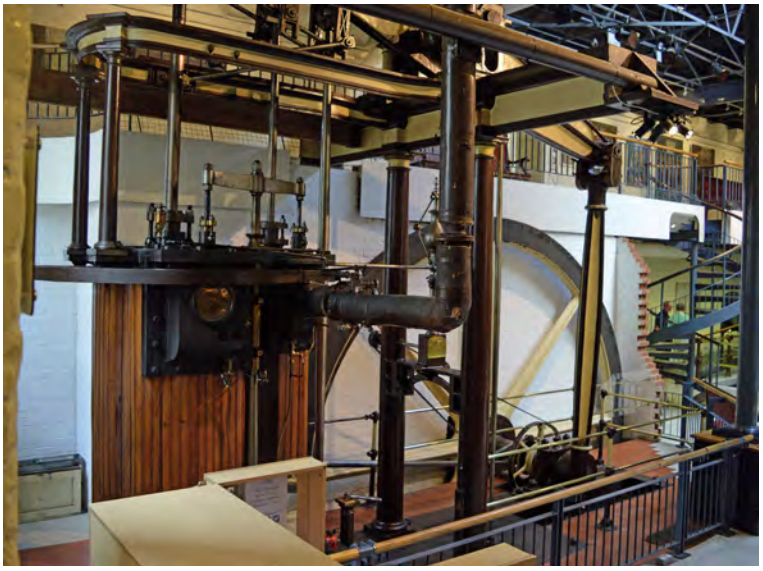
Pumping Station, Northants for about seven decades before a period of storage and return to steam at Kew in 1978. It is noteworthy in being a two cylinder 'Woolf' compound in which the strokes of the high and low pressure cylinders (40 and 60 inches respectively) differ owing to the fact that the former is placed closer to the fulcrum of the main beam.

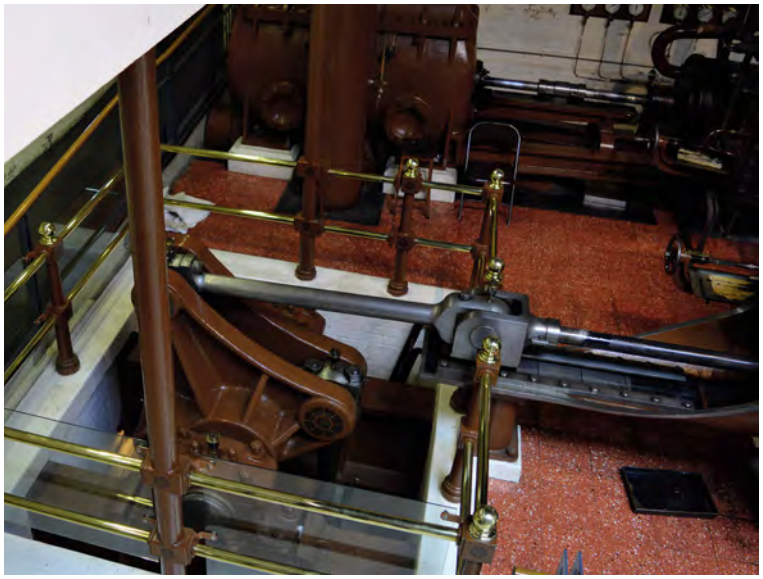
Only slightly more recent in construction is the twin beam 'simple' engine constructed in 1867 by James Kay of Bury and once employed on Lord Rothschild's private estate at Dancer's End near Tring in Hertfordshire for abstraction of water from a well prior to being presented to the Kew Bridge Engines Trust in the 1970's by Thames Water's Chiltern Division.

The final phase of development of reciprocating steam power for water pumping purposes is represented by two compound engines of different designs dating from the year 1910. The three cylinder triple expansion vertical engine built by Hathorn Davy & Co. of Leeds was employed at Newmarket, Suffolk until 1964 and was returned to working order at Kew some 16 years later but sadly, as with the Dancer's End 'twin', space considerations dictated the need for it to be displayed without its pumping equipment. The same is fortunately not true of the two cylinder horizontal cross-compound engine built by James Simpson & Co. for Waddon pumping station near Croydon. This engine only ceased normal operation in 1983, being transferred to Kew Bridge during the following year and returned to working order in 1990 along with its associated pumping equipment. Its layout is arranged so that the twin 'lifter' pumps, which raise water from the well, are driven from a tail rod from the low pressure cylinder whilst the 'delivery' pump to the water main is driven from a similar rod from the high pressure cylinder.

In 1903 the Grand Junction Water Works Co. came under the auspices of the MWB which also owned the pumping station at Kempton. During the winter of 1915-6 this body opened a 2ft gauge three mile long railway used to transport coal from a wharf at Hampton to feed Kempton's pumping engines. This railway employed three Kerr, Stuart 0-4-2T locomotives

BELOW
This twin beam engine was built by James Kay of Bury in 1867 originally for use on the private estate of Lord Rothschild near Tring in Hertfordshire before eventually coming into the ownership of Thames Water Authority and being restored at Kew Bridge in 1978-9. Its design is more typical of engines constructed for use in textile mills (an application common to the area in which its manufacturer was situated) than for water pumping applications. Features of note include the graceful fluted pillars and the polished wooden lagging on the cylinders and steam chests.

