

MODEL ENGINEER

Vol. 197 No. 4280

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8-31 August 2006

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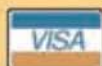
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Model Engineer is published by
Encanta Media Ltd.

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SUBSCRIPTIONS

26 issues (annual) UK £65.00,

Europe £80.00,

US Airmail \$130.00

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Printed by William Gibbons & Sons Ltd.

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ISSN 0026-7325

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MODEL ENGINEER

SUPER
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NEW SERIES:
OHV STEAM ENGINES

On the cover ...

Winner of IMLEC 2006 was Les
Pritchard driving his 5in. gauge
Lancashire & Yorkshire 'A' Class
locomotive pictured here at the
start of his winning run.

A regular contestant at IMLEC,
Les was an early runner on
Saturday in this year's event and
made an uneventful run without
significant problems. This on a
track that caught many
competitors out with its curves
and gradients.

For a full report turn to page 196
of this issue.

(Photograph by Neil Read)

PETE'S PAGE WORKSHOP WRINKLES

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WINSTON CHURCHILL IN 5in. GAUGE

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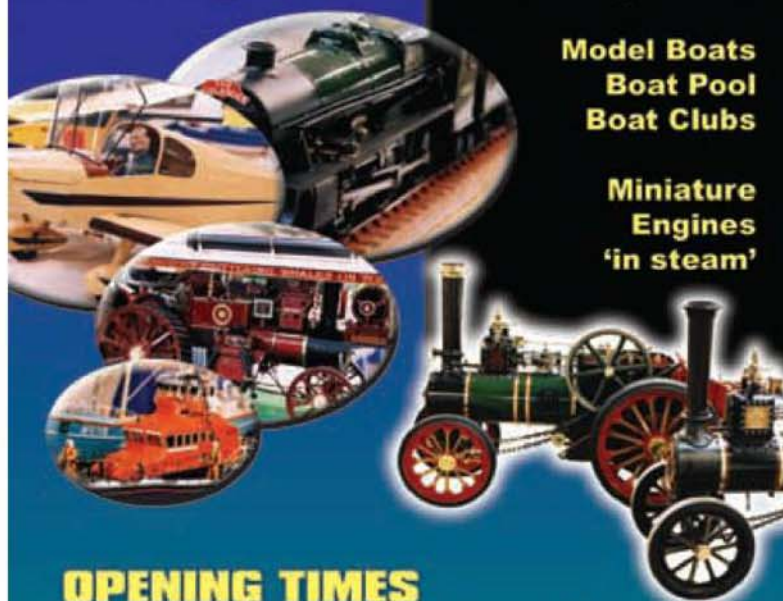
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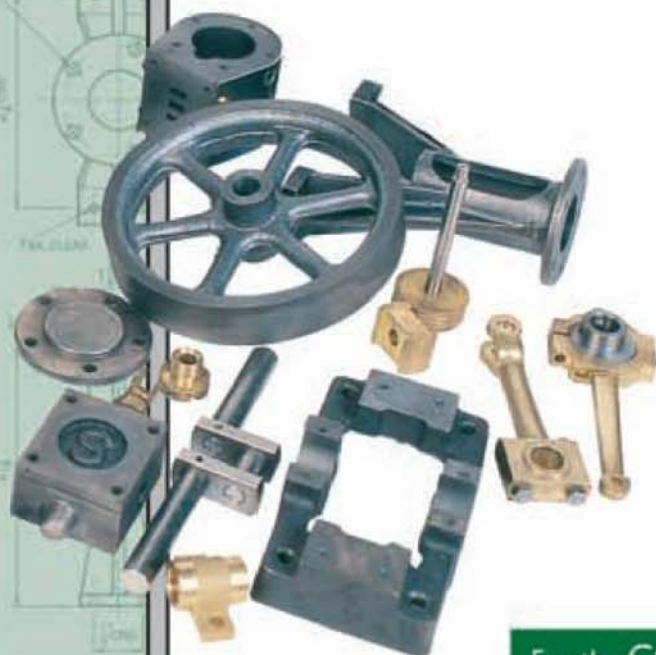
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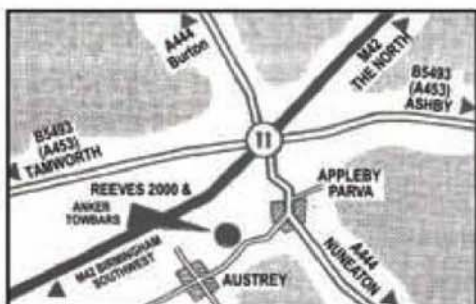
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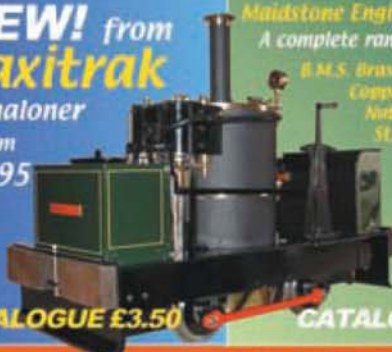
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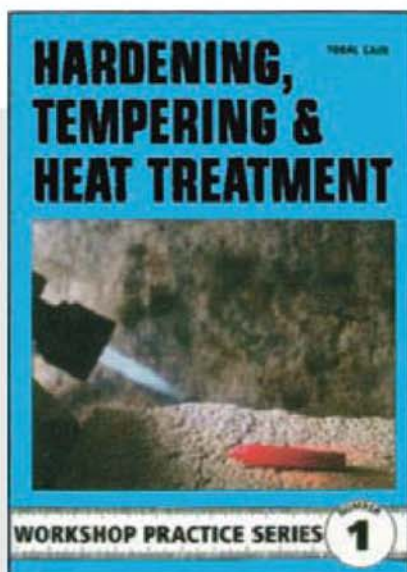
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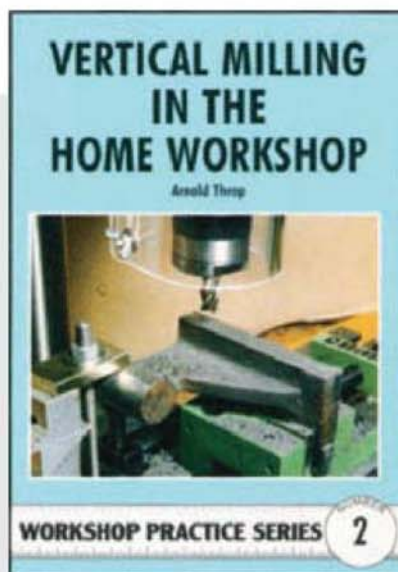
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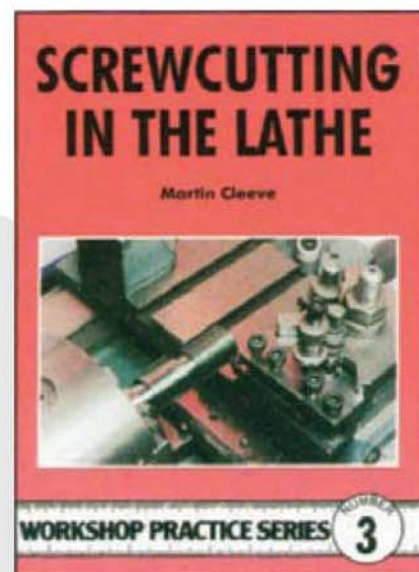
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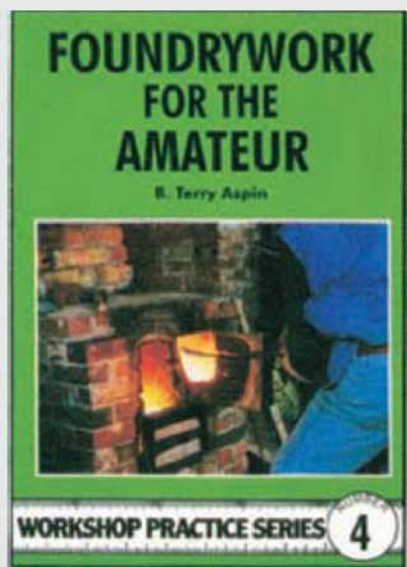
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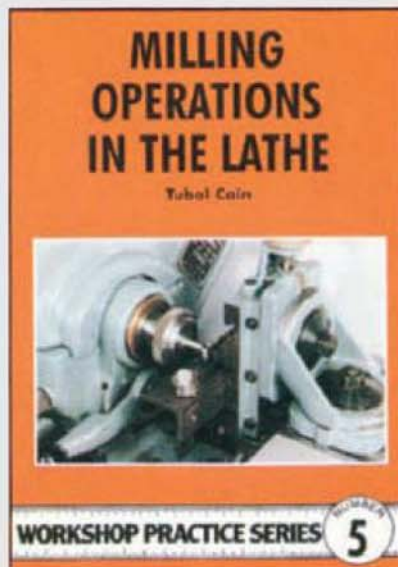
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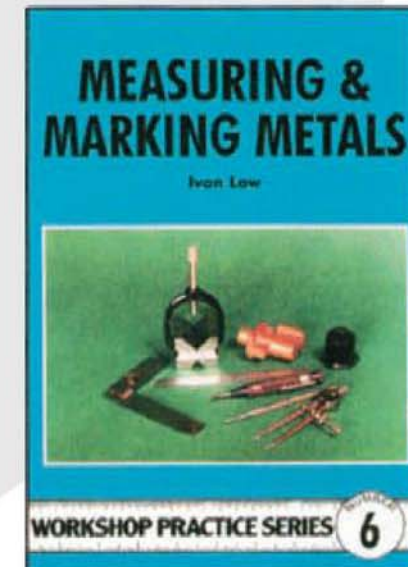
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SMOKE RINGS

With the Editors

Ancient recipes

Neil was recently asked to advise on the manufacture of a gear. The item in question was a replacement for a gear from the gearbox of a Triumph motorcycle - an SD model that was built in Coventry as recently as 1922. Some debate ensued with the owner as to the best choice of material to use for this task. The original was clearly made from a grade of steel that had been hardened, although whether it had been through hardened or case hardened was open to debate. The balance of opinion seemed to be that it had been through hardened. Indeed, if anything the hardening process had been over done and a number of teeth had been broken off and hence the need for a replacement.

Eventually a decision was made and a replacement machined from EN24, which was hardened to 50 to 55 Rockwell C. As the gear was part of the kick starter mechanism and not one of the main drive gears it was felt this material would offer the best compromise in terms of strength and hardness and would be unlikely to give distortion problems during heat treatment. Fortunately, the latter guess worked out in practice and the gear awaits fitment to the rebuilt gearbox.

However, this exercise did raise an interesting point - what was the specification of the original material? As was reported in these pages some time ago (*M.E.* 4206, 17 October 2003) in the article *Which Steel?* the notion of nationally recognised steel specifications was not considered until forced on the country by the Second World War. So, how did Triumph, or anyone else for that matter, source material for applications such as this gear. It is known that different steel makers had their own special recipes so maybe it was a case of finding a steel specification that suited your product and staying with that manufacturer as long as you needed him. We can imagine that not going down too well with the purchasing departments of the manufacturers needing the steel!

We cannot recall seeing old steel manufacturers lists from the pre-war era and wonder if any readers know of any that exist in private hands or local museums. It would sometimes be handy for those who are interested in pre-war machinery of all types to refer back to such documents, particularly those who are fussy and like to stay as close to the prototype as possible. Sales literature for engineering products from that era can be frustratingly vague when they talk about 'best quality mild steel' or 'special alloy steel' and it would often be of benefit to know exactly what the material chosen was even if you later go on to fit a modern replacement with an improved specification.

Engineering boost

A couple of pieces of news have recently crossed the editorial desk, both of which are encouraging for those who take an interest in engineering affairs and its well-being in the UK.

The first is the announcement that the inventor and entrepreneur James Dyson, of vacuum cleaner fame, is setting up a School of Design Innovation in Bath in 2008. This will be a state school for 2,500 pupils aged between 14 and 18

years. Half of the estimated GBP22m cost will be paid for by the James Dyson Foundation and the rest from the government.

In his announcement Mr. Dyson goes on to explain the importance of engineering and the need to excite youngsters as to what engineering can do. He stressed that engineering is about creating interesting things that go on to establish big businesses and earn profit for the country. The UK balance of payments is getting worse by a billion pounds every year so, in simple terms, we are becoming a poorer nation as work is lost to India and China.

Leading engineering firms like Airbus, Rolls-Royce and Formula One's Williams Racing will also be involved with the project.

The second piece of news concerns Sir Clive Sinclair and his latest invention. This avid inventor who brought us the pocket calculator, the ZX Spectrum computer, the digital wristwatch and the ill-fated C5 has developed a folding bicycle. Called the A-bike this is a very small machine designed for short journeys. Its main point of interest is its very light weight (12.5lb) and small size when folded. The folding operation takes approximately 10 seconds and the machine then fits in a small bag and is readily carried on to public transport. It is therefore designed to assist in the daily commute rather than replace more traditional bikes (or something motorised) for longer journeys.

With so much of the news connected with UK engineering being about closing things down we hope these ventures succeed and rekindle public interest in engineering as a profession and hobby.

The last issue of *M.E.* contained a report on the activities of the Society of Model Engineers in promoting training for model engineers. The fact that their courses seem to be well supported and popular with those who attend shows that there is a need to create things in many of us. Anything that promotes this is to be encouraged.



The Fareham 7¹/₄in. gauge track was used to convey IMLEC passengers to/ from the start area.

IMLEC 2006

This issue provides a full report on the IMLEC event held at the Fareham and District SME track on 1 and 2 July. Our production schedules dictate that this is the earliest we can realistically put the report into 'ours' and we hope readers approve of the timing. The purpose of this piece is just to say a big thank you to everyone involved, organisers and competitors alike.

The event was blessed with warm sunny weather and was one of the most smoothly organised events the editorial team have had the pleasure to attend. All the Fareham members seems to be involved even to the extent of modifying their England car flags to suit the event (see photo below) on the very day that England exited the World Cup.

Some IMLEC competitors take the competition very seriously while others go for a good time. Both types provide sport for the spectators and do it with good humour. Indeed, throughout the event we can recall no instances of head butting, technical fouls or the need for the organisers to show their 'red card', something some other sports competitors would do well to take heed of.

Next year sees the event go to Llanelli and District MES. Keep an eye open for details.



Seen at IMLEC 2006 at Fareham. One Fareham member enters into the fun of the event.

POST BAG

Methylated spirits

SIRS, - May I be permitted to add to the footnote to Les Kerr's article on a methylated spirit burner? Methylated spirit is in fact the name given in the United Kingdom for a mixture of ethyl alcohol and methyl alcohol, which are produced together in the traditional fermentation processes leading to spirit drinks such as whisky and brandy. Methyl alcohol (or methanol) is poisonous, causing blindness in human beings, so the distiller's art entails removing this 'light fraction' during the initial stages of the process. This material, containing all the methanol thus goes out of the food chain and was traditionally available for industrial use as a mixture of ethyl and methyl alcohols. As such it has the well-known addictive lure and ability to intoxicate, besides the health hazard mentioned above.

A nauseating agent is added in an attempt to make it unpalatable, and which gives it the characteristic smell. A purple dye is also added for identification purposes. So drink it at your peril!

To say that alcohol ignites at 518deg. C is misleading: that is its auto ignition temperature, which is really of no concern to us. What is more relevant is the flash point, which is below 0deg. C. In normal circumstances, if a source of ignition is present, the liquid will start burning readily, hence its use as a fuel.

An added benefit of methylated spirit is that, containing only a relatively small amount of carbon, its combustion is clean.

D.A.G. Brown, Rutland.

Casting quality (1)

SIRS, - In regard to Eric Clark's letter in M.E. 4274, 26 May 2006 regarding poor quality of castings I regret I can only suggest from my own 30 years experience working in the model engineering supply trade that things have been like this for quite some time and will never substantially improve. At least it will not improve while reliance continues on the time-honoured methods of manufacture by individual craftsmen who had served apprenticeships and been taught their trade by master craftsmen.

Great Britain no longer has the industrial base it had five decades ago when I did my own engineering apprenticeship. The men who taught me are now dead, or will be

in a decade or so. My former apprentice colleagues and I are now retired and only a few of us continue to pass on our experience in magazines such as this one.

I was told that in the year 2004 about 80 foundries went out of business. Many more will have closed since then due to lack of political will or expensive impositions of the Health and Safety Executive.

The time-honoured foundries were horrible, dirty, often dangerous environments to work in as a 'Black Country' tale about Aynuk and Ayli tells when one of them went for a job in a foundry and was taken round by the manager. "Oi ay werkin' in this filthy 'ole", he said. "This ay the werks," says the manager. "This am the canteen."

It seems that the youth of today do not want to work in that sort of environment, and who can blame them. The inventor of the computer has a lot to answer for in many respects and as a more or less direct result the foundries that are left lack many of the necessary skills to produce quality work.

I remember problems in the mid-1970s obtaining quality castings for the 7/4in. gauge King cast iron cylinders from complex patterns and core boxes. One elderly manager said something like "Wowee I shall enjoy making these!" and he was asked to make a sample of each. They were GOOD too! He was asked to produce 10 more of each. "How many? Impossible! Uneconomic! I only did these samples to keep my hand in."

One sad supplier director returned to tell his tale and has often repeated it. I note that these castings are now sold in gunmetal for the non-ferrous castings trade still survives and still has moulders of the traditional training, but even that is coming to its end.

The way forward into the 21st century seems to be down the road of investment (lost wax) casting not from 3-dimensional patterns, but from dies injected with wax under high pressure. The down side is that:

(a) The dies are best made with computer controlled machinery and

(b) As a direct result will almost certainly cost a lot more to produce and sell than were the comparatively small batches available previously. It's a different "ball game" if you want thousands of components. Then a production set-up becomes economic.

Over those three decades I made some good friends around the country and one complainant said to me "I'm not paying those prices just for a disc of cast iron (disc bogie wheels for a passenger car) so I'll make my own pattern and we have a local foundry who will help". He did just that. He wanted eight, the foundry made some spares and he had to pay nearly twice the supplier's price and was vehemently upset. I managed to refrain from saying "I told you so."

I would suggest to all who have had similar experiences, and I am not being unkind with this suggestion to the extent I would be delighted to correspond with Eric, for he and I both have 42 years experience of the hobby, make a pattern with some detail external work, ribs and bosses, preferably with a core box, go to a foundry and see if you can do better than the suppliers both in quality and cost. Then tell us how you fared after viewing the other side of the coin.

David Piddington, Birmingham.

Casting quality (2)

SIRS, - What a pity libel stops us naming the culprits. A while back, I phoned an order for a set of castings. When I received my credit card statement, I realised I had been debited more than the advertised price. The supplier then told me the price had gone up (no mention was made when I ordered) although the advertisement remained unchanged for months after.

One casting was obviously unusable and two were of the same hand. The faulty one was replaced, after I had paid for the return of several pounds of casting, with another with the same fault and was told I had to make do with the two same-handed bits.

The third casting was useable but there was nearly an A4 sheet of mistakes in the drawings.

I gave them a print out of the errors, but that did not even produce a thank you. They are still in business, but never again with me.

Another set, from a different firm, had hard spots, bits already below finished size and drawing errors.

I asked the same firm to cast a Fowler cylinder block (just a plain block with no cored holes or loose pieces). When I went to collect, I was offered, at full price, a casting with a finger size depression. I told them that if, as an apprentice, I had made a casting like that, I would hope it was put back in the pot before the foreman saw it.

Their next effort was pretty poor, but I made it do with filler.

How many readers have been sold metric size material when they have asked for imperial and then found out too late? Look out for 3/16, 1/4 and 3/8in. which can be 5, 6 and 10 millimetres.

John Day, Dorking.

Casting quality (3)

SIRS, - Mr. Clark's letter (M.E. 4274, 26 May 2006) struck a very loud chord with me. A well-known supplier on separate occasions supplied three fairly large ferrous castings. The first was chilled and a tipped tool would not cut it, so a local toolmaker removed the skin on a centre grinder.

The next casting was even worse! The next (together with its fellow) was sent to a local heat treatment specialist company, who after hardness testing annealed them all at my expense.

The second casting, once it had been annealed, machined up well. The third casting was not the correct one according to the drawing. A 7in. dia. solid disc for a 5 3/4in. dia. pulley is not my idea of a suitable casting.

The company refused to accept the return of this casting, saying it had been altered! What had been an item of unmerchantable quality had been altered at my expense to a quality item.

Bad foundry practice of striking the mould whilst still hot caused the chilling. Having received three in succession I had no reason to assume that any replacements would be of a better quality.

Amongst the brotherhood of model engineers there are many of us who have had years of professional experience in all branches of engineering who resent being treated in a cavalier manner by some suppliers. *Caveat Emptor*. R. J. Grave, Suffolk.

Can we take this opportunity to apologise to Mr. Grave for incorrectly attributing his previous letter (M.E. 4273, 12 May 2006) to a Mr. Phillips.

Casting quality (4)

SIRS, - I read with interest Eric Clark's letter M.E. 4274, 26 May 2006 concerning castings. As I have an interest in the supply of castings in association with Polly Model Engineering, who supply castings for my stationary engine models, I wonder if a view from the supplier's side may be of interest.