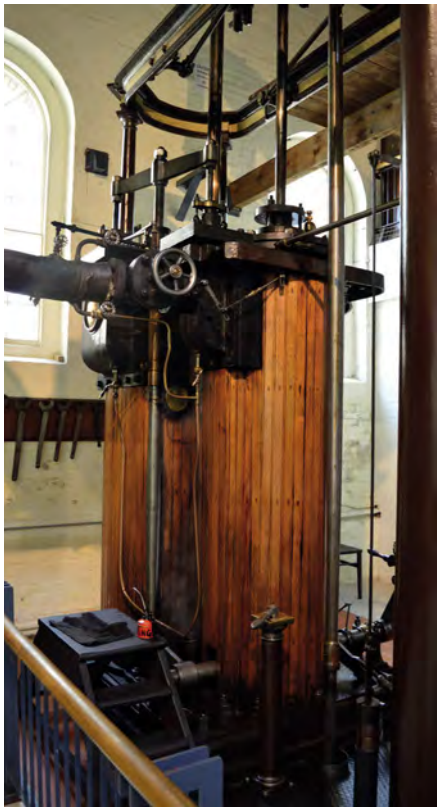




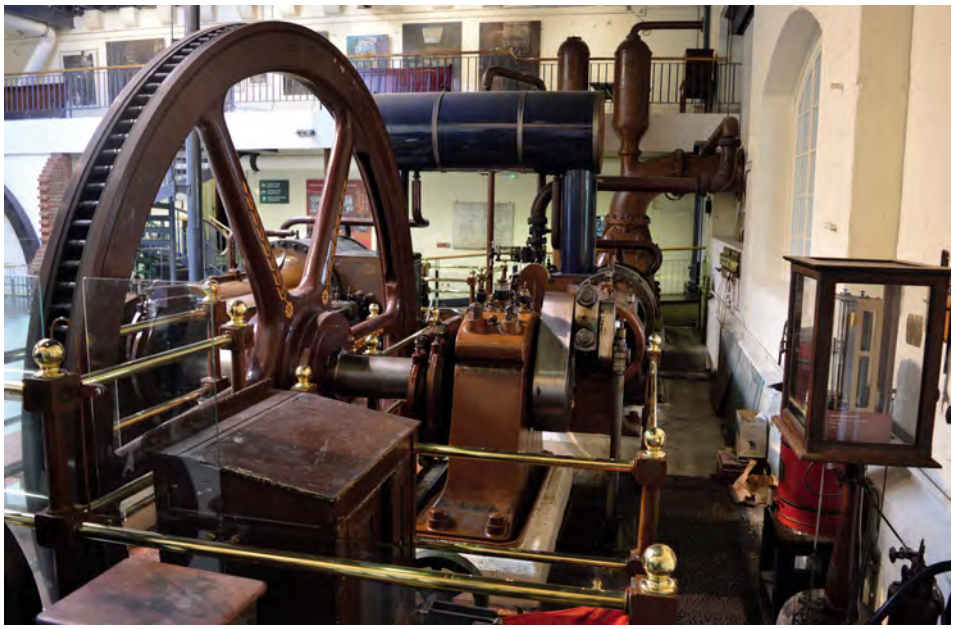
LEFT
As with the twin beam engine, this 1863 vintage Easton & Amos Woolf compound engine employs rotative drive from the beam to a crankshaft from which output the final drive to the pump is taken.

RIGHT
This view shows the compound cylinders of the Easton & Amos engine, with the smaller high-pressure cylinder being visible in the foreground and the larger low pressure cylinder, mounted further away from the beam's fulcrum, further behind.

LEFT
The arrangement of water pumps actuated by the 'Waddon' engine can be seen here with the 'lifter' pumps (connected to the low pressure cylinder) visible in the lower foreground whilst the delivery pump (connected to the high pressure cylinder) can be seen uppermost and further in the background.