Finding a foundry these days willing to undertake small quantities of castings is very difficult. Over the years I have had four foundries give up on me. The best foundry man I ever knew had a passion for the job and I would go along with an 'interesting' pattern and he would smile muttering about a challenge, a few days later he would ring up and say the castings were ready and always nicely finished.

The company he worked for, facing the prospect of heavy expenditure for meeting new health and safety legislation and emissions legislation, decided not to bother and closed the foundry down putting my friend out of work. He tried to start his own foundry but got nowhere facing opposition from financial lenders and business start up experts. However, if he fancied starting up as a hairdresser there would be no problem. Where is he now? On night work cleaning toilets in office blocks?

We finally found a nice foundry where we now get our castings, for a while only non-ferrous was available so we did all the castings in gunmetal including flywheels rather than risk going elsewhere for iron flywheels and getting back castings with the hard spots mentioned by Mr. Clark.

Our foundry is now working with iron and most are coming out fine but occasionally there will be one with a hard spot. Mr. Clark may have a book on how to avoid hard spots but in practice it is a different matter. I recently had six flywheels all poured at the same time. Five were okay but one was hard. You may not believe it but someone opening the door and coming into the foundry can cause a chill in a casting. Slightly damper sand and all manner of things can also affect the end product.

It is not an exact science, we may have been casting iron for two thousand years but interestingly, considering the recent letters on Chinese lathes, they have been casting iron for three thousand years, but there are so many variables you cannot guarantee perfect castings made in small quantities by hand methods. We are now considering having all our iron castings annealed to remove any hard spots but this will incur an extra cost.

For small volume hand moulded castings the prices charged are not expensive they are in fact quite cheap.

Over the last few years there have

been a number of technological advances in foundry technique, I will not go into detail but one is the replacement of mould boxes with a form of box included in the pattern, it will make it easier for the foundry but considerably increase the costs of patterns.

Yes, we should consider ourselves fortunate in still being able to get castings in small quantities from a British foundry.

Is there hope for the future? If the costs of Rapid Prototyping fall sufficiently and 3D CAD software follows suit then there is a chance we can keep pace with foundry requirements and keep costs down, otherwise start saving your pennies as the cost of castings will continue to rise, quite apart from the huge increases in the price of metals recently.

Anthony Mount, Devon.

Vandalism – a solution

SIRS, - In M.E. 4275, 9 June 2006 Malcolm Stride asks for help re. solving the problem of persistent vandalism.

We do not suffer from this on anything like the scale described, but having a few years ago suffered several break-ins to our somewhat isolated premises at Haynes, we tried various strategies. For night-time security we leave long life, low wattage bulbs on over both entrances to our clubroom/buffet. This is a few yards off a busy main road, and there is a chance that passing traffic will see and report any unusual incident.

Secondly we contacted the local Police dog handlers branch and invited them to use our facilities at any time, day or night, as part of their training programme or merely to give their dogs a run when the premises were otherwise unoccupied. Stressing that we have a ground level railway evoked a lot of interest, the dogs are often called on to assist in searching railway premises, but locally the full-size railway is a 24-hour operation, and there are certainly health and safety implications against using it as a training ground.

The dogs, their handlers and their very distinctive vans turn up at the site at all hours of the day and night, and surprise we have had no further problems.

We have, however, built up a rapport with the dog handlers, many of who, with their children have become enthusiastic supporters of our public running days.

All we can say is that it has worked for us, at Bedford, maybe a

similar approach to other police forces would bear fruit.

Most dog sections are only too keen to have permission to use alternative sites, the dogs apparently get bored with doing the same training over the same ground all the time.

A word of warning, if there are other users of your site, we have a furniture dealer at the front of ours, do warn them of what may happen, it comes as something of a culture shock to walk out the front and find two or three van loads of large and often noisy dogs parked in front of the shop!

I hope this helps.
Ted Jolliffe, Bedfordshire.

A correction

SIRS, - Thank you for publishing my letter in M.E. 4275, 9 June 2006. Unfortunately on re-reading it I have spotted two errors, neither of which change the thrust of the letter but for good order I felt I ought to write in case other readers raise them.

1) In the third paragraph, 5th line, the word "less" should read "more". This was a mental aberration on my part and will be obvious to anyone who tries this test.

2) The text from George Thomas is correctly quoted direct from his calculations but regrettably it appears that he too was vulnerable to the odd mistake. The required convergent "g" leads to $(2 \times 2 \times 13)/(3 \times 11)$ which equals $(10 \times 20 \times 65)/(30 \times 55 \times 5)$ as stated in his calculation. However, the latter leads to a simpler chain being $(40 \times 65)/(30 \times 55)$ which can be set up with an idler wheel, not $(50 \times 40 \times 65)/30 \times 55 \times 25$ as reproduced from his calculation sheet.

Please accept my sincere apologies for allowing these errors to creep into my letter.

Adrian Garner, by email.

Braking system for Anna

SIRS, - Interesting though Mr. Ian Abbott's comments are about my design, I think that he is worrying unnecessarily about uneven settings among the four tender axles. In a Bowden cable connection there is enough elasticity to ensure that balance is maintained between the two sides and from end to end. All that is required is that the four sets should be balanced to start with, not a very exacting task, bearing in mind that we are braking a vehicle from a maximum of about 10mph!

Looking at Mr. Abbott's details, however, I do approve of the

economy of materials he achieves by halving the number of cables to each bogie and I shall certainly consider incorporating this feature in my own example. Creating an imbalance, however, between the two bogies by having one cable turn through 180deg. is not, I believe, such a good idea. If you want compensation to be effective, then the paths for all systems should be symmetrical.

I look forward to seeing Mr. Abbott's finished result in action on the track.

D.A.G. Brown, Rutland.

Don't forget MESNI!

SIRS, - I have just been reading M.E. 4275, 9 June 2006 and was delighted to see the coverage of the Ulster Folk and Transport Museum at Cultra, Northern Ireland. However, I was a little surprised that Roger Backhouse, the author, made no mention of the Model Engineer's Society of Northern Ireland (MESNI) tracks in his article. The Club's headquarters is situated at the lower reaches of the museum site, adjacent to "The Flight Experience" just after the large iron ship *Result*. Here is located a ground level 7 1/4in. track as well as a raised 3 1/2in. and 5in. track. There is considerable activity at the track in season; Society members regularly steam their own as well as club locomotives and provide rides to members of the public visiting the museum. The society's monthly newsletter *The Link* is regularly mentioned on the *Club Chat* pages of your own magazine.

I felt I should write to redress the balance. In the article BCDR's track at Drumawhey Junction, 10 miles away, got a mention but ours did not. Also, I would remind interested parties of our existence down at the bottom of the site. I hope that Roger will find the time to visit the track and meet the members during his next visit to Cultra. Our website is www.mesni.co.uk
Brian Spurle, by e-mail.

We have also had a letter from Mr. Saunders on this topic. I think Roger concentrated on the museum as we had already published a Club Profile for the society in M.E. 4263, 23 December 2005 – Malcolm Stride.

Tangye origins

SIRS, - In the first article of his series (M.E. 4270, 31 March 2006) David Piddington refers generally to the Tangye family origins in

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Publication is at the discretion of the Editor.

The content of letters may be edited to suit the magazine style and space available.

Correspondents should note that production schedules normally involve a minimum lead time of six weeks for material submitted for publication.

In the interests of security, correspondents' details are not published unless specific instructions to do so are given.

Responses to published letters are forwarded as appropriate.

Cornwall. I believe that they actually hailed from Illogan, to the north west of Redruth. An Internet search for Tangye and Illogan provides extensive family history. Of interest to engineers, however, is that Richard Tangye maintained a summertime residence at Aviary Cottage at Mary's Well just outside Illogan, including a personal engineering workshop. The house is now a hotel and restaurant and up to a couple of years ago, whilst staying, we noted that there were photos of the workshop to be seen around the bar and lounge.

The house is near the abandoned route of the Portreath Branch of the GWR. Much of the route can be still followed. It is of particular interest on account of its termination in a spectacular steep gradient of some 70 metres drop straight down the side of the valley to the Portreath harbour and port.

John Boothman, High Wycombe.

GWR pannier tank codes

SIRS, - I would like to answer D. M. Hughes' letter (*M.E.* 4273, 12 May 2006). Mr. Hughes is absolutely right about the proper codes for the Pannier Tank and I've given myself a mental kick up the backside because I was aware of this when I wrote my article and omitted to mention these codes. My thanks go to Mr. Hughes for reminding me of the codes and for bringing them to public attention.

Indeed I can add further to what Mr. Hughes states and inform readers that the PH, PJ, PK and PL codes to which he refers for the engine's boiler could be found stamped on the lower raised beading on the locomotive's number plate. I saw this many times when I worked with these locomotives at Ebbw Junction Depot in 1956 and I can inform also Mr. Hughes that locomotive No. 8711 had a PH boiler in its last days. I know this because I purchased one of its number plates when it was scrapped at John Cashmore's yards at Newport in 1962.

Peter Rich, Newport.

Boiler testing and heat

SIRS, - Can I inject a note of caution to those who follow the procedure for curing small leaks in boilers using applied heat outlined by Peter Rich in his series on building locomotive boilers (*M.E.* 4274, 26 May 2006). Peter does warn builders to "remove it (the source of heat) in time not to go past the designed working

pressure" but past experience suggests that this warning needs to be emphasised.

The reason for my concern is that if the boiler is absolutely full of water with no air, the pressure will rise quite fast once the heat permeates through to the water. The trouble is that by this time the copper is likely to be hotter than the water and will be storing a considerable amount of heat which then transfers to the water causing the pressure to rise even more with no quick means of stopping it unless the tester has had the foresight to fit a valve to the boiler for testing.

The situation is even worse if there are small pockets of air in the boiler because the pressure will not start to rise noticeably until that air is compressed, by which time even more heat will be stored in the boiler structure. Those who have pumped up a boiler on test which has had small amounts of air in it will know the effect.

As an illustration of how little heat is needed, I once left a small (2½ by 10in. barrel) high pressure Scott type marine boiler (to the Alan Rayman design) under hydraulic test (at 300psi) in my workshop overnight. My assumption was that the pressure would gradually drop during the night.

Unfortunately the pressure held firm and when I finally got into the workshop at about midday the next day the sun was well up and the workshop had got quite warm causing the temperature of the boiler to rise.

The result was that the pressure had risen to about 450psi, which I could only estimate since the needle of the test gauge was past the end stops and well into its second lap.

Result, a good sound, but over pressurised boiler with well domed end caps and a now useless test gauge!

The answer is to apply the heat very slowly and to remove it as soon as any pressure rise is seen on the gauge. You have been warned.

Malcolm Stride, Berkshire.

Autolock chucks

SIRS, - I write with reference to the letter from a Mr. Sadler that you published (*M.E.* 4276, 23 June 2006) regarding the "correct"

assembly of a Clarkson Autolock 'S' - type Chuck, and oh dear me, such a shame that the "correct" assembly procedure is in fact 'incorrect'. The method that Mr. Sadler describes is in fact one which is certain to damage the hard centre inside the chuck body, and one which is also likely to lead to extreme difficulties in extracting the cutter after a heavy cut.

I feel Mr. Sadler would be far better off if he referred to the instruction book supplied with his Autolock chuck, instead of trying to write his own. In said publication, the instructions are very clear, and far more concise, and tell you to insert the collet into the main chuck, lining up the flats that drive it, and then screw in the nosepiece ALL the way up to the shoulder finger tight. Then and only then do you screw the cutter into the collet, finger tight, until the cone in the end of the cutter comes into contact with the hard centre in the body. The instructions also say to give the nose a final nip with the spanner.

My own method is a very slight variation on this theme, but achieves the same thing. Because of the large diameter thread and the close fitting nature of the nosepiece, it is very easy to get it slightly at an angle and then it jams easily. I screw my cutter into the collet a maximum of two turns, and then with the extra length of the cutter, it is a little easier to line up the nosepiece before screwing it all the way home. Then I screw the cutter up to the centre. I do not give the nose a nip with the spanner; I only use the spanner when removing a cutter. I have never had a problem with cutters working loose, running out of true, chattering due to not being held tight, or of the cutter moving inside the collet vertical so that the job becomes tapered.

I have also never damaged the cone inside my chuck. I should like to point out that as I work in manufacturing as well as being a model engineer at home, I drive my machines very hard, I do not take cuts in the 0.01in. region like a lot of model engineers do, my cuts are more in the 0.1in. to 0.2in. range.

The very name of the equipment should give you a clue, it is an Autolock chuck - it locks itself!

Contrary to what Mr. Sadler says in his letter, if the cutter does turn in the chuck on the first cut - which is as likely for any depth of cut, then the thread on the end of the cutter will actually push the collet harder into the taper of the nose and therefore grip the cutter tighter.

There is also the accuracy issue. The screw thread of the nosepiece cannot and will not accurately align the cutter on its own by its very nature. The nosepiece must be fully screwed home so that the precision ground shoulder is hard against the body, which will then mean that the collet held inside - the seat for which has been accurately machined at 90deg. to the seat - will be in line with the axis of the spindle.

I urge all model engineers who have read the above mentioned letter to totally disregard the instructions it provides and refer instead to the correct procedure in the instructions provided by Clarkson's with every new chuck. These instructions have been written by the makers specifically to give you maximum life expectancy out of your precision equipment. If you use Mr. Sadler's method as published in *M.E.*, then you will need to place a regular order with Clarkson's for new components.

Edward Parrott, Warwickshire.

Appreciation of Bowman

SIRS, - Thank you for publishing Marcus Rook's Bowman series which, like Stan Bray's pieces, is ideal for those aging 1940s and 50s schoolboys like myself, who are now learning, in retirement, on the 1950s machines we worshipped from a distance when new. I think pop-rivets were around between the wars, used in constructing early all-metal aircraft. A now long-dead garage proprietor told me they were also used on the Dagenham production line, to hold in place for welding the body panels of the 1936 Ford Model Y 8hp - and by several other manufacturers thereafter. Marcus Rooks advises using 'stamped brass end caps' for his boiler and Mamod cylinder and water gauges, without mentioning where to get them. Does Malins Engineering or a successor still exist, or did some entrepreneur buy up the bits? - if so who and where? Some years ago, with flywheels in mind, I bought some suitably sized cast brass castors in mounts for screwing on the ends of drain rods in an iron-mongers sale - if I can find which box they are in...

John Smith, Oxfordshire.



B.C.A. JIG BORER

Tony Griffiths

turns his attention to the 'ultimate' small jig borer/precision milling machine in its many guises from various manufacturers.

Number 4

The B.C.A. precision miller and jig driller is a development of the WJA, a late 1880s design by Wolf Jahn, the German company best known for its high-quality watchmakers' lathes and associated tools. In its original form the machine seems to have survived until the early 1920s and used a head adapted from those employed on the company's watchmakers' lathes where a spindle and bearings, both made from glass-hard ground steel were lapped to a perfect finish. They were advertised as being capable of "up to 5000 rpm."

The head was fitted with both screw and lever feeds and, although not clear from the advertising illustrations, the main column was split horizontally to allow the insertion of a distance piece to increase the clearance between the spindle nose and rotary table.

The concept was then taken up by Boley. By the late 1920s, it had developed as the Model 80 or, with a plain compound table, as the 80a. Those were smaller machines than later versions. The table was only 6in. (150mm) in diameter, the hole through the spindle 0.314in. (8mm), and the distance from column's inner face to spindle centre just 5in. (130mm). In this form it is clearly recognisable as the immediate forerunner of the B.C.A.

During the 1930s further improvements were made including the use of heavier castings and a head that could be inclined and driven by a feed-screw. This version was also advertised as the Leinen, and Boley & Leinen, BFL, the sales catalogues being identical apart from the name on the cover.

Because this was a unique machine, capable of being adapted to a wide variety of tasks and able to work with great accuracy, it is likely that just before (or in the opening months) of WW2, the British Government's Machine Tool Control Rationalisation Board ordered that copies be made for use in instrument factories, and other precision and repair facilities. These versions were sold badged first as Ultra and Excel and later as B.C.A. All the early UK-made machines appear to have been indistinguishable from the Leinen and the Boley versions of the late 1930s, apart from the motor mount and a covered circumferential gear on the rotary table.

Exactly what arrangements were made for the production and marketing of the British models is unknown but advertising literature of the time announced that the Ultra and Excel versions were made by companies within the, then, large B. Elliott Group - probably the Victoria Machine Tool Company and the Progress Drilling Machine Works. However, even this is not

certain. It was also stated in contemporary Elliott catalogues that their machines were made: "at the works of our subsidiary and associated companies whose whole output of machine tools and equipment is solely controlled by us." The clue lies in the word "associated", Elliott had enough buying power to commission and then re-badge machines from a large number of independent home and European makers, so exactly where the B.C.A. was manufactured will probably remain a mystery.

The borer was also listed in the sales catalogues of the well-known machine-tool marketing company E.H. Jones where they appeared with both B.C.A. and Sigma-Jones badges.

When the design passed out of Elliott's control manufacture appears to have been taken up by several companies in turn including the Kine Engineering Works in Redhill, Surrey (makers of Multico woodworking machinery) and B.C.A. Bloctube Controls of Aylesbury, Buckinghamshire, a firm whose main activity centred on mechanical control-rod systems for aircraft. By the late 1940s R. E. Godfrey Ltd. of King's Mill, Kings Mill Lane, South Nutfield, Redhill, Surrey had introduced the much heavier and more robust Mk 3, the last of the type with production then passing to the present makers, Tenga Engineering, of Redhill, Surrey.

During 1960s and 70s R.E. Godfrey was also responsible for the B.C.A. Optical Jig Borer, a much larger, floor-standing machine.

Early examples

Although all early examples of the machine appeared superficially identical, various improvements were made as UK production got underway, with some machines having 6in. clearance beneath the spindle nose and others 7in. Speeds also varied with those on the Ultra, for example, becoming 365 to 1045rpm while the Excel had a range that extended from 565 to 1560rpm. Another version was also built, presumably for some special-purpose task, with the motor spindle carrying a reduction gearbox that gave a maximum speed of only 500rpm. - a figure so low as to render it completely unsuitable for use with small-diameter cutters. However, probably the most significant improvement was to the head where, instead of being limited to 40deg. of inclination each side of vertical, an increase was made to a more useful 45deg. with precise location back to zero assured by the use of a ground dowel pin.

Although the changes to the head angle were welcome, the machine was still stuck with a drive system that mitigated against further improvement - a fractional horse power motor bolted to the back of the column and driving the spindle with a round, originally a composite-construction leather and fabric 'rope', via a series of jockey pulleys. After leaving the motor pulley the rope ran first over a jockey pulley mounted on a bar pivoting concentrically with the motor's spindle and tensioned by a heavy



The B.C.A. Mk 2, derived from a pre-war German design.

tapered cast-iron weight suspended within the main column. The drive then passed round a pair of pulleys carried on an adjustable (spring-loaded) arm mounted on a bracket formed as part of the head casting.

Various guide pulleys ensured the belt was always wrapped snugly around the spindle pulley. However, as the head reached its maximum inclination the rest of the assembly struggled to keep the belt in place, and the boss carrying the jockey pulleys eventually fouled the side of the column. On one example of the Ultra owned by the author a simple yet ingenious solution had been found - the motor was fixed to a plate carried on a boss that fitted into a hole on the back of the column. This arrangement allowed the motor to be swung in sympathy with the head and the belts to run almost in line, no matter how far over the head was inclined.

Unfortunately this system was not further developed - indeed, later versions of the machine, built by both B.C.A. and R. E. Godfrey, had heads restricted to just 30deg. of tilt. A solution seen some years ago on a friend's machine was to remove the jockey pulleys and use their mounting bracket to fit a small but powerful DC motor taken from the Winchester disc drive of an old main-frame computer. This particular set-up gave, in conjunction with a variable-speed controller and the 3-step pulley (using a modern poly-cord belt), a speed range that ran from 100 to over 4000 rpm. Today a small 3-phase motor under the control of a phase inverter would be the way to go.

On the Boley and subsequent versions the head was a specially designed unit. It had a 7/16in. bore spindle made from high-quality steel hardened, ground and running in hand-



The B.C.A. Mk 3, of which the latest version is still in production at Tenga Engineering.

finished parallel-bore (slotted) phosphor-bronze bushes, threaded at both ends, and set in tapered housings.

Serrated ring nuts, which drew the bearings down into their seats, were used for adjustment. However, to limit the extent to which they could be closed, each had a thin bronze insert (that could be thinned if necessary) slipped into their 'compression slot'. The upper and lower adjustment rings for the top bearing (the smaller of the two), were each extended to hold a large self-aligning SKF ball race designed to absorb the considerable spindle end thrust experienced during boring operations in harder materials.

The 3-step cast-iron drive pulley was keyed to the spindle and secured by a single slotted-head screw. On the left-hand side of the head was a screw-adjustable depth stop and most machines also had a simple clamp (to the right of the spindle) to lock the head when taking cuts with the compound or rotary table. The spindle nose was 5.5in. above the table (minimum distance 2in.) with cutters and boring heads held in rather small collets of the Lorch 'long-series' type. Some of these collets have been found with a

thread inside, ideal for holding cutters that would otherwise tend to 'walk out' of a plain collet if used to cut sideways.