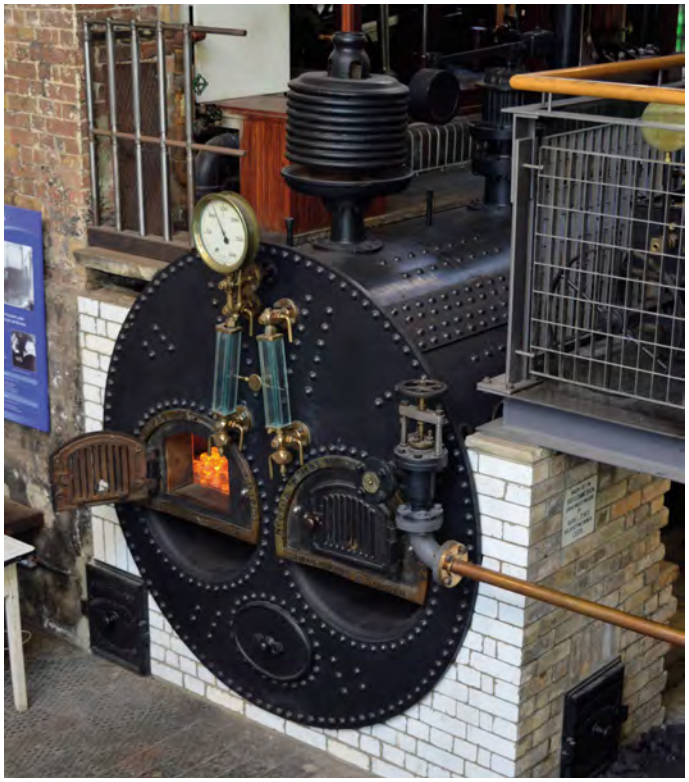


BELOW
The 'Waddon' two cylinder horizontal cross-compound engine was built in 1910 by James Simpson & Co. whose works were then situated at Lowfield, Balderton, near Newark, Notts. It remained in use at its Croydon base until taken out of use on June 28th 1983. In this view the crankshaft bearing and flycrank and 'big end' for the high pressure cylinder are clearly visible in the centre foreground whilst the high pressure cylinder itself and the mains water delivery pump are visible in the background, with the flywheel (located on the crankshaft between the high and low pressure flycranks) in the left of the picture. The receiver for the steam passing between the steam chests of the two cylinders can be seen (upper centre) immediately to the right of the flywheel.



Hampton, Kempton, and Sunbury and remained in use until 1947. Sadly the locomotives, rolling stock and most of the track were immediately scrapped but some relics, including an extensive collection of photographs, are preserved at Kew Bridge.

The potential attractions of an operational steam railway were not lost on the museum's trustees and a new 400 yard long 2ft gauge line was constructed on the site and visiting steam locomotives included 'Quarry Hunslet' 0-4-0ST Cloister and 'Bullhead Bagnall' 0-4-0ST Wendy. Given the recent increase in 'new build' activity in the steam locomotive preservation sphere, and the need to reduce the dependence on the availability of visiting locomotives, it was perhaps no surprise that thoughts at Kew Bridge would eventually turn to the construction of a new locomotive specifically for use on-site and appropriately a Kerr, Stuart design was chosen. Simplicity and cost considerations meant that this would be of the 'New Type Wren' 0-4-0ST class rather than the larger 'Hampton' specification and construction was well under way by September 1992. This proved to be a protracted affair and the work was eventually completed at Statfold Barn, where all of the relevant Hunslet 'constituent' intellectual property (including that pertaining to Kerr, Stuart & Co.) is now based, in 2009. The new locomotive was therefore given the Hunslet W/N 3906 (a sister engine, built wholly at Statfold is W/N 3905 of 1908 Jennie now to be found at the Amerton Railway) and the name Thomas Wicksteed after the engineer to the East London Waterworks Co. (1806-71) who introduced the Cornish engine to the



ABOVE
On certain specified days some of the pumping engines are steamed and this 1927 vintage Lancashire boiler is used to provide steam for the purpose. The 'Cornish' engines normally work at a rate of 6-6.5 strokes per minute on a pressure of approximately 40psi.

LEFT
The earliest beam engine built specifically to work at Kew Bridge waterworks was built by Maudslay, Sons and field of Lambeth in 1838 and in much rebuilt form it still survives in the Museum Collection today. As with the Boulton & Watt specimen it was altered to the Cornish cycle in 1848 and remained in ordinary service until 1944. This view shows the steam cylinder area with piston rod and steam and exhaust valve rodding. Once again, cast fluted columns are very much in evidence.

RIGHT
The Metropolitan Water Board was the operator of the Hampton & Kempton Waterworks 2ft gauge coal tramway and the existence of this railway, and the survival of certain relics from it in the Museum's collection, provided the pretext for the construction of a 2ft gauge steam railway at Kew Bridge. This normally operates on days when one or more of the pumping engines is in steam and previous visiting locomotives have included 'Quarry Hunslet' 0-4-0ST Cloister and Bagnall 0-4-0ST Wendy. Owing to the limitations posed by the initial reliance on visiting steam locomotives, the need arose for the Museum to operate its own steam locomotive and construction commenced on a new 0-4-0ST of the Kerr Stuart 'New Type Wren' class, which was completed at Statfold Barn in 2009. Here, the engine, Thomas Wicksteed, simmers between workings at the railway's passenger terminus adjacent to Kew Bridge Road.

capital's water pumping systems. Being the only resident steam locomotive at Kew Bridge, Thomas Wicksteed has not totally eliminated dependence upon visiting locomotives, as it will need the necessary periods out of service for overhaul, but it is certainly a major 'draw' during steaming days and, given the fact that we now have moves to re-instate at least part of the old Hampton and Kempton system, there may eventually be moves to replicate the 'Hampton' class.

In the meantime, the London Museum of Water and Steam remains an important part of our engineering heritage and is well worth a visit, especially during steaming days, which are currently scheduled throughout all months of the year. ■

‘YORKIE’ – A Yorkshire Engine Company 0-6-0 Locomotive in 16mm

Malcolm and **Derek** describe the installation of the radio gear

BY **MALCOLM HIGH** AND **DEREK CROOKES** CONTINUED FROM PAGE 191 DECEMBER 2016

Most 16mm locomotives now come with radio control – it sure beats chasing after it! If you are new to radio control, or just coming back to it after a period of time, it has certainly moved on. I remember my first ED set with a single valve, and ninety volt and one and a half volt batteries. The aerial was taller than me and the transmitter was so heavy it sat on the ground. Well, things have progressed and got cheaper. Nowadays the norm is 2.4GHz. This gives a number of advantages. The aerial is certainly a lot shorter, just an inch or so on the receiver, and it is generally interference free. It will also penetrate the brass sides of the tanks so the receiver can be mounted in the right-hand tank. The question is which system to buy.

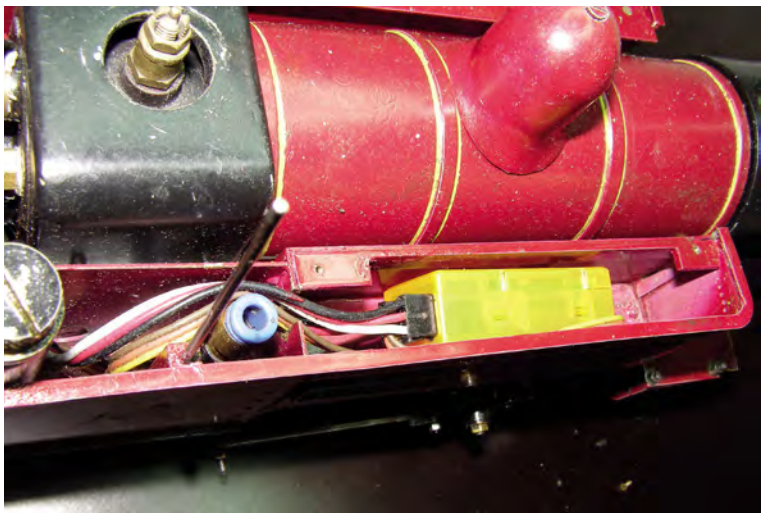
WHAT TO BUY

The basic entry level is a combo unit. This will give you a transmitter, a receiver and one or two servos. It will have four to six channels and power comes from dry cells. Look on the internet for current prices; there are plenty of suppliers. The next step up is a more complex unit but I think it is worth the extra money. These systems will have more channels, up to ten, and be able to control up to twenty different models, not all at the same time of course! Each model will need its own receiver, servo and batteries. If you work out the cost per model it is going to be far less having one of these systems than a number of combo transmitters. The more complex transmitters also offer servo end point adjustment, reversing and mixing as standard. At the end of the day you make your own choice as you

RIGHT
A 2.4 GHz 6 Channel 10 Model budget set.

LEFT
The servo mounted on the footplate.

BELOW
The receiver is housed in the right hand tank.



have to be comfortable with it. We may as well start off with the servo.

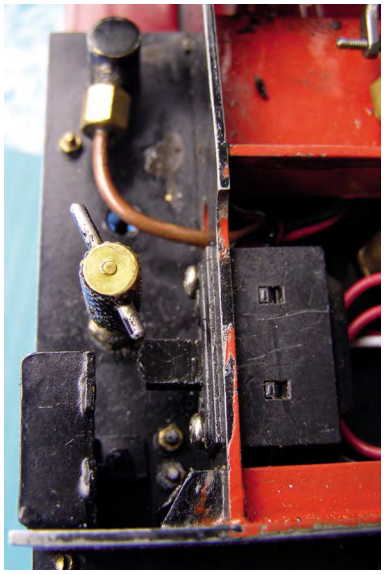
There is insufficient room in 'Yorkie' to have two servos so only the regulator is controlled. This is a shame because our Gauge 1 locomotives can be notched back once they have got up to speed – very realistic. Mounting the servo is not a problem as it is housed in the reversing stand. A micro servo is required, preferably with metal output gears. The plastic ones tend to strip easily. An analogue servo is more than adequate; digital is not worth the expense in this circumstance. Bolt the servo to the frame and thread the cable through the hole in the right hand bunker and tank. The servo arm is connected to the regulator by a piece of wire as shown in the image. If you have flown model planes before or had model boats you may have a clevis in your "will be useful one day" box which would be ideal. Leave the arm loose on the splines of the servo so it can be set up once the receiver is in place.

The switch sits behind the lubricator drain on the right hand side of the frames. This is a little awkward but it is a compromise between hiding it from view and being accessible. Bolt it in place and thread the wires through the footplate.

WHERE TO PUT IT

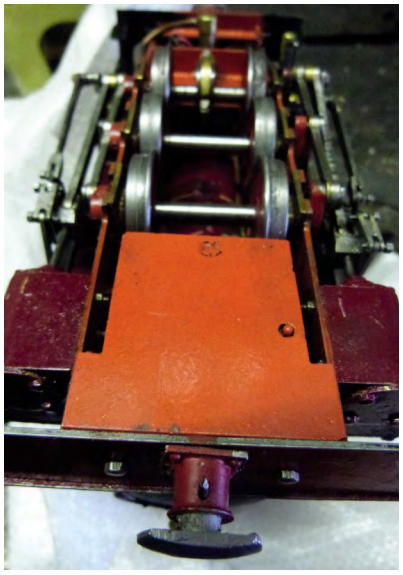
The batteries are awkward to find a place for. It was decided to stick with NiMH rather than going for LiPo which would have been much smaller but more difficult to charge as two cells in series would have been required. The four 2/3 AA cells which can be obtained from most good suppliers as a receiver pack are mounted in the roof. Cut a piece of brass or aluminium ten millimetres wide, form it around the cells and drill two holes so it can be bolted to the roof – see the image for details. The cable connects into the male end of the switch connector.