The feed screw, in hardened steel, ran through a long bronze nut slotted vertically halfway along its length, but without an adjustment screw. Play in the slide was adjusted by either an ordinary 'push-screw' gib strip or a thick, tapered gib block that was hand scraped to perfect flatness. Slideways were scraped.

Although the head carried an engraved rule scale extending to 5in., only 4.5in. of travel was available.

B.C.A. Mk 2

The B.C.A. Mk 2 (photo 1) offered the choice of two spindle ratios: 350, 470, 590 and 1000rpm as standard or, at extra cost 700, 940, 1180 and 2000rpm. Although useful for larger-diameter boring work neither range was really fast enough to get the best out of very small-diameter cutters and it is not unusual to find machines where owners have fitted a 2800rpm motor, or a larger drive pulley, to obtain significantly higher revolutions.

The compound-slide rest had scraped ways, a longitudinal travel of 7in. and a cross travel of 5in, although the Elliot sales literature mistakenly claimed 8in. for each axis of both the Ultra and the Excel. The feed screws were ground from hardened stock and ran through bronze nuts with the simplest form of backlash compensation: a slot cut through the nut with a screw to nip up the clearance. Although the micrometer dials were rather small, and lacked vernier scales, they were calibrated in 0.001in. increments and each axis was also provided with a rule fitted into a clamp such that it could be adjusted quickly and easily.

Attachment points to hold dial-indicators were also fitted, as were screw-adjustable stops, although, some machines have been found without either of these refinements. Instead of a conventional T-slotted rectangular table the top section of the compound slide was formed as a permanent 8in. diameter rotary table, engraved at 2-minute intervals and with three (later four) T-slots. The table worm-drive gear was contained in a rectangular housing at the front (on the German versions this was rounded off) that could be disengaged by slackening two cross-pin-headed screws, so allowing it to be spun by hand. Occasionally machines are found with a rectangular T-slotted slide on top of the rotary table which severely restricts the height of jobs that can be accommodated, and even less frequently a rectangular table in place of the round.

B.C.A. Mk 3

The final development of the borer, which attempted to address the remaining shortcomings of the Mk 2 and make it into a truly useful machine, was the B.C.A. Mk 3 (photo 2). Of significantly more massive construction, with a much deeper and wider main column, this version was arranged to carry the head higher and so give both an extra 2in. clearance between spindle nose and table and a slide travel of a little over 6in.

The head castings were heavier, with slightly wider slides (though the spindle and bearings remained unaltered) and on most machines both a direct-acting screw and a side-mounted handwheel were fitted, the latter driving (at 90deg.) through worm-and-wheel gearing to give an extra-fine feed. Unfortunately these welcome modifications resulted in the head's maximum inclination being reduced from 40deg. or 45deg. to only 30deg. Both elements of the compound table were lengthened to give an extra two inches of travel on each axis, and the feed screws equipped with ball thrust races and larger micrometer dials.

The number of slots in the 8in. rotary table was increased to four and, by using a 2-speed 3-phase motor, 11 spindle speeds were available spanning 300 to 3250rpm, a significant improvement on the limited and comparatively slow ranges available previously. The drive system was also modified and, instead of a tensioning weight within the column, an extra pair of jockey pulleys was used, mounted on a swinging bracket pivoting on a bar socketed into the left-hand side of the column.

Installed in a modeller's or experimenter's workshop any type of B.C.A. is probably the

ultimate in a compact, versatile precision milling machine. The built-in 8in. rotary table means that complex jobs can be set up and left in place through multiple machining operations, while the rule and dial-indicator mounts mean a quick and easy way of checking lengths and depths of cut.

The continuing usefulness of the machine is demonstrated by the fact that, in the 21st century, the Mk 3 remains in production at Tenga Engineering (late examples are finished in a rather pleasing smooth black finish) with a price that reflects both the great care taken in its construction and the use of the good quality materials.

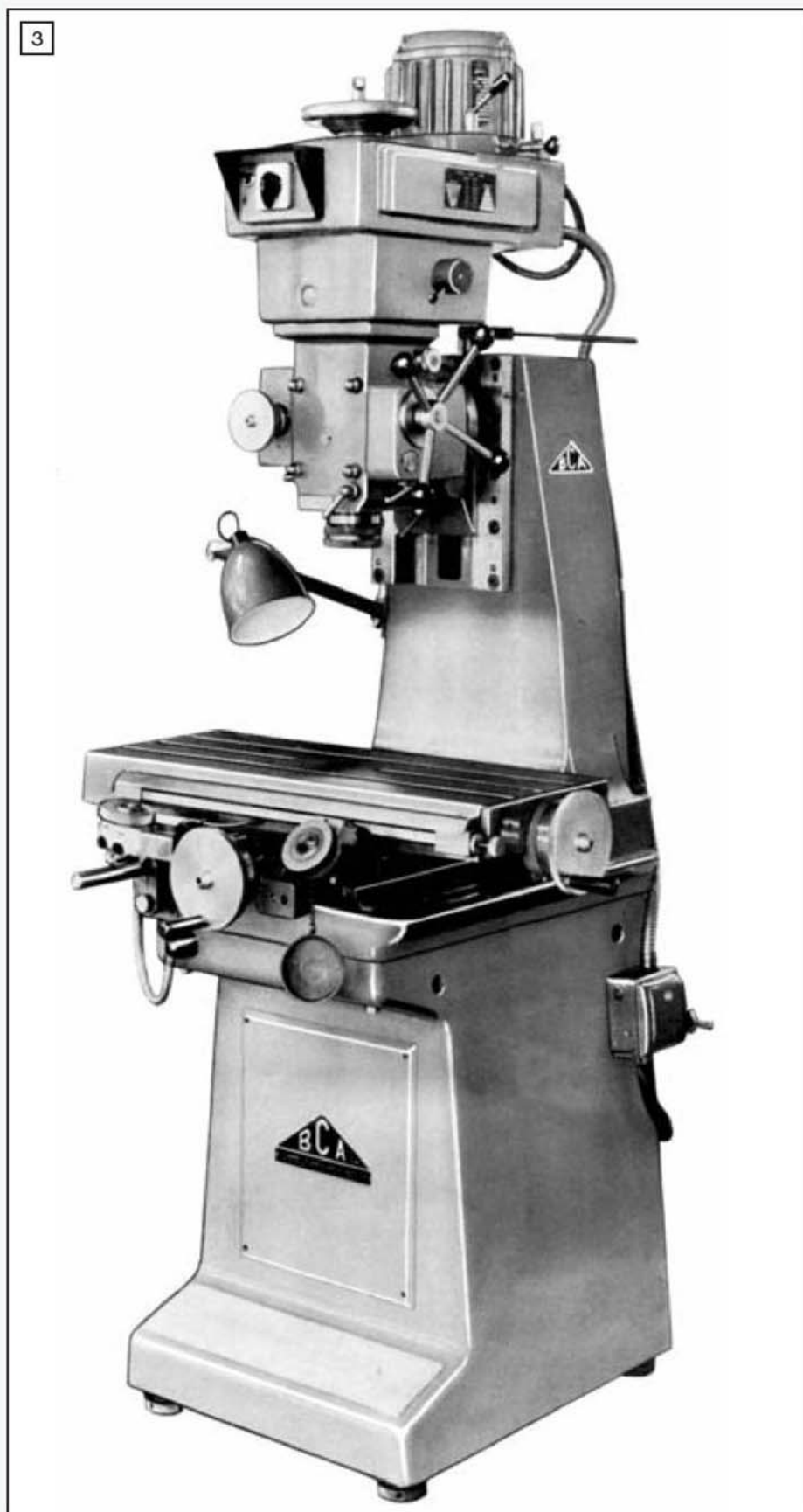
BCA Optical Jig Borer

Manufactured during the 1960s and 1970s by R. E. Godfrey Ltd., the BCA Optical Jig Borer (photo 3) complimented its much smaller, but better known, Mk 3 bench-mounted 'precision jig borer and driller'.

With a fixed height table and its vertical head moving in a ground dovetail slide formed on the front of the main column the 'Optical' was built along traditional jig borer lines and was, at 14 cwt (711 kg) without a motor, massively constructed for its size. The head assembly, with the main drive motor at the back, was completely self-contained and had its 7in. (178mm) of travel driven by a 4-handle capstan wheel working through a bevel box and large-diameter vertical screw than ran through a massive bronze nut. The slideway clearance was set by a tapered gib-strip with adjusters at both ends and the vertical adjustable stop was fitted with a dial indicator to ensure absolute accuracy.

The 3 $\frac{3}{8}$ in. diameter hard-chrome-plated quill carried a 20 INT taper nose and was both bored through to take a draw bar and had a screw fitting on the end for direct-mounting cutters. It could be raised and lowered by both a fine-feed handwheel working through worm-and-wheel-gearing or power feed. Using the hand feed 5in. of quill travel was available but with power engaged the working of an adjustable automatic safety stop caused this figure to be slightly reduced. Machines built during the 1960s had a 3h.p. motor driving through 5-step V-pulleys that gave, in conjunction with a single-lever-operated reduction gear, a choice of 10 speeds from 70 to 3000rpm. Later models were fitted with a 3 h.p. motor and a mechanical expanding-and-contracting variable speed system.

As well as a beautifully-engineered, smooth running and rigid head assembly, a jig borer requires a particularly well-supported and accurately-made table. The 12in. x 10in. (305mm x 762mm) example on the BCA was a good example of its type. The slideways were ground-finished, adjusted by tapered gib strips and the feed screws fitted with ball thrust races to ensure as smooth a feel as possible to the controls. Longitudinal travel was 15in. (381 mm), cross travel 6in. (152 mm) and the maximum clearance beneath the spindle nose 17in. (432 mm). Instead of engraved micrometer dials - and in advance of yet-to-be-invented digital readouts - the table feed was measured by an Italian-manufactured O.P.L. system whose circular optical readers incorporated an



BCA Optical jig borer - larger than other B.C.A. machines.

illumination system and, with a magnification of 10x, the ability to read down to a positional accuracy of 0.0001in.

A full range of accessories was available including: 5 and 8.5in. capacity universal boring heads, pneumatically-driven high-speed grinding unit, plain 4in. and 6in., 2-speed machine vices,

6in. swivel-base vice, precision-ground 2.25in. and 4in. vices, 12in. rotary table, angle setting block, table clamps, clamping block set, Albrecht keyless drill chucks, Clarkson Autolock chucks and various spindle reducing arbors.

More on these and other machine tools can be found on www.lathes.co.uk



Winners all!
Competitors take a
bow from the station
passenger bridge.

IMLEC 2006

David Carpenter and Neil Read report on an excellent weekend with the Fareham & District SME.

The first weekend in July was brilliant. And we're not just talking about the weather which stayed sunny and a little over 30C. throughout both days.

It was the weekend for IMLEC, the annual model locomotive efficiency trials, sponsored by *Model Engineer* for the Martin Evans Locomotive Challenge Cup. The venue this year was Fareham, near the south coast in Hampshire. The hosts put on an event that was as brilliant as the weather.

People must have known what to expect, as entries were quickly filled, from a mention in the

briefest of notes in M.E. Fareham wisely set a limit of 24 entries this year, and there were no shortage of 'reserve' entries, most of which were to be disappointed.

The Fareham & District Society's track looked an absolute joy. Manicured lawns were dappled by mature Willow, Silver Birch, and Copper Beech trees, making it one of the best landscaped in the country. There were plenty of chairs and much needed shade for spectators. The raised level track had undergone a major overhaul in the months before the event, with new spacers welded in place all the way round the entire circuit.

However, the neat appearance and great condition of the track hid some surprises. It has a



Bernard Clark

few tight curves, with low speed limits that lead on to some testing gradients. A local member confided: "They'll need to take off two passengers for the gradient and two for the track, compared with what they are used to."

And so it proved.

A number of people judged it just right. Others were maybe a tad overconfident in the pulling power of their locomotives.

However each person judged it, even those who had to drop some of the passengers they started with, all agreed they thoroughly enjoyed the experience. They welcomed what was a real test of their driving skill.

Bernard Clark 3¹/₂in. gauge Bassett Lowke 0-6-0 tank

All eyes were on run No. 1 made by Bernard Clark, to see just what effect the track would have. Bernard drives *Benjamin*, a 3¹/₂in. gauge Bassett Lowke tank locomotive, which he built with original drawings and castings in the 1970s, and which has been in regular use ever since. It is a regular performer at his home track public running days. At last year's event at Bernard's home track of Northampton, it was truly impressive, hauling four passengers at a rate of knots with the greatest of ease.

At Fareham, Bernard started with two passengers and an observer, and went off at a good speed. Unfortunately on lap two the Fareham factor came in, and the run saw delays. Eventually he decided to drop the two passengers, and completed the run.

Afterwards he confessed he should have lightened the load earlier to overcome the problem of being able to get up sufficient speed to tackle those gradients that follow on from slow bends. He also admitted that he hadn't allowed for the two slabs of concrete ballast on the dynamometer trolley before the run.

Barbara Milton 5in. gauge Simplex

Barbara is a self-confessed 'steam guzzler'. Given the chance she will drive anything powered by steam, including full sized locomotives and traction engines. Barbara, resplendent in a white T-shirt (that's confidence for you) drove the Martin Evans classic 0-6-0 tank locomotive, Simplex, owned by David Williams.

Barbara has experience from many IMLECs, which stood her in good stead. She chose to take five passengers plus an observer. After a good, effortless start, Barbara made it all look easy, and ran at a steady pace for the allotted half-an-hour.



Barbara Milton



Ken Parker



Karl Midgeley

Ken Parker 5in. gauge GWR 'small prairie' 2-6-2 tank

Another Martin Evans design, this time of the numerous tank so successful as the workhorse on suburban lines. This particular 'Firefly' was built by Peter Larkin, with some modifications to the original design. It first ran in 1979, and has covered many miles at its home track of Malden, and elsewhere. The locomotive was re-boilered about 18 months ago. This year was a welcome return for Ken, who had also driven the same engine at IMLECs in the early 1990s.

He started with eight passengers and an observer, and made a good start to his run. About two-thirds of the way through, he had a lengthy stop near to the boating lake. He dropped off three passengers and re-started. After another stop for a blow up near the start line, he finished in good style.

Les Pritchard 5in. gauge Lancashire & Yorkshire 'A' class 0-6-0

Les was off quickly on his run, a bit too quickly for the observer who commanded "slow down!" as Les approached a 5mph speed limit sign for a tight bend a bit too fast. Les took the hint, but continued at a legal quick pace for the rest of his run with five passengers and his assertive observer. At the time, there did not seem much else to report.

However, when the result of the run went up on the scoreboard by the clubhouse, Les had gone into first place. He stayed there.

The 'A' class 'Aspinall' is to the Don Young design, and took ten years to build, being completed in 1990. It has Don's favourite Joy valve gear, slide valves and a working boiler pressure of 100psi. This locomotive is not just a good 'doer'. It has also won a Silver Medal at the Model Engineer Exhibition. This 0-6-0 tender locomotive makes a quite small, but very attractive model in its black livery.

Les has won IMLEC twice before, driving a 'Rebuilt Royal Scot', in the 1980s. So his winning performance, this year on a track that tests driver as much as locomotive, came as no surprise, even against larger more powerful competitors.

Karl Midgeley 5in. gauge 'Maid of Kent' 4-4-0

Karl brought his grandfather, Ben Healey's, 'Maid' to IMLEC for the third time, hoping for his first trouble-free run. This engine, completed in 1983, is a good runner in the best LBSC tradition, but did not have the best of luck previously. Last



Les Pritchard



Paul Bexfield

year, *Maid Marion* suffered a blocked blower jet, and also retired a year earlier at Kinver.

Karl is a member of the Gravesend MES, has been driving since he was five, and hauling passengers since he was 16.

Karl wisely chose to carry just two passengers and the observer, and moved off quickly and easily in good style. With safety valves barely lifting, Karl carefully slowed at the speed limit signs, then picked up easily to clear the gradients. The run was completed with ease in the best Curly tradition, despite some problems with an injector. So it was third time lucky, after all. It would be good to see this locomotive at the Curly Bowl competition, too.

Paul Bexfield 5in. gauge LNER 'B1' 4-6-0

This locomotive was entered by Mike Gibbs and was built to the Martin Evans 'Springbok' design over a period of eight years by members of the model engineering section of the Vauxhall Motors Recreation Club. The original design was modified using works drawings of the original, resulting in a model with an accurately made chimney, dome cover, windows, plus dummy Wakefield lubricators, and other parts.

Paul made a steady start with his initial load of 11 passengers and an observer, but came to a halt on the first lap on the incline just before the tunnel. Shedding a passenger did not solve the



Jim Elliott

problem. Neither did shedding a second passenger and reversing back to the start.

More passengers and a passenger car were removed from the load leaving Paul with a load of six passengers and the observer. That proved better suited to the Fareham rails, and the run was completed without further ado.

Geoff Wigzell 5in. gauge LMS 'Ivatt Class 2' 2-6-0

This locomotive was based on the Don Young design of the BR 'Class 2', but much modified to produce the Ivatt version, and to ensure that it would go as well as possible. This locomotive was a 'natural' for Geoff who grew up with Ivatt engines in his young days in North Wales.

Geoff made an excellent start, with four passengers and an observer, and continued at a good, steady pace, until getting on for half way through the half-hour run, when he fell victim to the tunnel gradient. He reversed back to the start area and stopped to get steam up for a second attempt.

A little later another stop, at the lake gradient this time, and another roll back and steam up was needed. The same location right at the end of the run saw another stop and lightening the load, before the run was finished with one passenger and the observer.



John Barr

Jim Elliott 5in. 'Speedy' 0-6-0 tank locomotive

This locomotive was built to the famous LBSC design, plus Don Young's much used valve gear modifications. It was completed in 1986, and rebuilt nine years later with a 100psi boiler, radiant superheaters, and modified draughting.

This was Jim's sixth IMLEC campaign. He was the winner at Northampton in 1999, and third at Leyland the following year.

Jim decided to run with six passengers and the observer, and made a good confident start. However, he had to make a couple of stops at the lake area. After shedding one passenger, he backed up, had some difficulty in re-starting, but made it, and completed the run successfully. Jim thoroughly enjoyed the "interesting" Fareham track.

John Barr 3 1/2in. gauge Gresley A4 Pacific

John purchased this fine locomotive from its builder, Alan Gent of the Butterly Society, last year. It had taken six years to build, and was a regular runner, and needed little in the way of refurbishment. A failed regulator, some new valve gear parts, and a paintwork touch-up were all that was required.

John fairly blasted away from the start line with his single passenger and observer. His run



Jack Dibnah

was very quick indeed, and to the casual onlooker seemed to be well up to, and perhaps beyond, the speed limits.

However, unfettered, John was clearly having a great time, and completed the whole 30 minutes at a cracking pace, the only penalty being that he used up virtually all his coal allocation. Even so, he was the best of the 3 1/2in. gauge locomotives, with a run that was thoroughly enjoyable to watch.

David Neish 5in. LBSC 'J2' 4-6-2 tank

David took five years to build this handsome passenger express tank, and is to be seen regularly at Guildford MES. It also has an IMLEC third to its credit, from the Bristol event in 2003. Completed in 1999 this locomotive has a 100psi boiler based on the 'Nigel Gresley' design, but shortened to suit the LBSC prototype.

Bessborough set off on a steady run. A betting man seeing this drive would have been tempted to invest a coin or two. Everything was steady and controlled. However, after about five minutes, it came to a stop on the tunnel approach. David reversed to get a run at the gradient, and made a faultless re-start, and completed the run without further problem.

David went into second place on the leader



Norman Archer



Geoff Wigzell



James Brunning



Paul Tompkins



Mike Richardson



Edgar Playfoot



John Lloyd

board, and only relinquished it later to fellow Guildford member, Paul Tompkins.

Jack Dibnah 5in. Isle of Man 2-4-0 tank

Another fine model, this Isle of Man Railway, Beyer Peacock, was built and entered by Mike Casey, using home produced castings. Mike won a well-deserved Silver Medal at the Model Engineer Exhibition for this representation of the 3ft. gauge original.



David Neish

At earlier IMLECs this locomotive had the bad luck to blow a superheater on one occasion, and to time its run during a downpour on another.

Things were not looking good for third time lucky in the steaming bay, and once started on the run it was clear that there was a problem. Jack called a halt after a few minutes, due to a problem with the spark arrester.

However, a new deflector was borrowed, fitted, and Jack was given another run at the end of the first day. This time, there were no problems at all, and Jack finished high on the leader board and stayed in third spot for some time, and ended up fifth, pretty good for someone less than a third of the age of most competitors. Load four passengers plus observer.

Norman Archer 3 1/2in. gauge 2-6-2 narrow gauge tank

Mountaineer is a narrow gauge locomotive built by the American Locomotive Corporation to serve in France during the First World War. It is now one of the attractions on the Ffestiniog Railway in North Wales. This model was built by Norman Archer and Dave Gibbs to the design of Don Young. At 1 3/4in. to the foot it is a substantial locomotive.

This was a good run with no major problems. He appeared to be making the locomotive work on the gradients to increase the work done. There

was just one stop right near to the end, and Norman shed his four passengers, before completing the run.