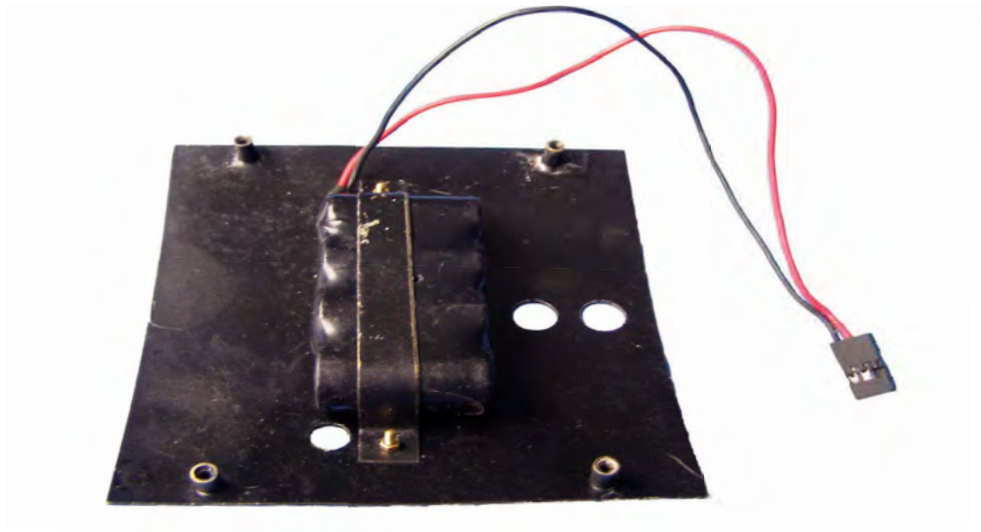
Finally the receiver can be placed in the right-hand tank. Obviously when considering which receiver to buy size is an important consideration as it has to fit inside the tank. Connect the power and servo leads and you are about done, except the radio has to be 'bound' to the receiver. Binding ensures that your transmitter will 'talk' to your receiver and no others. When 2.4GHz first came out one of the biggest suppliers got this wrong and all the transmitters had the same code so they interfered with all the receivers. Very embarrassing!



LEFT
The switch mounts in the frames behind the lubricator drain.

RIGHT
The balace weight bolted to the front beam.





SETTING IT ALL UP

Binding will be covered in your manual. Basically you put a special connector in the data port of the receiver and switch it on. The data port sometimes doubles up as the battery port so the power cable has to go into one of the channel ports. Press a button on the transmitter and turn it on. Normally a light on the receiver blinks for a few seconds, goes out and then comes back on again. That is it. Switch off, remove the connector from the data port and you have bound your receiver to your transmitter.

Note that one manufacturer's receiver will not necessarily work with another manufacturer's transmitter as they may use different coding. It is probably safest to stick to one manufacturer. Having said that it is not necessary to use the most expensive receiver. These will be designed for aircraft and will probably be over the top for our needs. It would be preferable to have one with two antenna inputs; you can tell these as they have two short aerials. When mounting them in the tank ensure that one aerial is horizontal and the other is vertical.

ABOVE
The batteries mounted in the roof.

If you have the electronic level indicator this is powered from an unused channel.

The only thing left to do is to set up the servo. Manually close the regulator and move the regulator stick on your receiver to the closed position. The servo should move. With the linkage to the regulator attached, place the servo arm on the splines and fit the screw. When you move the regulator stick the servo should open the valve. The end points can be adjusted on the transmitter and there is also a trim adjustment which will move the servo slightly one way or the other.

Finally there is one more item to make. The locomotive tends to be light on the front wheels – it is likely the prototype was as well. There is sufficient room behind the front buffer to fit a piece of steel to act as an adhesion aid. Machine a block of metal to the profile shown in the photograph above or just use a piece of rectangular BMS cut to length. It can be bolted between the frames when the painting is done.

« TO BE CONTINUED »

CLUB NEWSROUND

BY **JOHN ARROWSMITH**

Another year has passed and no doubt we will all be wondering what 2017 will have in store for us. I would like to wish you all a Happy, Safe and Healthy New Year and hope that your new year resolutions last more than a couple of days! Looking through the latest newsletters and webpages I see that there are quite a few new projects at a number of clubs in the pipeline for the coming year which suggests that model engineering is still an active and absorbing hobby which can allow you to express your creative talents in a safe and interesting atmosphere. I hope all the clubs who are speculating about the age profiles of their clubs will do something about it and try very hard to recruit younger people into the hobby. I did hear at the MMEX a club member say he was going to suggest to his committee that they introduce a monthly membership subscription because of the age profile at the club. I hope it hasn't got that bad yet! A cautionary note now – I understand that there are some bogus boiler certificates in circulation. The Southern Federation have notified clubs about this so take note of their recommendations and be very careful if you are thinking of buying a locomotive or boiler. Take advice if you are not sure otherwise any insurance you take out will be invalid.

There are quite a large number of model engineers who enjoy wagon building and, to that end, one of EIM's regular contributors, Doug Hewson, has just published his new book called 'Constructing 5" Gauge Wagons' which I expect will become a very useful publication in this area of model engineering.