John Lloyd 5in. gauge SR 'Merchant Navy' 4-6-2 Pacific

This is a model of the 'Merchant Navy' in original form, with Bullied's 'air-smoothed' casing and chain-driven valve gear. Another fine looking locomotive, finished in the bright SR malachite green. This is a regular runner at the Southampton track, and competed at the Bristol IMLEC three years ago.

John started with 10 passengers plus the observer. Straight away a problem was apparent. Water in the cylinders, and coupled wheels that did not turn, put the run in jeopardy. John stopped after a short distance and attended to a mechanical problem, then backed up to the start area to raise steam. Finally John got away about 10 minutes into his allotted time, but failed the tunnel incline. He took off three passengers, and backed back up to the start area. A passenger truck was removed and the load cut to five passengers plus observer. John finally had everything going when the 'Merchant Navy' suffered three derailments of the front bogie. By this time John was pouring more water over himself than into the locomotive! However, he persevered to the end to the appreciation of those watching.



Dave Middleditch



Geoff Symes

Geoff Symes 5in. gauge 'Dolphur' 2-8-4 tank

This large engine is built to GLR drawings, with an enlarged boiler and a South American mountain railway outline. It has cylinders of 2in. bore and 3in. stroke.

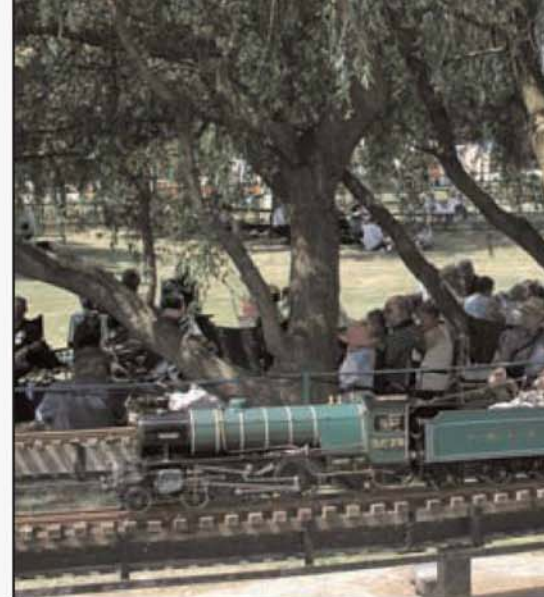
This narrow gauge heavyweight took some time to reach pressure, in the steaming bay, and at the start, putting Fareham's meticulously



John Hurley

adhered to time-table at some risk. Fortunately this was made up subsequently, thanks to some really smart change-overs by the ever efficient but always friendly Fareham team.

Geoff ran with 11 passengers and an observer. Waiting until everything was just so, paid off with a totally trouble-free run, apart from a safety valve blowing off a lot of the time. Geoff was understandably very pleased



Paul Collins

with what was a real demonstration run showing just what this impressive locomotive could achieve.

James Brunning 5in. gauge 'Speedy' 0-6-0 tank

A second model of the GWR 0-6-0 pannier tank to the 'words and music', finished in GWR Brunswick green livery. The prototype for 'Speedy' was the 1500 class of heavy-duty shunters, whose sole role was to move coaching stock in and out of Paddington station.

The load of five passengers and the observer, was well judged. James moved straight off and began a very steady run, slowing slightly on the inclines. Unfortunately, with less than 10 minutes to go, there was an audible clunk from the Speedy as it approached the lake area and that was that for the day. With great efficiency the Fareham team had a flat truck round the track to load the stricken Speedy and returned it to the steaming bays, where James quickly surmised that the piston worked free from the end of the screwed and peened over piston rod.

RESULTS OF 2006 HELD AT FAREHAM DISTRICT

Run	Entrant	Driver	Society	Gauge [in]	Wheel Arrangement	Model	Trucks/Pass (Start : Finish)	Coal Issued [Kg]	Coal Returned [Kg]
1	BERNARD CLARK	BERNARD CLARK	NORTHAMPTON	3.5in	0-6-0	B/LOWKE TANK	1T/2P : 1T 0/P	2	1.531
2	BARBARA MILTON	BARBARA MILTON	BRISTOL	5.0in	0-6-0	SIMPLEX	2T/5P : 2T/5P	2	1.111
3	KEN PARKER	KEN PARKER	MALDEN	5.0in	2-6-2	FIREFLY	3T/8P : 3T/5P	2	0.834
4	LES PRITCHARD	LES PRITCHARD	HARLINGTON	5.0in	0-6-0	L&Y A CLASS	2T/5P : 2T/5P	2	1.374
5	BEN HEALEY	KARL MIDGELEY	GUILDFORD	5.0in	4-4-0	MAID OF KENT	1T/2P : 1T 2/P	2	0.812
6	MIKE GIBBS	PAUL BEXFIELD	VAUXHALL	5.0in	4-6-0	LNER B1	5T/13P : 3T/6P	1.996	1.185
7	GEOFF WIGZELL	GEOFF WIGZELL	GRAVESEND	5.0in	2-6-0	IVATT CLASS 2	2T/4P : 2T/1P	1.997	1.132
8	JIM ELLIOT	JIM ELLIOT	OXFORD	5.0in	0-6-0	SPEEDY	3T/6P : 3T/5P	2.002	1.391
9	JOHN BARR	JOHN BARR	LEYLAND	3.5in	4-6-2	A4 PACIFIC	1T/1P : 1T/1P	2	1.2
10	DAVID NEISH	DAVID NEISH	GUILDFORD	5.0in	4-6-2	TANK LBSCR J2	3T/6P : 3T/6P	2	1.362
11	MIKE CASEY	JACK DIBNAH	MANX	5.0in	2-4-0	IOM TANK	2T/4P : 2T/4P	2.002	1.285
12	NORMAN ARCHER	NORMAN ARCHER	PORTSMOUTH	3.5in	2-6-2	MOUNTAINEER	2T/4P : 2T/0P	2.003	0.568
13	JOHN LLOYD	DAVE FINN	SOUTHAMPTON	5.0in	4-6-2	MERCHANT NAVY	4T/10P : 2T/5P	4.003	2.205
14	GEOFF SYMES	GEOFF SYMES	WORTHING	5.0in	2-8-4	DHOLPUR	3T/11P : 3T/11P	4.003	2.444
15	JAMES BRUNNING	JAMES BRUNNING	ASCOT	5.0in	0-6-0	SPEEDY	2T/5P : 2T/5P	4	3.274
16	MIKE RICHARDSON	MIKE RICHARDSON	BRISTOL	5.0in	0-6-0	SIMPLEX	1T/2P : 1T/2P	3.996	3.127
17	EDGAR PLAYFOOT	EDGAR PLAYFOOT	MAIDSTONE	5.0in	4-6-0	ROYAL SCOT	3T/6P : 3T/6P	3.998	3.33
18	PAUL TOMPKINS	PAUL TOMPKINS	GUILDFORD	5.0in	0-6-0	MINX	2T/5.5 : 2T/5.5	2	1.374
19	PAUL COLLINS	PAUL COLLINS	HARLINGTON	5.0in	4-4-2	BABY ATLANTIC	2T/2P : 2T/2P	2.002	0.911
20	LEN STEEL	LEN STEEL	GUILDFORD	5.0in	4-6-2	BRITANNIA	4T/10P : 4T/10P	2.002	0.873
21	DAVE TOMKINS	J MIDDLEDITCH	GUILDFORD	5.0in	0-8-0	NETTA	2T/5P : 2T/5P	1.999	0.65
22	JOHN HURLEY	JOHN HURLEY	KINVER	5.0in	4-6-0	ROYAL SCOT	3T/8P : 3T/6P	4	2.673
23	STEVE EATON	STEVE EATON	CHESTERFIELD	5.0in	4-6-2	BRITANNIA	4T/11P : 4T/9P	1.993	1.033
24	LIONEL FLIPPANCE	LIONEL FLIPPANCE	WORTHING	5.0in	2-8-2	BR PROPOSED	6T/17P : 6T/1P	1.992	1.27



Mike Richardson 5in. gauge 'Simplex' 0-6-0 tank

Lionheart took some six years to construct, and was completed in 1988. The overall dimensions of the original Martin Evans design have been stretched to add 2 1/2 in. to the length and 1/2 in. to the width, without changing the wheelbase.

The result is a locomotive with a larger cab having more room to drive, larger water tanks, and a longer smokebox. It finished 13th at the 1999 IMLEC.

This was one of those runs that there is little to write about. With two passengers and an observer, this was a straightforward trouble-free run. Only a slight problem with the water level on the first two laps gave Mike a minimal cause for concern.

Edgar Playfoot 5in. gauge rebuilt 'Royal Scot' 4-6-0

This fine model of the rebuilt Scot was completed at the end of 2003, and is finished in LMS crimson lake livery. The boiler is to Martin Evan's design, with detail taken from the



Lionel Flippance

preserved locomotive at Bressingham. More than 1,000 3/64 in. rivets went into making the tender, which includes a working water chute.

Unfortunately Edgar had the front bogie de-rail three times on the first lap. He decided to retire to prevent possible damage to this superb model.

Paul Tompkins 5in. gauge 'Minx' 0-6-0

Built by Paul and Dave Tompkins LBSC's 'Minx' design is a good choice for a quick, easy, hard-working locomotive. This one was built in just a year, with fellow club member and IMLEC competitor, Len Steel, making the boiler.

Paul has also built a 5in. gauge 7F, and is currently building a batch of Britannias.

Vauxhall ran with five adults, one child, and an observer. This was a good clear run, although it did make a stop half way through. Paul found that the locomotive would only run with the blower on, otherwise it was problem free.

The *Curly* classic went into second spot, and was not to be bettered.



Len Steel

Paul Collins 5in. gauge 'Baby Atlantic' 4-4-2

No 3279 Sapper is based on the *Ivatt Atlantic* built at Doncaster in 19005. The model is fitted with the later B1 type of tender. Last year, Paul drove his Lynton and Barnstable engine, while this year's winner Les Pritchard drove the Sapper.

Paul ran with two passengers and an observer. After a good start Paul had a good ride for the first 20 minutes when he stopped just after the exit tunnel due to injector problems.

Paul made the most of the stop by relaxing with a cigarette. Once restarted he had no further problems and completed the run with ease, despite running short of water near the end.

Len Steel 5in. gauge 'Britannia' 4-6-2

Coeur de Lion was built by Lionel Flippance in the 1980s and was entered in the 1985 IMLEC at

IMLEC COMPETITION SOCIETY OF MODEL ENGINEERS

Coal Used [lb]	Time Run [min]	Distance Run [m]	Driving Car. Constant ft. lb/ft	Driving Car. Work Req. [ft lb]	Work Done Recorded [ft lb]	Work Done Actual [ft lb]	Average DB Hp	SFC [lb/hp/hr]	Calorific Value Btu/lb	Efficiency %	Previous IMLEC Winner.	Final Position
1.033676	29.04	5630	3.3648	18943.824	28200	47143.824	0.04919424	43.41350163	14000	0.418615655		18
1.959356	32.22	14290	3.3648	48082.992	154000	202082.992	0.19005981	19.19768132	14895	0.889772609		8
2.569864	33.08	12730	3.3648	42833.904	195440	238273.904	0.2182715	21.35496433	14000	0.851023263		9
1.379704	29.36	15890	3.3648	53466.672	193200	246666.672	0.2545895	11.07492106	14000	1.640966228		1
2.618352	28.19	15870	3.3648	53399.376	95700	149099.376	0.16027538	34.77101715	14000	0.52266436		17
1.787444	31.19	11810	3.3648	39738.288	158500	198238.288	0.19260086	17.85295442	14000	1.017958765		7
1.90646	32.51	10530	3.3648	35431.344	88500	123931.344	0.11551816	30.4587256	14000	0.59666224		15
1.346644	30.2	12890	3.3648	43372.272	158100	201472.272	0.20215961	13.23435276	14000	1.373211955	YES (2)	0
1.7632	26.57	17470	3.3648	58783.056	83820	142603.056	0.16263849	24.48149498	14000	0.742339119		10
1.406152	29.97	13170	3.3648	44314.416	191500	235814.416	0.23843481	11.80666139	14895	1.446774023		3
1.580268	30.56	17488	3.3648	58843.6224	186300	245143.622	0.24308228	12.76366323	14000	1.423852314		5
3.16274	35.04	14380	3.3648	48385.824	145500	193885.824	0.16767489	32.29852018	14000	0.562675049		16
3.962792	31.37	9060	3.3648	30485.088	119900	150385.088	0.14527013	52.17490819	14000	0.348320142		18
3.436036	30.8	15910	3.3648	53533.968	357300	410833.968	0.40420501	16.55985583	14000	1.097447443		6
1.600104	15	10650	3.3648	35835.12	128070	163905.12	0.33112145	19.32951161	14895	0.883704221		RETIRED
1.915276	31.52	17470	3.3648	58783.056	96000	154783.056	0.14880697	24.50039803	14000	0.741786375		11
1.472272	N/A	N/A	3.3648	N/A	N/A	N/A	N/A	N/A	14000	N/A		RETIRED
1.379704	30.54	14300	3.3648	48116.64	173400	221516.64	0.21979782	12.33231923	14000	1.473653989		2
2.404564	29.53	15940	3.3648	53634.912	114850	168484.912	0.17289548	28.2579411	14000	0.643131478		14
2.488316	29.59	12460	3.3648	41925.408	215300	257225.408	0.26342377	19.15388421	14000	0.948819113	YES (3)	0
2.973196	28.59	14280	3.3648	48049.344	164820	212869.344	0.22562386	27.65512389	14000	0.657150245		13
2.924708	31.54	14890	3.3648	50101.872	184800	234901.872	0.22568924	24.65251465	14000	0.737189357		12
2.11584	29.11	14940	3.3648	50270.112	282900	333170.112	0.3468246	12.57424676	14000	1.445301001		4
1.591288	32.35	14990	3.3648	50438.352	420720	471158.352	0.44134547	6.687242679	14000	2.717647961	YES (1)	



Steve Eaton

Urmston where it came second. Len acquired the engine in 1988, and his IMLEC record with it includes a win at Llanelli in 1997, second place at Leyland in 2002, and fifth at Northampton last year. Len has been modelling since his youth and is now a member of several clubs.

Len's load was eight adults, two children, and an observer. He made a steady run and all went well, with some slipping on the gradients, until after about 20 minutes the front bogie derailed.

A little later the gradient won the battle. A fire collapse added to another stop, and forced a retreat for another restart. Len also left a few grass fires in his wake, quickly dealt with by the track marshals.

Dave Middleditch 5in. gauge 'Netta' 0-8-0

Another locomotive from the LBSC stable that (almost) anyone can build. This particular one was built by Dave Tompkins, uncle of runner-up Paul. This engine was originally going to be a 'Maid of Kent' but Dave changed his mind preferring to see the cylinders matched to an eight-coupled engine.

The tender was made from scrap aluminium,

glued together. This locomotive, like the family's second place 'Minx', was built to be enjoyed. One for fine fun rather than fine scale.

Dave decided on five passengers plus the observer. The run went smoothly, apart from the temporary glitch of a derailed trolley on the first lap. However, the 'Netta' restarted with just a little wheel slip to complete an otherwise uneventful run for another LBSC classic.

John Hurley 5in. gauge rebuilt 'Royal Scot' 4-6-0

John's 'Royal Scot' is finished in LMS post-war lined black, a contrast to the crimson lake of Edgar Playfoot's locomotive. Last year, John campaigned his LMS Jubilee, so there is no doubt about his railway allegiance.

John is a founder member of the Kinver and West Midlands SME, and for many years worked as a driver for the Severn Valley Railway. He completed his first locomotive, a 'Britannia' to LBSC's words and music, in 1963.

John's load at Fareham was seven adults, two children and an observer. On the first lap John decided to lighten the load and dropped three

passengers, and restarted alright on the tunnel gradient. About half way through the run the front bogie jumped the rails, but John was quickly underway again. The bogie repeated its trick on the very last lap.

Steve Eaton 5in. gauge 'Britannia' 4-6-2

Steve's father, Fred, started this locomotive in the 1970s. Fred died in 1994, and Steve completed the locomotive, named *Rough Diamond* by his father.

Although still a young man, Steve is a very experienced model engineer, having started at about 12 years of age, with more than a dozen locomotives completed since. Last year Steve led IMLEC until pipped at the post by Ballan Baker.

This was the locomotive's first outing for a whole year, since the previous IMLEC, in fact. Steve took on board 10 adults, two boys, and an observer. He quickly realised that this was a bit too much and dropped two passengers on the first lap. After that he ran well, very controlled, and constantly tending the fire, with just a short stop before the end of the run. Steve was rewarded with a creditable fourth place.

Lionel Flippance 5in. gauge proposed BR 2-8-2

After building and running the 'Britannia', now owned by Len Steel, Lionel wanted another locomotive with similar characteristics. The proposed 2-8-2 was just the thing, although it was never built in full size, having been superseded by the 9F. However, as a model it has been extremely successful. It has won IMLEC on four occasions, but this year, as at other IMLECs, it is classed as a 'previous winner' and along with four others this year, could only compete in that elite category.

Lionel loaded up 16 passengers, one child, and the obligatory observer. Twice it attempted the tunnel gradient with this heavy load. Twice it very nearly made it.

He dropped four passengers, and was then off on a run that produced figures which once again were far in advance of everyone else, even the other previous winners.

Within minutes of Lionel finishing his run, the Fareham team had the full results available. The traditional IMLEC display board told the following tale:

- 1: Les Pritchard, Lancashire and Yorkshire 'A' class
- 2: Paul Tompkins, Minx
- 3: David Neish, LBSC J2 Express Tank

Best 3½in. gauge:

John Barr, Gresley A4

Best Previous winner:

Lionel Flippance, BR 'proposed' 2-8-2

Once again, we had a fascinating two days. Totally absorbing.

Our sincere thanks go to everyone who worked so hard to make it a memorable weekend.

We, at *Model Engineer* look forward to sponsoring the event again next year at Llanelli.



Les Pritchard accepts the Martin Evans Locomotive Challenge Cup from Model Engineer editor, David Carpenter.

OVERHEAD VALVE ENGINES

Colin Pape

from France introduces us to his unusual family of overhead valve engines and describes how they evolved.

● *Part I*

A few years ago I started to read about compound engines and I had the chance to visit some museums and have a look at a selection of actual machines including several working examples. The idea of designing and building one was quite attractive.

Initially, I thought about making a version of a triple-expansion engine that I had seen but when I started to study this engine I discovered that it had a number of characteristics that caused me to have some doubts. Some of the characteristics are common to most types of steam engines and these are concerned with the valve gear. Every cylinder has its own set of valve gear including the drive. Then, if the engine is a reversing type, every cylinder has its own set of reversing gear. The other characteristic of the triple-expansion engine was that it had to have components called receivers (more about them later).

I was interested in the reversing gear of one engine that I saw running and to better understand how it all worked I designed and built a single-cylinder engine that used the Hackworth reversing gear. I learned quite a lot from that project but I decided that I was not ready to design and build an engine that required three sets of everything and receivers as well.

I began to wonder if it would be possible to build a compound engine that had just one simple valve gear and just one set of reversing gear and no receivers. In addition, could I make it self-starting without any complications like having to inject high-pressure air or steam into the lower pressure cylinders? Some ideas began to form and as they became more precise I could see that I was going to have to do things that I had never done before.

To tackle the multiple valve problem I decided to follow the approach of today's internal combustion engines and to provide the equivalent of an overhead camshaft and overhead valve

(ohv) gear with a single drive system.

To tackle the multiple reversing gear problem I decided to adapt the approach I had used before in developing an oscillating cylinder engine that had its ports incorporated in the cylinder pivot. In this case the cylinders would be stationary so the ports would have to move. I had never designed a compound engine so I decided to keep this as simple as possible with the minimum of cylinders and only one stage of compounding.

This article is about the steps that I took to arrive at the final engine and how the different problems that arose were resolved. I have included working drawings of some of the engines and some notes on how they work, how they were built and what I would do differently if I did them again.

The final engine and the learning engines are shown in **photo 1**. All the engines were designed to run on compressed air.

Step-by-step approach

Because of all the new things involved I decided it would be wise to go step-by-step. Some basic ideas needed to be confirmed as quickly as possible and then hopefully retained in later steps. I was thinking of having three steps along the way so some things could actually get tested and improved, if necessary, three times before the final engine came along.

Step 1

The first thing I had to do was to decide on the valve drive system and because of the distance between the crankshaft and the ohv shaft I thought that timing belts would be the most economic way to drive the valves and to keep them synchronised to the crankshaft.

Timing belts and toothed pulleys

Timing belts are flexible belts made in a rubber type material and have teeth moulded on the inner surface. These belts engage with toothed pulleys that are rather like spur gears with small, wide teeth.

Through the engagement of the teeth, synchronisation can be maintained between the connected shafts.

The engines that I design are always small so I was only interested in small belts and small pulleys. The load would be very small and moulded plastic pulleys would be perfectly adequate. All the engines in my plan were going to have the same basic dimensions so as to use as many common parts as possible. The final engine was going to be a V-configuration but the steps leading up to it would all be single bank, in-line engines.

I located two suppliers in the U.K. and another in France and I am sure that there are many more. My first task was to go through the catalogues and find stock belts and pulleys that would allow me to have the same stroke in all the engines, straight or V-type.

I wanted to have a crankshaft to valve shaft distance of about 80 millimetres. I finally found some components in the Davall group catalogue that would do the job. They offered belts with a width of 1/4 inch and many standard lengths and a range of pulleys to suit. I re-checked my basic calculations and went to their offices near Hatfield to place my small order and I must say that I was treated very well and I have been very satisfied with my purchases. I do not have any connection with the company.

Having made the outlay to buy the belts and pulleys I had a major incentive to make sure the steps that I had sketched out actually succeeded. Basic dimensions were effectively 'cast in concrete'.

First engine

I decided to make a first engine that would give me some experience in using timing belts and to



The family of overhead valve engines that form the subject matter of this series.



The neat little step 1 engine began the author's design quest. Note the toothed timing belt and pulleys.

check some basic dimensions. It would also be a way to find out if the ideas for the valves and reversing would work. I called this engine my step 1 engine.

This engine is shown in **photo 2**. It is a single-cylinder, single-acting engine. It has an overhead valve system driven by a timing belt. It has a reversing system that works by changing the gas flow path into the cylinder.

In the interest of keeping things as simple as possible I decided that all the cylinders would be single-acting and there would be no piston rods or crossheads or crosshead guides in the new engines. The guide function of the crosshead can be met by having a longer piston and a longer cylinder. The guiding function is not so effective as the external guides but I could see that things would be a bit crowded in the final engine so eliminating the crossheads was an interesting idea.

Using only single-acting cylinders would allow me to keep all the inlet and exhaust connections (plumbing) to the cylinders inside the cylinder block until, of course, the time came when there were two cylinder blocks.

Also, for simplicity I decided to implement a fixed cut-off in this engine and to use the same value for cut-off in the high-pressure stage of the simple compound engine that I would build next.

The basic dimensions of this engine are:

Bore: 13mm

Stroke: 25mm

Inlet cut-off: 50%

The bore is the same as all my recent engines but the stroke is longer than anything I have made before.

Valve system

The main new feature of this engine was the overhead valve and its drive. The valve consists of a shaft that rotates once per crankshaft revolution. The shaft is caused to rotate by a timing belt running on a pulley fixed to one end of the shaft. The belt maintains the valve in the correct position relative to the crankshaft. In order to avoid the belt transmitting a sideways force to the rotor I designed the rotor to 'float'. I was hoping that this approach would apply to all the engines.

The valve shaft has circumferential passageways (slots) cut in its surface. These passageways provide a connection between the ports in the cylinders and the arriving gas and a connection to the atmosphere for the exhausted gas. The length of the passageways controls the duration of opening of the inlet and outlet ports, their position on the circumference controls the timing. There are different inlet and exhaust slots for the different rotation directions so, by controlling which slots were used, I hoped to control the engine direction.

In subsequent engines I planned to use a similar rotor. It would have more slots because the number of cylinders would increase so the rotor would get longer but the drive could stay the same.

Inlet cut-off

I had decided to set the inlet cut-off at approximately 50%. The exhaust valve is open

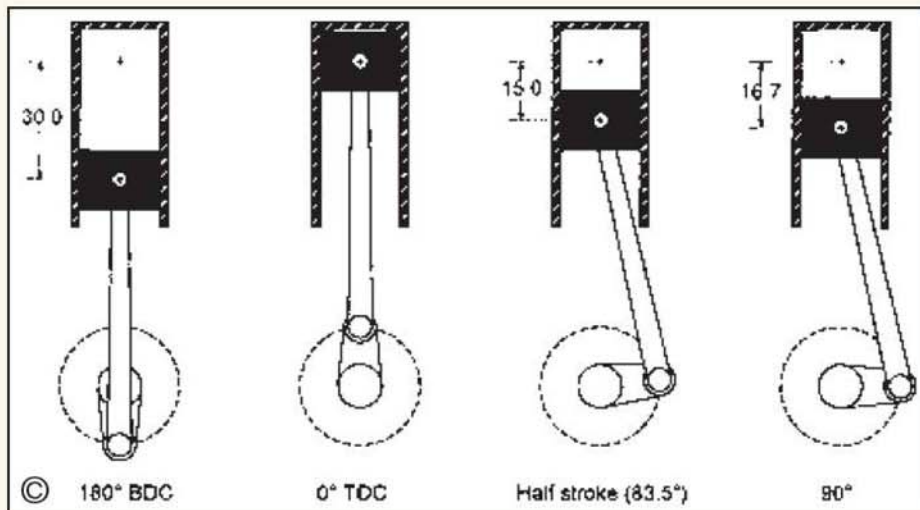


Fig 1. At half stroke the crankshaft is not yet at 90 degrees.

for virtually a whole half-cycle. As the throttle is opened there should be more and more energy left in the gas at the end of the stroke.

It is possible to implement various degrees of input cut-off by choosing different lengths of input slots cut in the valve shaft. For this engine I chose a value of 50% and since all these engines were intended to be as simple as possible, the cut-off value was fixed.

As an aside I would like to say a few words about cut-off. In the way I use the term it refers to how much of a crankshaft half-cycle has been used. In my usage, 50% means that the valve is open for 90deg. of the inlet half-cycle. This is not the same as the cylinder being half full with the piston being at half stroke. **Figure 1** illustrates this difference. The example engine has a stroke of 30 arbitrary units.

Lessons learned

The engine did not work as planned but I learned a lot. The first thing I learned was that I could not use the basic formula for calculating timing belt lengths. I had discovered a simple formula in the catalogue of one belt manufacturer. Basically, this formula says that for two equal sized pulleys the belt length required is the circumference of one of the pulleys at its pitch circle diameter plus twice the centre to centre distances between the two pulleys. This seemed quite logical and I used it but the belt turned out to be too tight and it loaded the valve drive shaft unnecessarily.

I had anticipated a load from the belt in the design of the valve rotor and this is the reason that it 'floats'. The rotor is a piece of steel with a good finish rotating in a hole that also has a good finish. An oil film lubricates the rotor and it turns without any high spots or slop. There is no rigid connection between the valve drive shaft and the valve rotor but the rotor is driven positively by the drive shaft. The load from the belt is carried entirely by the drive shaft. There is no sideways load on the rotor. The valve rotor presents very little load and I did not need heavy engagement of the belt teeth in the toothed pulleys.

Since the only formula I had was of no use I had to establish a value by experiment. I made a variable height front frame for the engine by cutting the original one in two. The two-part frame is shown in **photo 3**. I could then vary the distance between the crankshaft and the valve rotor. I found that a good centre-to-centre distance was just

0.3mm less than the calculated value. I used the new value in all the single cylinder head engines and it was entirely satisfactory.

The second thing that I found was that I had a dimension problem. There was too little clearance between the con-rod and the bottom end of the cylinder. I had verified this clearance in the design but when I was making the engine I decided to lengthen the piston because I was thinking ahead to the compound version. I was planning to have all the pistons the same length. I did not re-check the calculations. The engine ran but there was too little clearance for comfort.

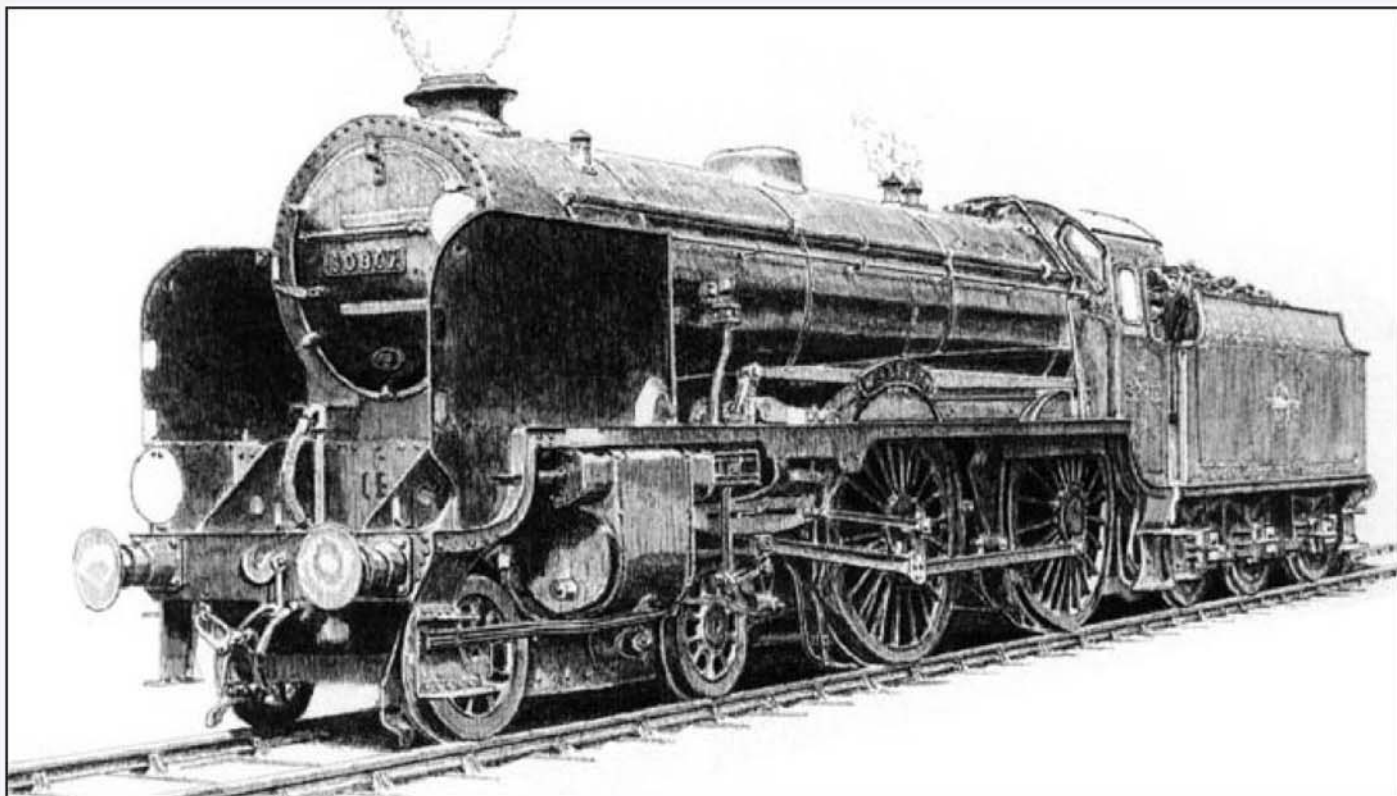
The third thing I learned was that my initial reverser design was no good. The engine would run in both directions but it needed adjustment each time the direction was changed.

On the positive side, the valve rotor and the drive worked well.

●To be continued.



A variable height front frame was made by cutting the original one in two.



STOWE SOUTHERN RAILWAY 'SCHOOLS' CLASS LOCOMOTIVE

Neville Evans

continues the description of this attractive locomotive before handing over to George Golightly for some notes on the Welsh IMLEC.

● *Part III continued from page 90 (M.E. 4278, 21 July 2006)*

Many of the greatest difficulties in locomotive design arise because track will only support a certain tonnage per unit length. Spreading the engine weight over a greater length of track involves the provision of carrying wheels that merely support the engine without doing anything useful in the way of work. An example of a designer having to supply a piece of equipment that is complex, expensive and adds a lot of useless weight.

This length business particularly caught the attention of the Midland Railway, who decreed that all its six coupled locomotives should have a wheelbase divided into 8ft. and 8ft. 6 inches. If one inspects the otherwise admirable Fowler 2-6-4 tanks, it becomes apparent that they are in fact longer than a 'Princess' or a 'Duchess' Pacific, as they are a sort of back to front Pacific with the long,

attenuated Midland style coupled wheelbase. Stanier, when he modified them with tapered boilers and provided some of them with three cylinders for the Tilbury line, had perforce to follow suit. It wasn't until Fairburn's time on the LMS that common sense prevailed and some genius took his career in his hands by pointing out that, although spreading the wheelbase also spread the load, if in fact you shortened said wheelbase you dramatically reduced the weight and therefore first cost as well as lessening the amount of load on the track. The final chapter of the saga came when British Rail modified the design slightly to become the Standard Class 4 MT tank. Thus ended the story of one of the very best engines ever to run on British lines.



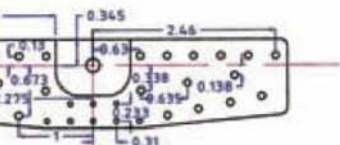
A close up view of the bogie assembly on Repton.

The reason for the track being of less than perfect quality was sometimes due to penny pinching in laying the track foundations, or inadequacies in the type and amount of ballast used. A prime example of the latter caused the derailment on the 24 August 1927, of the admirable Maunsell 'River' class tank engine *River Cray* at Sevenoaks in Kent due to unsuitable ballast having been provided. When questioned, the drivers stated that the locomotives ran more smoothly backward, when the four wheel bogie of this 2-6-4 engine would have been leading, than it did forward, when the two wheeled pony truck was in the lead. A member of the class was later tested on the LNER main line, with Harold Holcroft of the Southern Railway in attendance. The engine ran in a very stable manner on the well laid track of the LNER showing that there was no problem with the locomotive as a vehicle and that the answer to the crash lay with the shingle ballast, laid for reasons of economy.

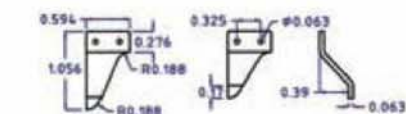
Weak bridges that should have been replaced or simply strengthened at minimal cost, were another cause for complaint by the motive power department due to unforeseen increases in the volume of traffic, which necessitated more powerful, and therefore heavier, locomotives pulling heavier trains. The Civil Engineers however, had the casting vote in any dispute concerning operations, because they

Another important factor in the promotion of stability is the bogie wheelbase. This dimension is best made as large as possible, on account of the marked improvements affected both in riding and in guiding qualities, as the wheel base is lengthened. It is quite possible that one of the factors that contributed to the poor riding qualities of the 'Royal Scot' class was that the bogie wheelbase was quite short at 6ft. 6in. and some of the Patriots that were converted into 'Modified Scots' only had bogie wheelbases of 6ft. 3 inches. The bogie centre pin was located aft of the bogie centre in some cases and this was claimed to give greater stability, as well as reducing the flange forces on the leading wheels. A further feature of this arrangement, which I like, is that sideways movement of the rear bogie wheel is lessened thus reducing the possibility of these wheels fouling an outside cylinder.

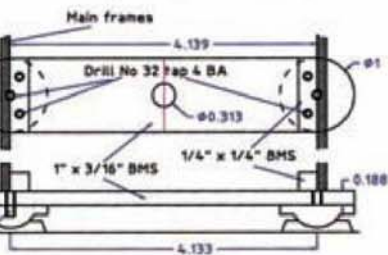




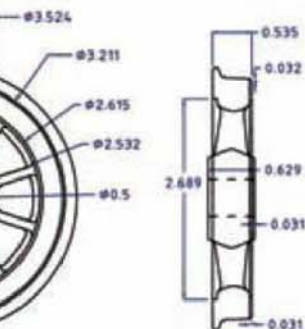
E CENTRE RIVET PATTERN



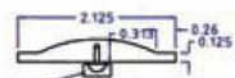
GUARD IRON 2 off BMS



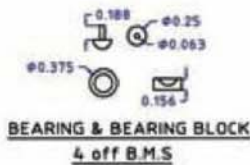
BOGIE STRETCHER & PIVOTS



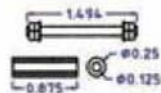
BOGIE AXLE 1/2" dia Sil.St. centre deeply



**BOGIE SPRING EQUALISER BAR
4 off l.w. castings**

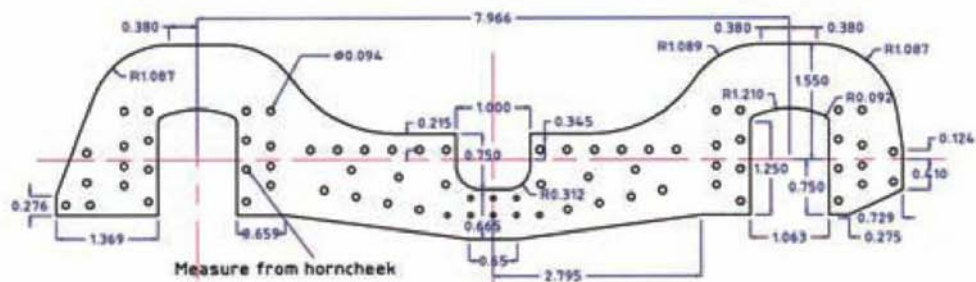


**BEARING & BEARING BLOCK
4 off B.M.S**

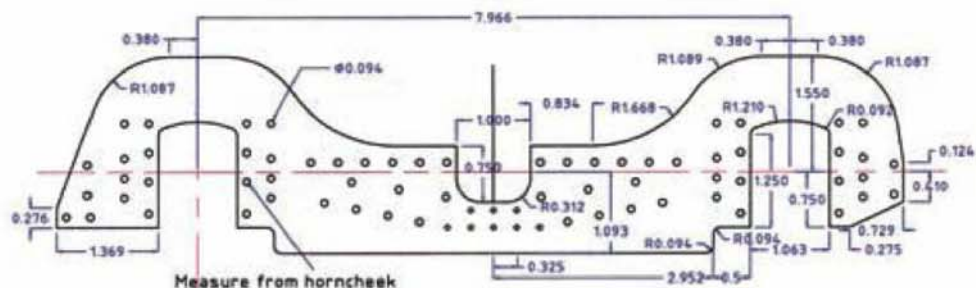


HORNCHIEK KEEP 4 off B.M.S

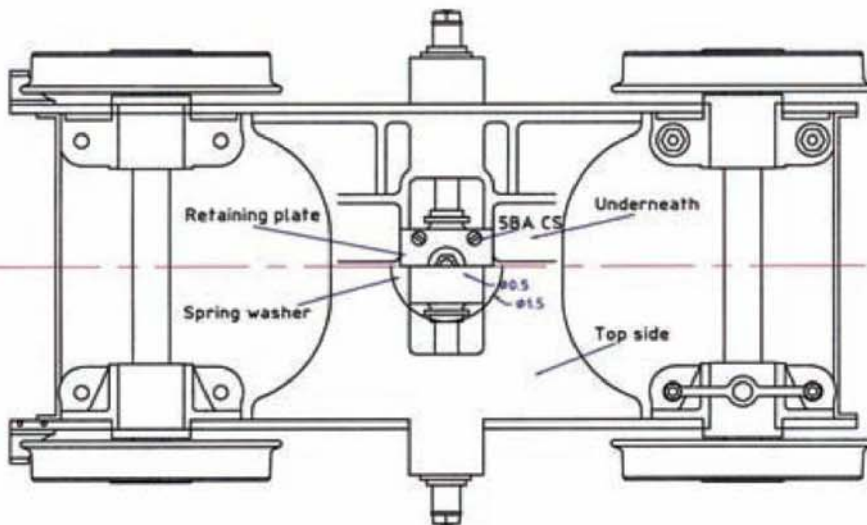
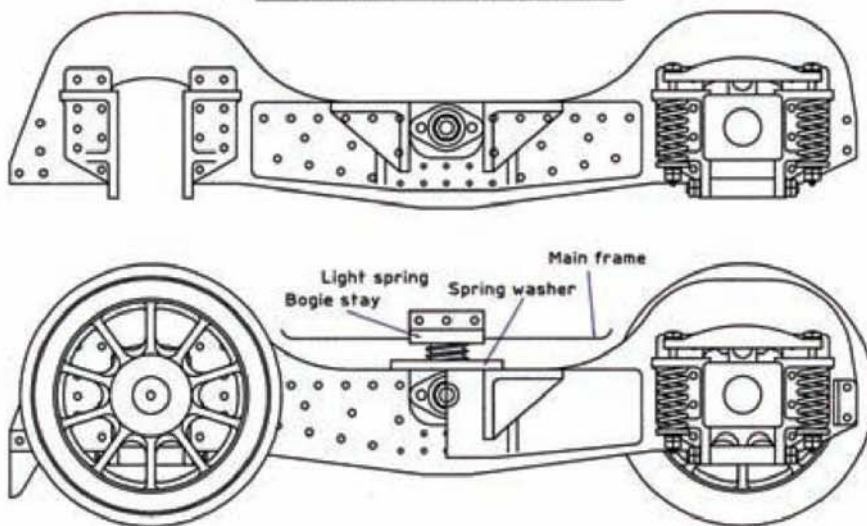
OWE" BOGIE



EARLY SIDEFRAME TO C. 1935

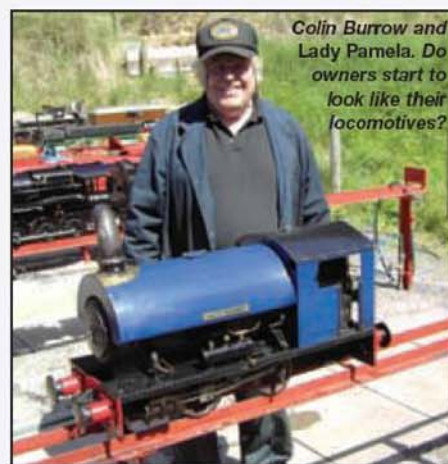


STRENGTHENED SIDEFRAME FROM C. 1935





Andrew Williams and his 9F won the Welsh Efficiency Cup.