At the Ashmanhaugh Light Railway the last day of the running season was extremely busy with lots of visitors and all trains working to capacity. Their 'Fun Day' in October was another successful event as two visitors brought three locomotives, two Sweet Williams and a Romulus, with them which operated with the club locomotives so that at times five trains were in operation. A freight train also put in an appearance to entertain the crowds. They have the prospect of a new locomotive arriving at the railway as one member has invested in a new Feldbahn which hopefully will be delivered in January to supplement the existing fleet in the spring.

I have been informed that the Proficiency Scheme for both youngsters and newcomers to miniature railways, developed by the 7¼" Gauge Society a few years ago is available again and now has a Gold Standard test to really enable anyone to achieve the standards necessary to enjoy small railways to the full. I can thoroughly recommend this scheme to all clubs as a way to help teach the modern generation about operating small gauge railways. As I have said many times, it is up to individual clubs to put the time and effort into endorsing a scheme like this to really make a difference. It helps explain in simple terms what miniature railways are all about and how people can learn the terminology applied to railways. The time element involved is no more than any club would put into showing a newcomer or young person what is expected of them. It explains in detail

A wonderful view at the 7¼" AGM – this was the main station at the Beer Heights Railway.

how railways work and, by having a test at regular stages, it enables people to become familiar with the way your club works and achieve a working standard that can be assessed and give confidence to both. I hope that many more clubs will give this scheme a chance and encourage a new generation of miniature rail operators who hopefully will then get involved in other aspects of model engineering. Of course if you have a better way let EIM know so that others can benefit from your experience. The Society's AGM was held at Pecorama in Devon this year and by all accounts a great time was had by all. The photographs show what an attractive railway it was for this event.

The latest news magazine from the City of Oxford SME is the 250th publication and the editor has taken a look back at the previous 249 editions. He says that while the appearance has changed enormously in many ways the functions at the club are just the same. Their Dreaming Spires Rally was very successful again and was blessed with glorious weather to enhance the proceedings. Numbers of participants were down this year due in some respects to the event clashing with the IMLEC event at Urmston. On the other hand the Polly Rally had totally different weather and all who took part were totally drenched but never the less they enjoyed the host's hospitality. In August a start was made on the new track extension which will be approximately 230 metres long and alongside this the ground level steaming bays are having an upgrade as well. If all that is not enough they are also planning to have the public areas block paved, so no shortage of work down there.

ABOVE
This double header enters the station with Hunslet 'Charles' as the train engine.

BELOW
Dennis Billington pauses in the station with his Feldbahn while Brian Remnant passes on the loop in the background.

Like many clubs in 2016 it was a busy year and the Tyneside SME was no exception with their open weekend receiving visitors from seven different clubs who all brought locomotives which, combined with their own club members' engines, provided plenty of entertainment over the two days. The new club house was much appreciated by all while the ladies provided their

usual good spread of food and drinks which was combined with an excellent attendance by club members, ensuring a first class event. The club also had a static display at the Stephenson Museum alongside Chris Vine with Bongo and his range of children's books which was another enjoyable experience. A visit by the Institute of Mechanical Engineers provided the opportunity for the club to show the range of skills and workmanship within the club by having a range of models on display. The visitors were very impressed by the display and the new club house with many complimentary comments being expressed.

The Rugby MES is a very go-ahead club and, having built an excellent new track extension, they have also received an award under the Tesco 'Bags of Help' scheme to assist them with building a new station and improved public access. This is a new scheme supported by the 5p charge on plastic carrier bags with the proceeds being awarded to community and related projects like this. As the Tesco motto says "every little helps" so the club will be well placed to get this new project started. An extension to the raised track is also planned. They will be hosting the 2017 Sweet Pea Rally over the weekend of the 10/11th June so put it in your diary now to remind you later in the year.

Down under at the Steam Locomotive Society of Victoria members there have also had a busy winter season with lots of track and ground improvements. They have completed the re-laying of the goods yard and they say it has entailed many man hours and sore knees to get it finished. It looks great now it is complete. The new unloader area has had the concrete laid complete with new drains which again has made the area clean and tidy. The design of the unloader storage shed has begun and construction will begin when this is complete. The clubs 'Steam Oil' drums have been decanted into one litre bottles for free collection by members although the club do keep a record of how much is being used.

ABOVE
Andrew Meredith gets instructions as he departs with his GWR small Prairie.

RIGHT
The splendid new goods yard constructed at the Steam Locomotive Society's track at Moorabbin, Australia.

At the Vale of Aylesbury MES they have completed the tarmac laying on the approach path to their site and the car park is next on the list. Their Open Day in the summer drew large crowds which needed all 15 of the passenger carriages to be put into operation but even so there was a 45 minute wait for a ride. Progress on the Garden Railway has been steady with lots of track laying and repairs. A new canopy is being constructed to protect the 32mm operators. On the 45mm layout a new turntable is in preparation for the steam-up area and track plans have been drawn up in readiness. A spectacular working cable car system has also been attracting lots of attention.