Colin Burrow and Lady Pamela. Do owners start to look like their locomotives?

The bogie, which is fitted under the front end of the Schools class locomotive, is standard with that of the Lord Nelson class 4-6-0s. It is of thoroughly modern design and, importantly, possesses a very long wheel base of 7ft. 6 inches. As I mentioned a short while ago, this bogie is very similar to that fitted to the two Hawkesworth 4-6-0s (that is the 'Modified Hall' and the 'County'), the main difference being that the GWR engines used leaf springs, whereas the Southern locomotives were fitted with coil springs. Coiled bearing springs for the axleboxes were not generally thought to be a good idea in full size, as they promoted excessive liveliness in the bogie, but were often used when limited clearances were a problem. The wheelbases were the same at 7ft. 6 inches. The 'Schools' bogie however carried some 3½ tons more weight than did that of the 'Nelson', and after a comparatively short time, fractures began to occur in the bogie

frames. New frames of greater depth were substituted from about mid way in the building of the class, and all the earlier ones had been dealt with by 1935. This suggests a hint of urgency where the 'Schools' were concerned. The 'Nelsons' however were modified at a more leisurely pace and indeed No. 851 was not modified at all. This probably means that there wasn't much wrong with the original design, and that the 'Nelsons' were modified in the interest of standardisation.

The first bogie for *Stowe* has been finished and Derek Tulley reports no major misadventures along the way. In fact, after building the main frames, no-one should have any trouble with the bogie construction, especially after Derek has produced his invaluable list of my mistakes and omissions, for which, many thanks. The bearings are JTT810 which are double sealed 1/2in. inner diameter needle

rollers and are available from Practical Scale. These items are designed to be slightly squeezed when fitted, to ensure correct roller clearance. Use a size for size fit, in other words fit the bearing in a hole the same size as the measured diameter of the casing. If in doubt your friendly neighbourhood bearing shop will give you a handout detailing everything you need to know about bearings by way of fit, lubrication, maximum loads and revolutions. Don't over lubricate. Here endeth the sermon.

It may be noticed that the bogie stretcher appears to be of somewhat flimsy construction, and that it is held on with only three 4BA screws per side. Fear not, the main weight of the front end of the locomotive is taken by the two bogie pivots that are attached to the main frame. The only load that the screws take is the 'dangly load' of the bogie weight when the engine is lifted.

●To be continued.

Welsh IMLEC

by George Golightly

The fifteenth WIMLEC was held at Pembrey Country Park near Llanelli in glorious weather on Saturday 3 and Sunday 4 June 2006. The Park was looking absolutely superb and, as a bonus, the tide was up in the afternoon so that people were able to paddle and bathe in the pleasantly warm water at Cefn Sidon beach, surely one of the most spectacular beaches in the country. Due to the flatness of the coastal plain, the Park and Grand Prix racing circuit possess their own microclimate and clouds normally don't start to form until two or three miles inland. This means that often, when it is raining further east, the Park remains dry.

Sadly this year we were low on entrants, which meant that we only had 14 competitive

runs. Having said that, we were not short of visitors and we didn't need to look for passengers as there were more than enough volunteers.

Andrew Williams of the Pembrokeshire club had an excellent run with his 5in. gauge 9F, to win the Welsh Efficiency Cup. The engine was built over a period of six and a half years from a Winson kit and has been running for over two years with no problems. Andrew achieved an efficiency of 1.927%. Second place was taken by Daniel France of the Merthyr society with 1.625%. Daniel also took the 3½in. gauge cup with his Hunslet at 1.85%, as well as loaning the 'Manor' to Dewi Griffiths, his grandson, who put in a cracking performance at 1.374%. A heartfelt 'well done' to our youngest competitor, who took control of the

train from the start, looking very relaxed and thoroughly enjoying himself. He had a clear and uneventful run with no stops or shortage of steam.

The Overall Winners Cup for engines that have previously won the WIMLEC only had two entrants this year. They were Ivor Roberts and Les Walters. It was unfortunate that Ivor's 6100 GWR tank developed a valve gear problem that forced him to retire, so the OW Cup went to Les Walters with an efficiency of 1.015%.

On Saturday evening we held the usual barbecue. For this we have to thank the ladies in the kitchen who also provided refreshments throughout the day as well as excellent breakfasts on both days. Our thanks go to Giovanna and Debbie for organising the food and people so well.



Llanelli & District Model Engineers Results for Llimlec Efficiency Competition 2006 held at Pembrey Track.

Run no.	Competitor	Club	Engine	Wheel arrangement	Gauge	Distance run	Coal used	Calculated efficiency	Pos.
1	M. Richards	Llanelli	Mountaineer	2-6-2	3.5	9332	3.09	0.151	8
2	Colin Burrow	Swansea	Pamela	0-4-0	5	12445	2.0	1.233	5
3	Gavin Kinch	Llanelli	Dolphur	2-8-4	5			Retd.	
4	Jim Elliott	Oxford	Speedy	0-6-0	5	15547	1.25	1.277	4
5	Andrew Williams	Pembroke	9F	2-10-0	5	17062	2.22	1.927	1
6	Les Walters	Swansea	Manor	4-6-0	5	13970	2.53	1.015	6
7	Daniel France	Merthyr	Hunslet	0-4-0	3.5	10980	1.85	0.816	1st 3.5in.
8	Colin Morgan	Swansea	Baltic Tank	4-6-4	5	17022	2.71	1.034	6
9	Daniel France	Merthyr	Manor	4-6-0	5	17061	2.28	1.625	2
10	Gavin Kinch	Llanelli	Dolphur	2-8-4	5			Retd.	
11	Simon Burrow	Swansea	Pamela	0-4-0	5	14021	3.25	0.901	7
12	Dewi Griffiths	Merthyr	Manor	4-6-0	5	15533	1.87	1.374	3
13	Ivor Roberts	Llanelli	Western Tank	2-6-2	5			Retd.	
14	Peter Dobson	Llanelli	Dolphur	2-8-4	5			Retd.	

ROAD STEAM

The late Stan Nipper and Martin Wallis

describe the connecting rods and crossheads, but Martin starts with a few remarks about his friend Stan Nipper.

●Part XXIII continued from page 94
(M.E. 4278, 21 July 2006)

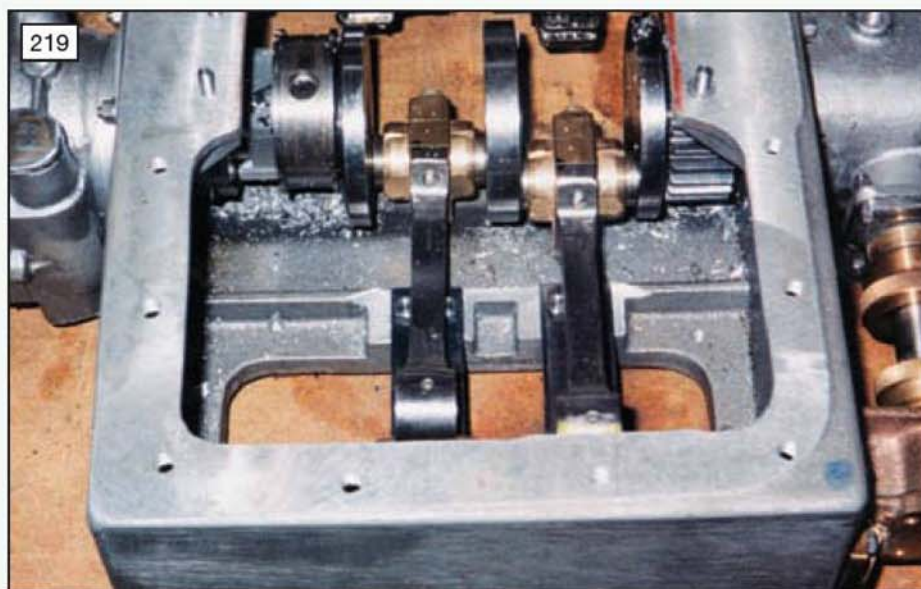
As readers will have read in M.E. 4277, 7 July 2006 my co-author Stan Nipper has sadly died, so I am preparing these notes on my own. The *Universal Carrier* articles have been the product of numerous emails between Stan and myself, Stan always making suggestions, and of course proof reading and tweaking my text as required. The void he leaves is keenly felt.

Stan prepared the entire CAD drawings for these articles, starting with the Savage works drawings and scaling and interpreting then to provide the splendid drawings we are familiar with. I must emphasise that the drawings are not a simple matter of dividing the dimensions by four as there is so much to check, cross-reference and round up/down to produce a sensible dimension. Believe me it is no small task - I have been there with the *Little Samson* design. So many thanks Stan from all the present, and future, *Universal Carrier* builders.

To allay any worries, the vast majority of the drawings for the model have been completed, the sequential A3 drawings running to a grand total of 81 sheets including the index. The one exception is the cab roof, which seemed to be an optional extra anyway. If a roof was ordered Savage had a variety of designs - some rather more appealing than others. Some were decidedly 'functional' in appearance.

User Group

A *Little Samson* builder, Don Ricardo, suggested the idea of a 'user group' for like-minded *Little Samson* builders. It has proven to be very successful having, at the time of writing, some 38 members. There is now a database and a FAQ



The connecting rod assembled inside the crankcase. Note the wide sweeping marks from the cutter that machined the pads for the guide bars (photo: John Thompson).

SAVAGE'S UNIVERSAL CARRIER

(frequently asked questions) list and dozens of pictures posted by members. The group is run by members (in point of fact run by Ron!) for members and has proved a very useful forum for discussions of both *Little Samson* and the *Universal Carrier*. Topics include rolling wheel rims, building your own rolls (pictures included), fitting hornplates, the best paint brands, colour schemes, and so on.

The purpose of mentioning the user group is to enquire if others exist for other designs? Does anyone host a list of such groups? I understand it is easy enough to un-subscribe from these groups if they are not to the builder's taste, and they seem not to be a source of spam, junk mail and general unwanted communications, etc.

And so back to our model, starting with the crosshead guides.

Crosshead Guides

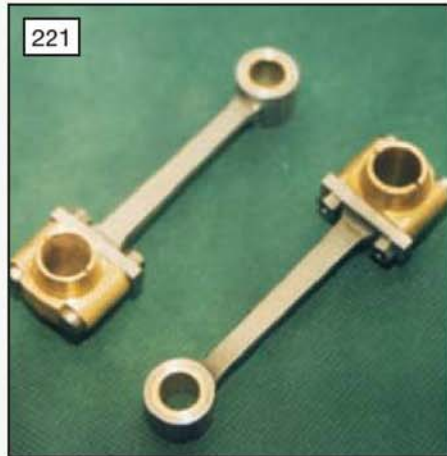
The *Universal Carrier* has a single, substantial,

crosshead guide per cylinder. Generous bearing areas are provided for the crossheads to work against and, being located in the bottom of the crankcase, have abundant oil bath lubrication. The required section is 0.75in. by 0.188in., or a suitable metric equivalent. A good straight piece of bright mild steel will do the job perfectly well; with so much oil around they will last virtually for ever. Some builders may prefer to give their bars a quick tidy up on a surface grinder (I guess an evening class or through a friend) and perhaps a few determined individuals may also wish to case harden them. Alternatively carbon steel may be substituted, rectangular sections being commonly called gauge plate, which may be fully heat treated.

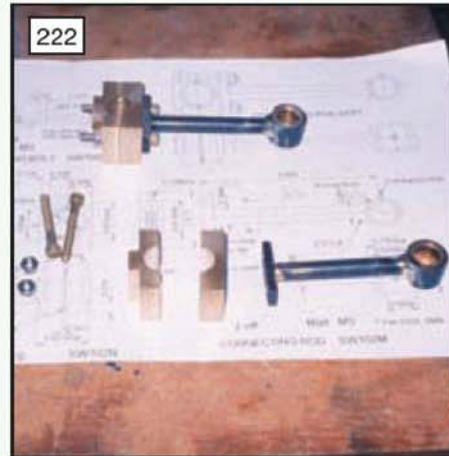
Four pads are provided in the bottom of the crankcase for the guide bars to locate on. If a lengthy T-slot or dovetail cutter is available, that is long enough to reach through the crankcase, the job is but a couple of minutes work. Failing that a



A pair of sand cast crossheads and keeps (photo: Martin Wallis).



A finish machined pair of connecting rods (photo: Stan Nipper).



A pair of rods made by silver solder fabrication (photo: John Thompson).

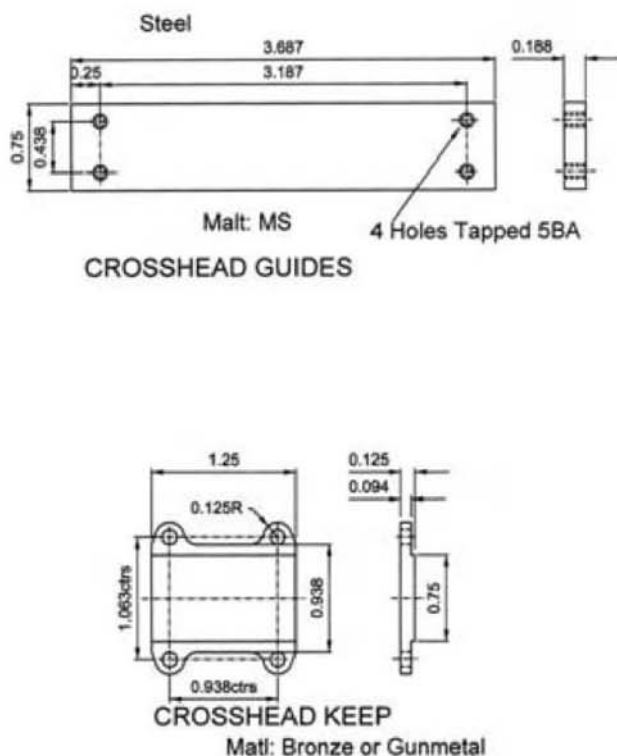
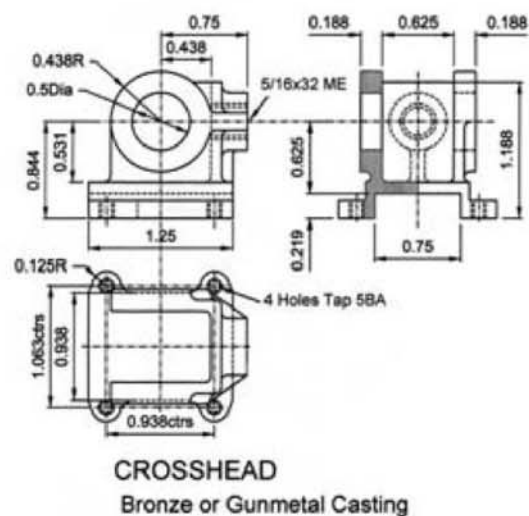


FIG 81 CROSSHEAD, GUIDES AND LINKS



©

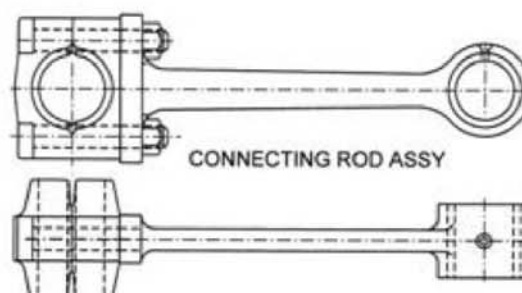
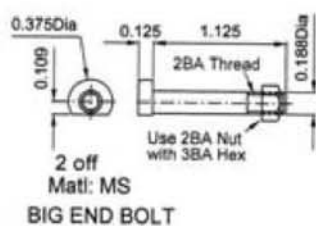
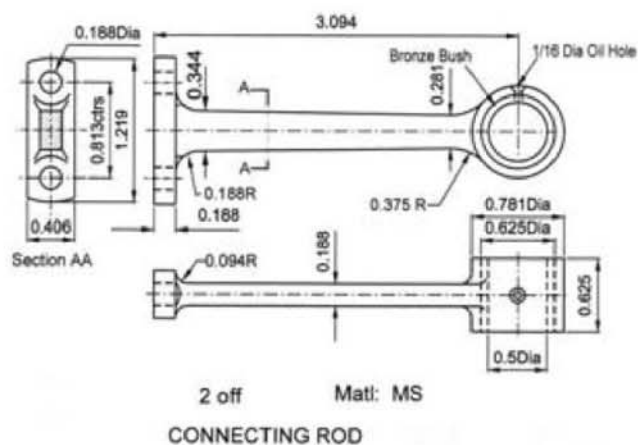
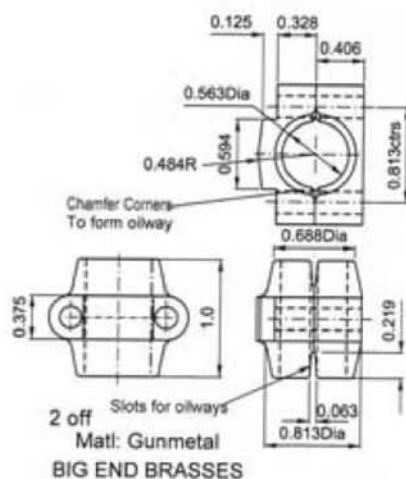
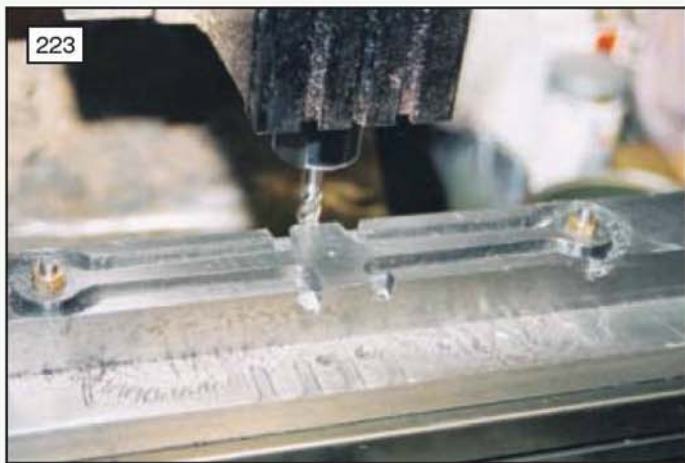


FIG 82 CONNECTING RODS



©



223
Cutting out a pair of rods from steel bar using a CNC milling machine (photo: Stan Nipper).



224
The completed pair of rods before being separated into two (photo: Stan Nipper).

fly cutter arrangement will need to be made to do the deed. Happily being aluminium alloy the cutting forces are not too great, but never the less it is wise to make the cutter as robust as possible.

Do not drill and tap the holes that fix the guides down just yet, much better to wait until the piston rod/ crosshead/ connecting rod assembly is offered up to confirm the exact position. The pair of holes at one end may be drilled and spotted through into the crankcase but the fixings at the other end will need the holes to be drilled in the crankcase first and then spotted through into the guide bar.

Positive location

The Savage works drawings do not detail the fixings for the guides but a surviving photo indicates countersunk screws (see photo 229) presumably with nuts underneath as a cavity is provided in the crankcase cover to accommodate same. On both our model and the prototype it follows that if these bolts are not a close fit in their holes there will be no positive location. If the guides were removed and replaced it would not necessarily follow that they would go back in the same place. An improvement would be fitted bolts where a portion of each bolt's shank is turned parallel and made a close fit in the hole in the guide bar and crankcase.

Some builders might wish to fit a locating dowel, a worthwhile addition provided it is a tight fit in one of the components. Should it come out a stray dowel rolling around in the crankcase would almost certainly get caught somewhere, probably in the gear teeth, and cause considerable damage. It is worth noting that all the nuts inside the crankcase are castellated and fitted with split pins for just this reason.

Good to rattle

The concern over loose nuts and stray dowel pins in the crankcase reminds me of a fascinating conversation many years back with an old engine man. Go to any traction engine rally and listen to the motion of a few engines. It will not take long to find one with a 'clickedy clack' slide valve.

When just ticking over there is insufficient steam pressure to keep the valve on the face. It is periodically falling off the face and then re-seating when the next breath of steam arrives. In fact, to be correct, it is more likely that the valve is actively pushed off its face; remember the valve ought to shut to exhaust a little before dead centre, which traps some steam in the bore. The purpose of this is to bring the piston



225
Boring the little end hole in the lathe (photo: Stan Nipper)

to rest without any wear and tear on the big and little ends.

To obviate the 'clickedy clack' the engine designers usually fitted a flat leaf spring betwixt buckle and valve. Evidently it was common practice to remove the spring as, should it break or come loose, the parts would get caught in the steam ports severely scoring both the valve and valve face. Evidently one of the first jobs on a new engine was to remove the spring. The old chap said it "was good to rattle" as you knew there was nothing in there to fall to bits!

Crossheads

Much head scratching and worry was experienced with the crossheads. Clearly a casting was going to be useful, a fabrication is naturally an alternative but using a casting would save a lot of time and was likely to be the favourite option with most builders. However, should it be sand-cast or lost-wax cast? From experience a lost wax casting was going to be very little short of treble the expense: and that did not take into account the considerable amount of extra time that would be needed to make the tooling to manufacture the waxes.

Happily practical considerations dictated the answer; several of the 'advance party' of builders were in danger of overtaking the pattern making department's ability to provide the necessary materials. A sand cast option was decided. The results are shown in photo 220.

The hole for the piston rod is threaded $\frac{5}{16}$ in. x 32tpi and must be threaded so its axis is parallel to the guide face. It is probably easiest to

machine the guide face first and clean across the outside faces so, when popped in the 4-jaw chuck, one jaw will be against the guide face and two jaws against the machined side faces ensuring accuracy. The piston rod position is dimensioned at 0.625in. above the guide face on assembly. If the alignment is imperfect it is easy enough to adjust the height of the guide bars by either shimming (too low) or machining a fraction off the guide bar pads in the crankcase (too high).

The little end hole is drilled, bored and reamed 0.5in. and then used as a plug gauge when turning the little end pin. As there are such large bearings areas it is unnecessary to harden the little end, unless the builder prefers otherwise.

Connecting rods

The connecting rods are 3.094in. between big and little end centres. A rather silly dimension but a quarter of the full size's 12.375in., the dimension somehow arrived at all those years ago in the Savage drafting department.

While the centres are given to three decimal places great accuracy is not essential. Should the rod prove a bit too long a fraction may be machined off the big end flange or, if too short, a slither of packing inserted: but neither is at all likely as there is plenty of room at both ends of the crosshead's stroke.

A completed pair of connecting rods is shown in photo 221. The full size rods would have been forged from bar, but in our case the correct profiles are easier to achieve by wastage, i.e. cutting them from the solid, as may be seen from the ensuing illustrations. Working by wastage is time consuming but does allow for prototypical sections and the correct fillets in the internal corners.

An alternative is fabrication, no more complicated than three stock sections silver-soldered together, indeed a further time saving may be had by making the rod parallel rather than tapered, as may be seen in photo 222. Functionally, a silver-soldered rod is quite satisfactory and since it is out of sight in the crankcase it will not detract from the appearance of the model. Such short cuts are very much a matter of personal taste; I would not wish to comment!

If cutting the rods from solid material there is some merit in making them initially in one length, see photo 223, as the two little end holes may be used to fix the blank to the machine table. The fillet radii are easily achieved by simply selecting the right size of cutter. ►



The bearing journal being bored. Note the silver steel location dowels (photo: Stan Nipper).

However, remember that once the cutter runs into the radius at the end of the cut, unless the feed is reduced, there may be a tendency for the cutter to 'pull' into the work and leave an unsightly blemish.

Big end brasses

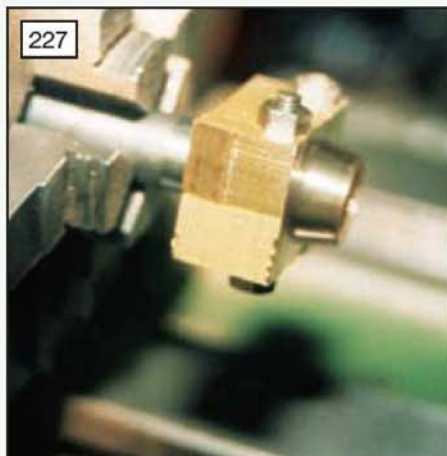
The big end bearings may be cut from a suitable piece of bronze or gun metal bar. Brass is not particularly suitable - which always makes me wonder why they are invariably referred to in catalogues and spare parts lists as big end 'brasses'. Perhaps they were once made of brass, but as bronze or gun metal is a much superior bearing material, and was readily available, I cannot see why.

A 'stick' may be machined from suitable stock from which the four halves may be individually cut. Make sure all the surfaces are at right angles to each other before cutting off the bearing halves and soft soldering the pairs together. The big end bolt holes may then be drilled and reamed. A start may be made on the big end hole itself but remember, when opening out the pilot hole, that future drills will be apt to catch and pull into the work. The correct solution is to back the drills off, which involves grinding the point to remove most of the relief behind the cutting edge. However, a workable alternative is to drill the holes in the milling machine by winding the knee up. With the quill locked any size of drill may be used with safety.

It is unlikely builders will have a 0.563in. diameter reamer so a plug gauge is well worth turning up, made to match the big end diameters on the crankshaft. The bearings are then bored out by degrees until the plug gauge just slides smoothly in, see **photo 226**. To turn the ends of the bearing a stub mandrel, see **photo 227**, is turned up. If the bearing is a light push fit - just wrung on - it is surprising how substantial a cut it will sustain. Remember the small fillets, at both ends of the crank pin where the journal meets the cheeks, necessitates a matching radius on both ends of the bearing.

To concur with the works drawings the brasses require a 0.188in. radius around the big end bolts, see **photo 228**, presumably to save material and weight, but as may be seen in an earlier illustration these may be omitted and left rectangular. Two slots are provided for oil ways.

The big end bolts are specials in two respects. Firstly the shank diameter needs to be a close sliding fit in the bearing halves to locate them and secondly the head is round with a flat that prevents rotation when tightening. Photograph 229 shows a castellated nut with split pin.

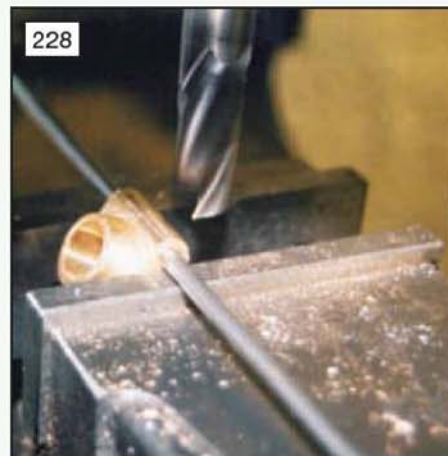


A stub mandrel holds the bearing while machining the side faces (photo: Stan Nipper).

Assembly

The big ends and little ends should be a close running fit on their journals, neither tight nor loose. For the little end, with any luck, reaming the little ends and using a piece of ground bar for the pins will provide the necessary fits.

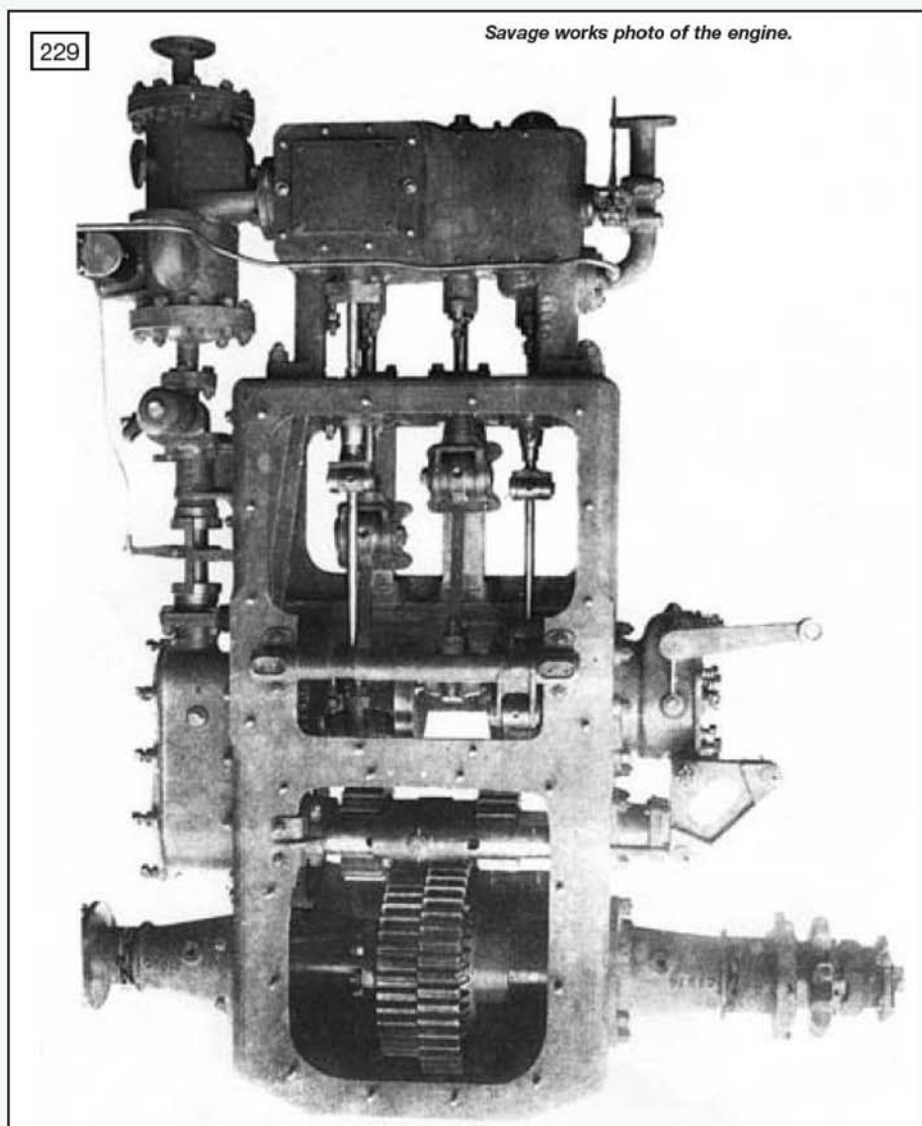
If the engine is to run smoothly it should turn over freely. If there are any tight spots these should be investigated. If the big ends are tight a single thickness of newspaper between the bearings may



The radius is machined to complete the bearing (photo: Stan Nipper).

be beneficial, but other than that the cause is probably some small misalignment. The most likely culprit is the connecting rod. To check it pass a length of ground rod through the big and little ends and check they are parallel. John's engine was originally not as sweet as it might be, the culprit was a misalignment on his fabricated rods (**photo 222**) which after a bit of thought he decided to replace with a pair cut from the solid (**photo 219**).

●To be continued.



Savage works photo of the engine.

Jim Haslam

concludes this short series starting with the bevel gears for this useful attachment.

●Part III continued from page 86
(M. E. 4278, 21 July 2006)

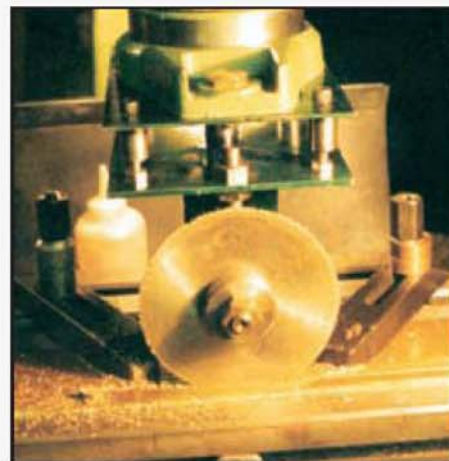
I have in the past, whilst working in a drawing office, specified data for the manufacture of spur and bevel gears. However, that was rather a long time ago and it was comforting to have Ivan Law's book *Gears and Gear Cutting* (Workshop Practice Series No. 17) on hand to check out the details. The book gave me the confidence to have a go and this resulted in a most interesting piece of machine work. The resulting gears run quietly but benefit from being able to adjust their backlash. This was done by modifying the length of the bush (item 4).

1: Machine the gear blanks as indicated on the drawing i.e. from material of extra length thus providing a holding spigot and abutment shoulder to prevent the work piece moving into the chuck during cutting and also throw the cutter clear of the chuck and chuck jaws. Drill and tap for two grub screws set at 90deg. to one another.

2: Set the first blank up in the dividing head chuck and take particular care in setting the gear

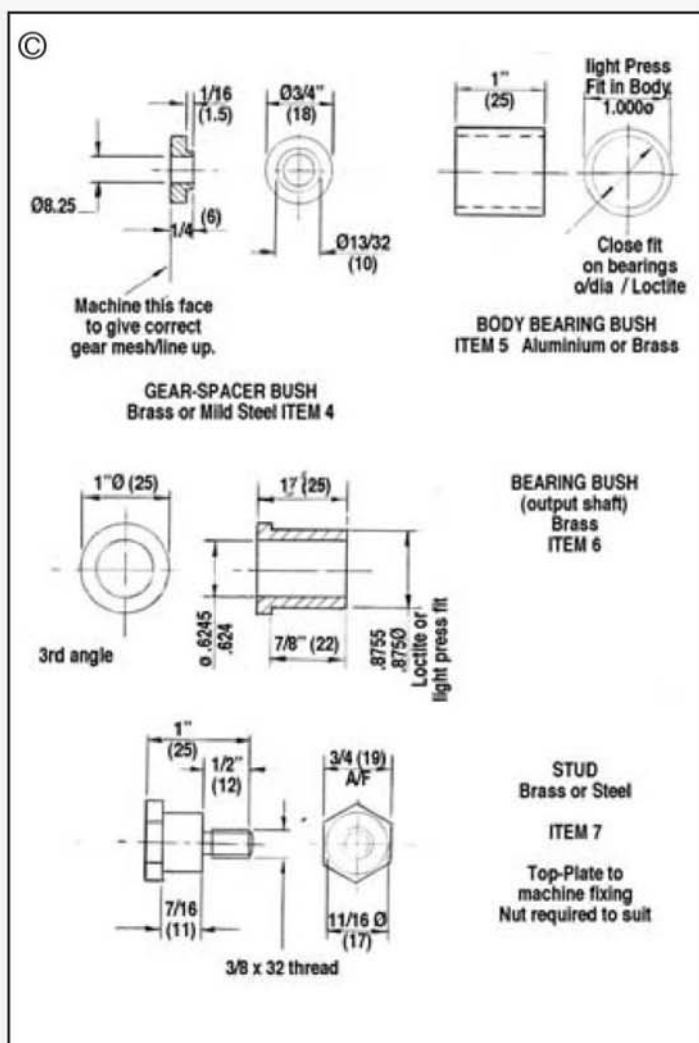
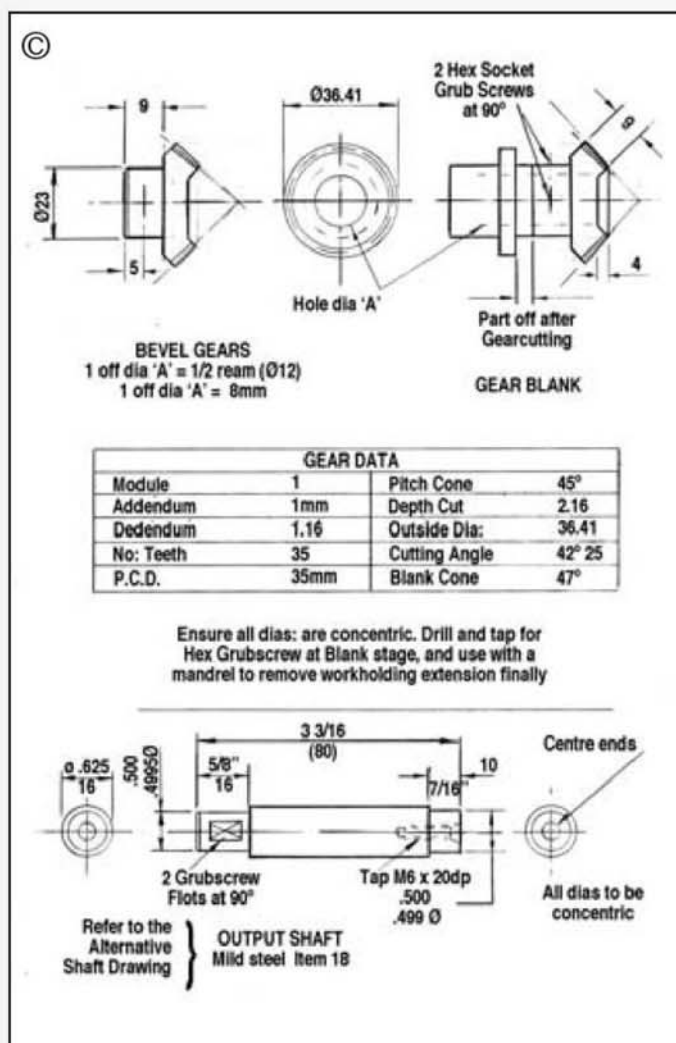


Cutting the flutes in the specially made, left hand thread tap.



Using the attachment to saw up some sheet brass. Note the secure clamping arrangements.

HORIZONTAL SPINDLE MILLING ATTACHMENT



cutter central otherwise 'leaning over' teeth will result.

3: Set the dividing head to give the required number of divisions.

4: Set the dividing head on the worktable at the required cutting angle ensuring that it is not set at the 90deg. component angle in error.

5: Cut the teeth or, more correctly, the tooth spaces to the required full depth.

6: Remove any machining burrs with care.

Output shaft (item 18)

Ensure all diameters are concentric.

1: Face the bar to length and centre both ends.

2: Machine all over between centres.

3: Drill and tap (would be ideal as a left hand thread).

4: File or machine the flats.

Note, before making this item consider the alternative output shaft and cutter bushes submitted with the left hand thread to overcome slip and the screw becoming loose as a result of 'up cut' operation (see later).

Bearing bush (item 6)

Face the end and centre drill. Follow up with a pilot drill and finish with a 12mm diameter drill. Bore to a good surface finish and to a size that is a good fit on the output shaft. Machine the bush to a light press fit in the body (you could also use Loctite). Part off and face to length.

Stud (item 7)

Face the end of the material and machine the thread diameter. Cut the thread. Produce the shoulder diameter and part off.

Gear spacer bush (item 4)

Machine to drawing and adjust as required on length to obtain the correct mesh of the gears.

Body bearing bush (item 5)

Diameters must be concentric with bores to suit the bearing's outside diameter. Loctite into the body.

Up cut or down cut

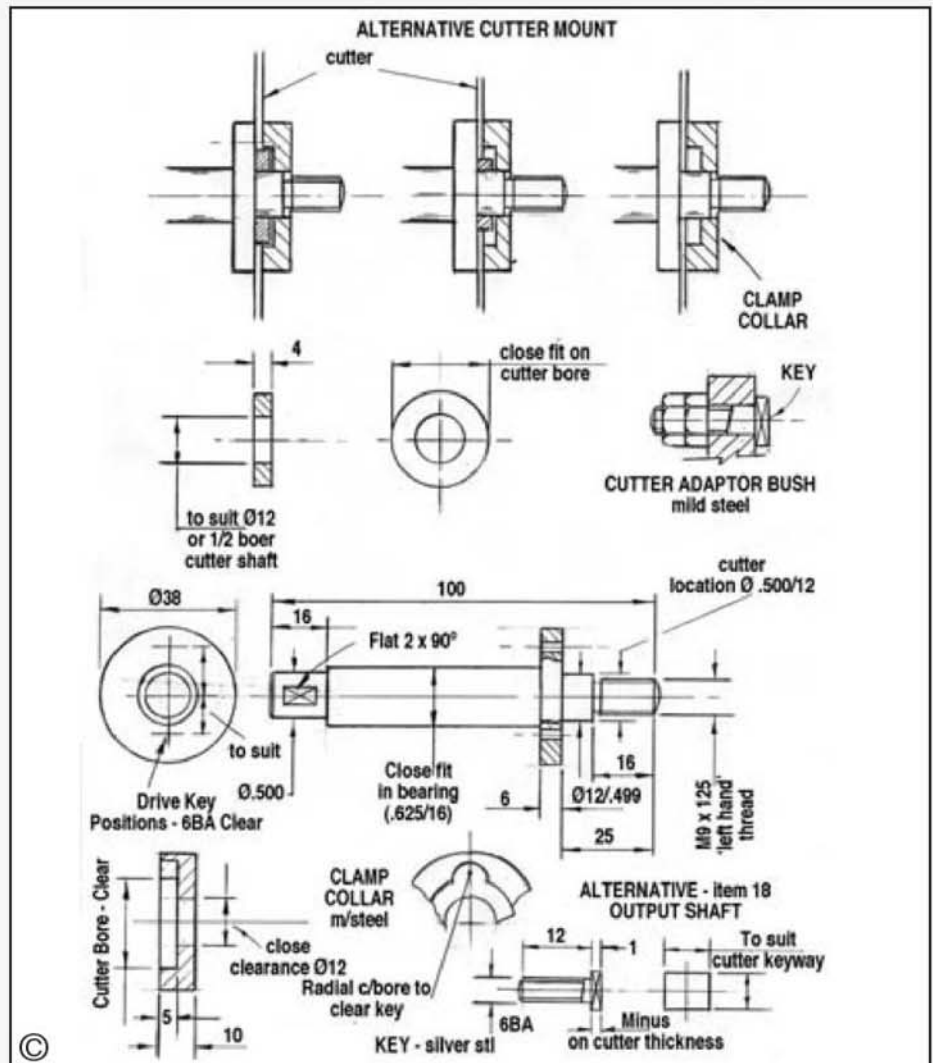
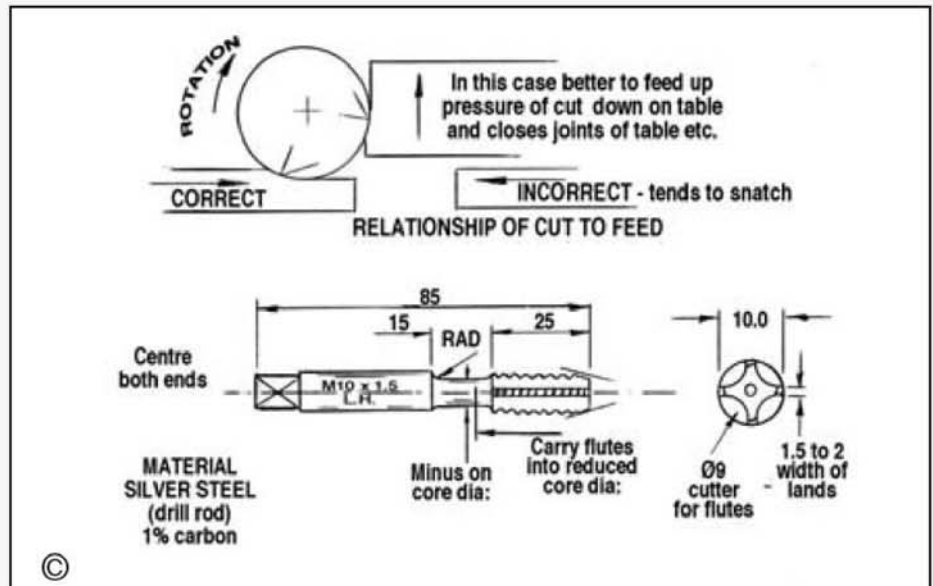
It is usual practice on light machines to use 'up cut' milling where the material removed per tooth starts at zero and rises to a maximum at the end of the feed applied per tooth. With 'down cut' milling (sometimes called climb milling) the material removed per tooth starts at a maximum and falls to zero at the conclusion of the feed applied per tooth. Down cut milling tends to draw the work into the cutter and unless the machine is designed to withstand this, by elimination of backlash in the feed screws, a broken cutter and scrapped work may result. Down cut milling is really only applicable to large industrial machines where adequate design precautions can be made and where high metal removal rates are a priority.