Up at the Warrington & District SMEE the track extension is now complete and is being well tested by club members. On one day in October, after some adjustments to some guard rails, four steam locomotives and a couple of diesels were giving the track a real good workout. The reports are that it provides the drivers with a good test of their skills. They are hoping to have an official opening in the spring. Suitable signalling positions are also being decided so that posts can be installed at the right place. If you are considering etching name and number plates for your work their webpage has a very interesting and useful article on this subject which may answer a few questions for you.

The 2017 NGLEC is to be held at the Oswestry MES over the weekend of the 20/21st May. Contact the Northern Association for more information or to book in. ■

YOUNG ENGINEERS

BY **JOHN ARROWSMITH**

Once again may I wish all young engineers wherever they are a Happy and Healthy New Year with the hope that they will be able to progress their skills and building techniques to the best of their ability. Last year was an interesting one for young people with a number getting involved with many aspects of club life both miniature and full-size.

The young men responsible for the oscillating engines with their tutors and Phil Abbot.

At the Midlands Exhibition it was very pleasing to see the number of entries in Competition Class 14 Young Engineers and the number of models present on various club stands. 1st Prize in Class 14 was won by Angus French and joint 2nd Prizes were awarded to Ryan Philo for his scratch built Morgan 3 wheeler and to Zahar Webb for her fire boat. Three Very Highly Commended certificates were also awarded for a catamaran, governess cart and a pink Jeep.

In addition, a display entry by nine young people from the South East, who are coached at their school by Phil Abbot from the Blackheath Model Power Boat Club, made for an interesting addition to the class. Not only did they all enter identical model oscillating engines that they are building but they also attended the exhibition along with two of their teachers to enjoy their first time at a model engineering exhibition. Talking to me during their visit they all said what a great experience it was for them to see such a wide range of models displayed. Hopefully they will return next year with finished models.

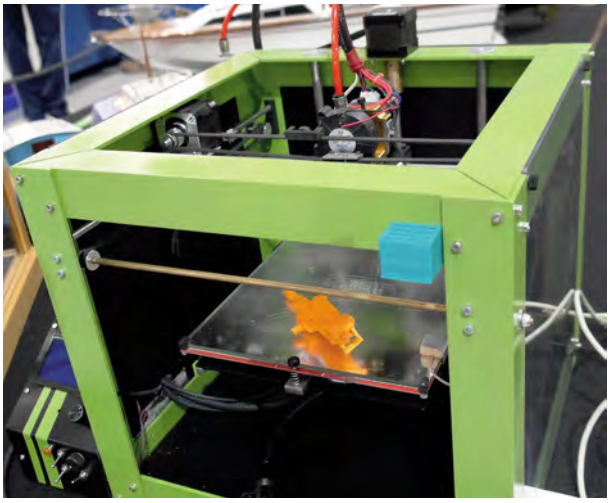
I have mentioned in my Club News page about the 7¼" Gauge Society's Proficiency Scheme and without repeating myself I do sincerely hope that clubs will consider applying to take part as it really does make the introduction to miniature railways very simple. ■

MORE PICTURES »

The group presentation in Display Class 14 of 8 oscillating engines made by young students from a London school.

LEFT
Ryan Philo with his Morgan 3 Wheeler and prize certificate.

RIGHT
16 Year old Angus French was awarded 1st Prize for this excellent example of a 3D Printing Machine which he designed and built.



RIGHT
Jack Colby receives his Myford paperwork from Chris Deith.

JANUARY DIARY

1 Bournemouth SME. Public running Littledown Park 11:00 – 15:00.

1 Belfast & County Down MRS. Public running Upper Gransha Road 13:00 – 17:00.

1 Birmingham SME. New Year's Day Run from 11:00.

1 Chesterfield MES. Arctic running at Hady 11:00 – 15:00.

1 Claymills PS. New Year Steaming 10:00 – 17:00.

1 Echills Wood Railway. Public running at Kingsbury Water Park from 11:00.

1 Evergreens Miniature Railway. Frostbite Open Day 10:30 – 16:00.

1 Grimsby & Cleethorpes MES. Public running at Waltham Mill noon – 16:00.

1 Haleworth & District MES. New Year Day Steam Up from 10:30.

1 Leyland SME. Chairman's New Year Run, Worden Park from 11:00.

1 Plymouth Miniature Steam. Members' Day "Frostbite Specials."

1 Sutton Coldfield MES. New Year Day Steam Up at Little Hay from 10:30.

1 Swanley New Barn Railway. Charity Steam Up 11:00 – 15:00. Donations to charity.

1 Rochdale SME. Public running, Springfield Park from noon.

1 Urmston MES. Public running at Abbotsfield Park 10:00 – 16:00 and every Sunday in January.

1 Wirral MES. Public running, Royden Park 13:30 – 15:30.

1 Woking MES. Mizens Railway New Year's Day Running 13:00 – 16:00.

4 Bristol SME. A 3D Printing Evening with Kevin Slater at Begbrook 19:30.

6 Ickenham & District MES. "Clock Making at the Palace of Westminster" 20:00.

6 Vale of Aylesbury MES. Video Evening BRC Quainton 19:00.

7 Tiverton MES. Monthly Steam Up at Worthy Moor.

10 Southampton SME. Club Meeting Bittern Park Social Club 19:30.

12 Burton on Trent MES. An Introduction to 16mm Scale Garden Railway. Evening talk 19:30.

13 Colchester SME. Evening meeting talk: "Controlling London Underground" 20:00.

13 Hereford SME. Evening talk: "My New Zealand Trip" Richard Donovan 19:30.

17 Taunton SME. Evening Meeting, " Building a 1/3rd scale Armstrong Siddley Aero Engine". Steve Wessel.

18 Leeds SME. Evening talk: "P2 Prince of Wales" at Eggborough.

19 West Wilts SME. Evening Talk: "Isle of Man Railways" at Clubhouse 19:30.

20 Brighton & Hove Society. Evening talk: "65 Years at Hove Park" West Blatchington Windmill 19:30.

20-22 London Model Engineering Exhibition at Alexandra Palace from 10:00 each day.

25 Birmingham SME. Gauge 1 Evening, clubhouse 19:00.

Details for inclusion in this diary must be received at least EIGHT weeks prior to publication. Please ensure that full information is given, including the full address of where every event is being held. Whilst every possible care is taken in compiling this diary, we cannot accept responsibility for any errors or omissions.

CLASSIFIED ADVERTISEMENTS

RATES: Display box: £10.50 for scc (plus VAT) (min 25mm), Classified lineage 70p per word (inc.VAT) (min 20 words)
All classified advertisements must be prepaid. ALL ADVERTISEMENTS SUBJECT TO VAT AT RATE AT TIME OF PRINT

ADVERTISERS' INDEX

www.engineeringinminiature.co.uk

WARCO

2 NEW MILLING MACHINES from Warco!

WM16B belt drive mill

- Poly vee belt drive - very positive and smooth running system
- Brushless motor
- Infinitely variable speed
- Rack and pinion drilling action
- Rigid square column
- Head tilt calibrated 45°- 0 - 45°
- Rev. counter
- Spindle taper 3MT
- Powerful 1 kw motor
- Table size 700 x 180mm
- Standard equipment: drill chuck and arbor

£1,250
including VAT and UK mainland delivery, excluding Highlands and Islands

GH18 gear head mill

- Oil immersed steel tempered gears
- Rigid construction with large section square column
- Rack and pinion drill feed
- Head tilt calibrated 45°- 0 - 45°
- Positive quill depth stop
- Powerful 1kw motor
- Speeds 6 – 95/1,420rpm
- Table size 700 x 190mm
- Spindle taper 3MT
- Supplied with 13mm drill chuck

£1,365
including VAT and UK mainland delivery, excluding Highlands and Islands

✓ *Both mills operate on a single phase supply.*
✓ *A wide range of accessories, including cabinet stands, are available.*
✓ *Digital readout can be fitted.*

Visit our stand at the
London Model
Engineering Exhibition
Alexandra Palace 20-22 January

T: 01428 682929 Warco House, Fisher Lane, Chiddingfold, Surrey GU8 4TD
E: sales@warco.co.uk W: www.warco.co.uk

WARCO

HOME AND WORKSHOP MACHINERY

Genuine Used Machines & Tooling

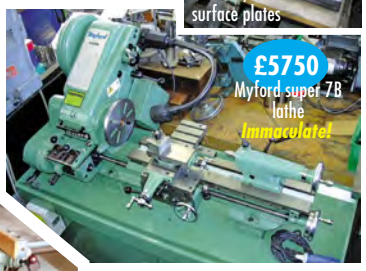
144 Maidstone Road, Foots Cray, Sidcup, Kent DA14 5HS

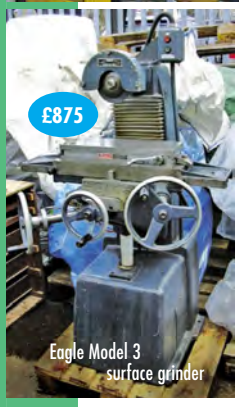
Tel: 0208 300 9070 - Evenings: 01959 532199 - Fax: 0208 309 6311

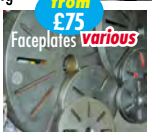
www.homeandworkshop.co.uk • sales@homeandworkshop.co.uk

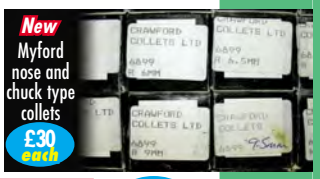
Opening Times: Monday-Friday 9am-5.30pm • Saturday Morning 9am-1pm

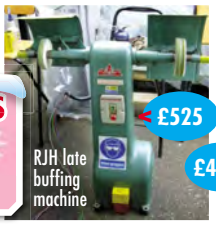
10 minutes from M25 - Junction 3 and South Circular - A205











OPEN DAYS

Thursday 29th and Friday 30th December

>>> 10.00am till 4.00pm <<<

Special deals! • See WEB SITE for details

Happy Christmas & New Year from all at Home and Workshop Machinery

MYFORD GENUINE PARTS

Running out fast!

Purchased from Nottingham

Check the **web site** for full list!

NOW ARRIVED!

- Harrison M300 lathes
- Sajo (Sweden) VRF 52M vertical mills
- J & S 540 grinders
- Startrite 18-S-10 metal bandsaw
- Surface tables
- Warco surface grinder
- Box and pan folder + more!

New even easier to use Web site!

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 are currently seeking late `Myford Super 7B´ & `Super 7 large bore´ model lathes!

SHIPPING WORLDWIDE