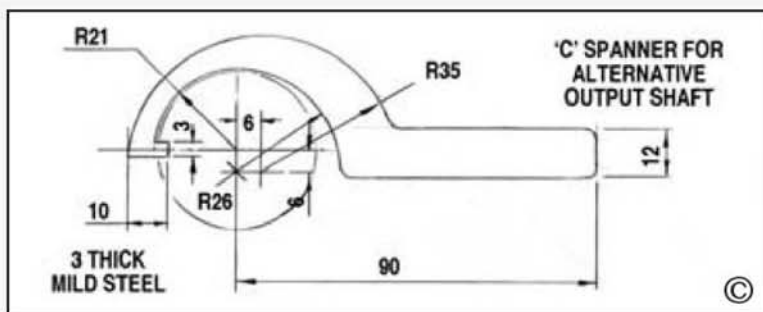
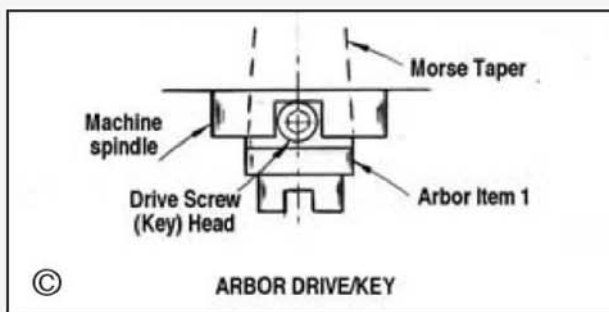
The thin slitting saws we model engineers use for slitting work do not always have a key way, especially in the smaller sizes. When clamped to the mandrel with a single screw they can slip, particularly when oil gets between the clamping faces. Also there is a tendency for the screw to come undone unless it has a left-handed thread. However, a left-handed tap is an

expensive item to buy for just this one application. I overcame the problem by using down cut rotation and very light feed rates. But I also show an alternative shaft with a more robust clamping

arrangement for the cutter and a left hand thread thus allowing for standard up cut milling.

The larger thread size also makes screw cutting of the thread easier and particularly the





making of a left hand tap where there is a need to remove all burrs before the tool is hardened and tempered.

Left hand tap

Left-handed helix taps and dies tend to be expensive and often difficult to obtain in preferred sizes and the taps are not always available in sets of three. For these reasons I found it expedient to make a suitable tap for this application. A nut was then made and the male thread screw cut to suit the nut.

The larger the tap, within reason, the easier it is to make as the thread form can be carefully checked and hand chased as required and a coarse thread is easier to deburr after the flutes have been cut. Some model engineers make rather crude taps having two flats machined on them. These are simple to make but do not cut very well. It is worth making a proper tap like that shown in the drawing.

It is possible to make a M10 tap from 10mm dia. silver steel as the thread cutting process throws up burrs, which make the tap cut slightly over size. Careful chasing will reduce these to bring the tap to size. It does help not to have to use silver steel of a larger diameter but accurate chucking facilities are a must.

Cut the material to length and face and centre both ends. Machine the thread diameter and provide a reduced core diameter to facilitate presentation of the screw-cutting tool. Set the work up in the 3-jaw chuck with tailstock support. Set the screw cutting tool up square to the work and set the machine up to cut 1.5mm pitch. Make sure the tool travels away from the chuck. Cut the thread and chase to give the correct form.

Set the tap up in the dividing head and mill four flutes. Clean up any burrs and file a angular lead on the first two threads backing them off like you see on commercial taps. Harden the tap by heating it to cherry red and quenching in clean water. Allow to dry, polish and temper to the colour of straw.

Reminder: It is best to make the nut with the tap before screw-cutting the male thread. Support the tap with the tailstock centre not forgetting to rotate it counter clockwise.

Lining up

For some time now I have been aware of the need for some tenons to help make set-ups on the milling machine table easier. This head makes that requirement even more urgent. The head of the vertical milling machine and the attachment can both swivel so some means of quickly setting cutters parallel or square to the table is essential. The tenons can be rectangular blocks or cylindrical but must be secure. The drawing shows a shouldered stud flatted to assist insertion when rotated for correct fit. The thumbscrews keep it locked and secure.

For rapid setting a set square will enable them to be lined up and if a square of larger size is not available a parallel strip of steel or a rule can be used with the square to overcome this. If necessary the tenons can be checked with a dial test indicator.

With the tenons secured in line the attachment can be offered up with a suitable piece of steel mounted on the arbor in the place of a cutter. The bevel box can then be set parallel to the tenons using feelers to check the gaps front and back. The machine should be switched off and isolated during these adjustments.

Spindle drive

It is possible that slip can occur in the drive if the No.3 Morse taper in the spindle is not a good mating fit in the machine spindle, even though it is secured by the draw bar.

To overcome this, fit the arbor (item 1) in the machine spindle and scribe the outline of the spindle's keyway on to it. Remove the arbor and mark out for a M6 tapped hole such that the head

of a M6 x 12 screw will fit in the spindle keyway as shown in the above sketch. The head of the screw will provide a positive drive.

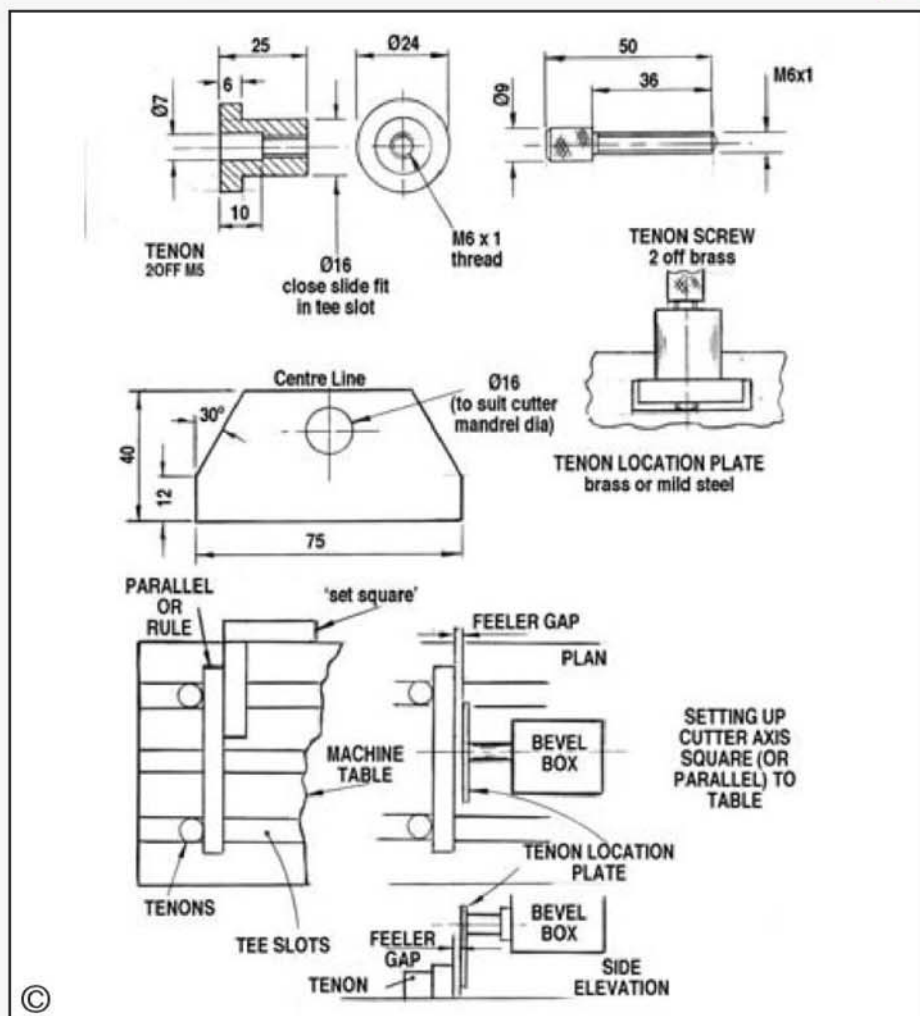
Finally, it is worth fitting soft push in plugs to the two lubrication points to stop the ingress of dirt. A cutting speed of 200rpm with a 75mm dia. slitting saw will give satisfactory cutting on brass. Ensure the sheet material is firmly clamped to avoid chatter and vibration.

Sources of supply

The following foundries may be able to help model engineers looking for a suitable gearbox body for this project:

P. Whitehead, Altringham,
Nr. Manchester; tel: 0161 928 4631
S&J Castings, Nr. Bolton;
tel: 01204 79 3339

Gears can be obtained from:
Mini-gears; tel: 0161 432 0222
Davall; tel: 01707 265432;
fax: 01707 268536





The Dremel glue gun parked in the retractable stand with accessories.



The Dremel glue gun in use.

M.E. VISITS SILVERSTONE

Malcolm Stride
answers the question: "Why did
Model Engineer visit Silverstone?"

The answer is that we were invited by Dremel who are launching a new range of small tools which will be of interest to model engineers. The tools are new versions of a glue gun, mini drill (Stylus) and scroll saw. Such tools are familiar to many model engineers and the new versions provide a greater level of sophistication to such tools. We did get to use all the tools during the day, so my comments are based on some use.

Why Silverstone? Well Dremel are one of the sponsors of the Midland F1 team (many readers will have known this as Jordan before it was sold by Eddie Jordan) who are based at the circuit. The event was arranged to coincide with the Thursday set-up day for the British Grand Prix held over the weekend of June 10/11, so your editorial staff got to see behind the scenes in the Midland F1 factory and pit areas, meet team driver Christijan Albers and had a walk down the pit lane during the day, such are the hardships of working for *Model Engineer*!

But now it's time to comment on the Dremel tools that are being introduced to the public on 1 September 2006.

The tools

Dremel have obviously thought about the design of all the tools because they all have features which make them easier to use and provide greater flexibility in use.



The Stylus mini drill on its charging stand with some accessories.

I will start off with the glue gun, which although not normally considered a model engineering tool will be of interest to those who build model aircraft or model boats.

The glue gun

Starting with the glue gun (photo 1); this has several features designed to make the gun easy and versatile in use including a stable fold out stand for parking the gun between glue applications, dual temperature (195/120deg. C) settings for normal/delicate jobs, a ready indicator light, an on/off switch on the gun, three different tips, an anti-drip facility and an LED illuminating light (headlight) under the tip. Certainly my experience with other guns indicates that these features will make the gun very convenient in use.

The gun is compatible with regular 11mm dia. glue sticks and is well designed to fit the hand and as can be seen (photo 2), has a long (three finger in Dremel terms) trigger. The gun fitted my hand quite comfortably and the long trigger certainly aided control over the application process as I discovered in use on the day. The glue gun will retail at a recommended price of £24.99.

The Stylus

The Dremel Stylus is an updated version of the well-known mini drill tool and Dremel have again gone back to basics and looked at the



The Stylus in use with a sanding drum showing the good grip afforded by the design.



The Scrollstation showing the solid build and the sanding disc and other facilities.



The disc sander in use showing the adjustable guide fence and table.



The saw in use with the work clamp holding the work down to the table.

design from scratch. The first thing that readers will notice is the shape of the tool which is a pistol grip shape, giving a much more natural grip in use.

The cordless tool is powered by a lithium-ion battery which is charged when the stylus is placed in the stand (photo 3) and, as can be seen the stand incorporates tool storage facilities thus ensuring that they are always to hand. The use of a Lithium-Ion battery means that the stylus has plenty of power and also that it can be replaced on the charging stand for the battery to be topped up when not in use without any of the memory effect associated with older Ni-Cad batteries. This feature means that it should always be charged up and available for use whenever needed for de-burring, drilling or polishing small parts in the workshop.

The battery power also has the great benefit that there is no power cord to drag or restrict use thus enabling use in very confined spaces making the tool very useful if work is carried out on the inside of a locomotive chassis for example.

The speed is selected by means of the large knob on the end of the motor casing but the tool also has a separate on/off switch which means that the speed setting is not lost when the drill is switched off.

Tools are held in collets with 0.8, 1.6, 2.4 and 3.2mm collets available. The range of tools available includes sanding drums and discs, drills and burrs and the kit supplied includes 15 such accessories.

In use the tool certainly felt comfortable (photo 4) and easy to control. I found that when using a drum sander or burr, use of the other hand on the top casing of the tool gave a very stable grip and enabled close control of the tool. The casing did get warm during prolonged continuous use but not uncomfortably so.

Changing tools is easy because the spindle is provided with a lock button to prevent rotation. The quoted speed range is from 5,000 to 25,000rpm.

I think many model engineers use such tools on an occasional basis and the Stylus with its charging station will fit the bill very well. I have used mini drills in the past for de-burring and polishing small parts and also for shaping the combustion chambers of small I/C engines.

One of the things we discovered during our day was that F1 racing teams take such tools to races because of the lightweight and small size. Those who saw Tiago Monteiro's car after he got involved in the first lap collision (nothing to do with him)

at Indianapolis will perhaps think, as I did, that a glue gun or two would have been useful! The Stylus will retail at £59.99.

The Scrollstation

The Dremel Scrollstation combines the features of a scroll saw and a rotary sander in one machine (photo 5) and also includes a power take off for use with a flexi-shaft and attachments.

The basic specification of the machine is a cutting depth of 450mm, cutting height 50mm (but this depends on the material being cut), speed 500-1500 strokes per minute with a 19mm stroke length, table length 520mm, table width 385mm, weight 24kg.

The blade can be rotated through 90deg. to enable long lengths to be cut, so the cutting depth figure is not relevant for all situations. The machine is very solidly built and has a cast iron table which can be tilted up to 45deg. to the left and 5deg. to the right enabling angled cuts up to 45deg. mitres. One thing I particularly liked were the top mounted controls which are very convenient in use.

On the day our task was to make a small racing car, which was an appropriate choice given the venue, and gave us a purpose when using the machines. The body of the car was cut from a piece of pine approximately 50mm thick and the

saw gave a good clean square cut on this material. The top mounted controls enabled me to adjust the speed whilst cutting to get the best cut.

Of interest to model engineers and particularly clock makers, non-ferrous metals up to 3mm can be cut with the correct blade type.

The sanding disc is mounted on the right side of the machine (photo 6) and has a tilting table and an angle fence for sanding mitres or similar. This view also shows the flexible dust blower arm, in addition the machine has an adaptor for a vacuum cleaner hose to aid dust control which is very important for all sorts of reasons.

The machine we used was not fixed down in any way and at higher speeds moved around so I would suggest that the saw needs to be fixed down when in use to get the best performance.

Changing the blades is easy because no tools are required and there is a pull out blade storage draw under the right-hand side of the table. Both pin ended and plain blades can be used.

The saw has an adjustable work clamp to aid the cutting of thinner materials (photo 7); this is set down onto the work and helps to stop it lifting on the up stroke.

This machine, like the others is well built and should be on the list of those looking for such facilities. In a small workshop, the fact that it has a sanding disc built in will make it a very attractive option. The Scrollstation will retail at £239.

I think Dremel have done a very good job with these tools and I suspect many model engineers will be attracted to them.

Just to prove that your editorial team did do something on the day, I must include photo 8, which was taken by me with Neil Read busy painting our car (the fact that it bore a passing resemblance to a Morgan may have had something to do with Neil's favoured mode of transport). Our Editor was busy supervising (as they do!).

All this activity took place under the Midland F1 wind tunnel and we were given a guided tour of this facility before starting our own car development and building.

The resulting cars were entered into a down hill race and a *Concours d'elegance* which was judged by team driver Christijan Albers.

All in all a very interesting day, both for the opportunity to actually try the new Dremel tools and the visit to the British Grand Prix preparations and in particular the Midland F1 team.

I must thank Dremel and Starfish Communications for the photographs of the tools for this report and both them and Midland F1 for their hospitality on the day.



Just to prove that your editorial team did do something on the day, I include this photo, which was taken by me and shows Neil Read busy painting our car. The fact that it bore a passing resemblance to a Morgan may have something to do with Neil's favoured mode of transport.

WORKSHOP WRINKLES

Peter Spenlove-Spenlove

discusses several workshop related topics starting with how to deal with splinters in the fingers.

When working metal one often feels a sharp 'twinge' as a tiny splinter enters your finger. Small, spiral toothed end mills, when taking a light cut in brass, are liable to generate very small, almost invisible splinters that are very sharp. To avoid such pain and trouble, do not remove swarf from the work with your hands but use a small brush. Also, do not use the cloth that you later use to wipe your oily hands after work.

To remove splinters that have entered your fingers, keep two pairs of good quality tweezers and a pocket magnifier in a clean box ready for use under a strong lamp. Make sure the tips of the tweezers really do meet as some do not even when new. A fine stone and a flat needle file can be used to correct any faults. It is also a good idea to add a slight radius to the two corners of flat tweezers as indicated by the arrows in the photograph. This helps to avoid nipping the skin while trying to grab a splinter. Do not use these tweezers for workshop jobs but keep them for the task of splinter removal. Buy another pair for general workshop use.

Tool storage

My vertical milling machine is similar to most and has a slab sided column on a cast tray designed to catch swarf and oil. To save operating time I collected a dedicated set of spanners. Putting them on the machine table or tray is inviting loss in swarf, cut fingers and the

spreading of swarf and dirt to clean parts such as the draw bolt.

To avoid such problems I drilled and tapped holes to fix metal loops and screws to store the tools within easy, quick reach. From the top down in the photo can be seen a plywood spindle nose scraper to make sure the spindle taper is clean, a draw bar socket spanner (1/2in. Whit.), a homemade metric/Imperial spanner for the vices and a 7/16in. Whit. bi-hex ring spanner for the clamping T-bolts.

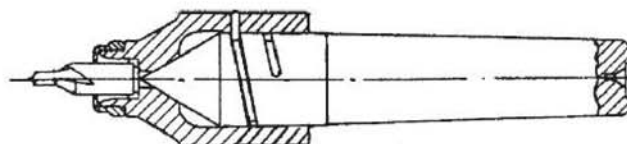
Wings

I needed a couple of 4BA wing-headed screws. The round-headed screws I had in stock were slotted for occasional hand tightening with a screwdriver. I found a thin washer that fitted the slot and cut it in half. One half was then silver-soldered into the screw's slot. All the sharp edges were cleaned up with a fine file and the finished winged screw dipped in engine black paint to prevent rust.

Centre drilling

This tool, the description of which was taken from an old textbook, is said to be useful to the turner as it saves winding a heavy tailstock back and forth along the lathe bed to change the centre for the drill chuck and back again when carrying out 'mass production' jobs.

To make it, a soft centre fitted with a hard tip (tungsten carbide centre) is fitted into the lathe



Tailstock Centre-drilling Device.



OIL WELL

headstock and a parallel portion turned as shown. A coarse, short square thread can then be machined into the parallel part.

Remove the centre from the lathe and fit the chuck. Grip a piece of steel for the cap and drill through. Bore to a close fit on the parallel part of the centre and turn the internal 60deg. taper. Drill through the wall of the cap for the peg that locates in the square thread on the centre. It would probably make fitting and removal easier if the outer diameter of the cap is neatly knurled.

Fit the centre back in to the headstock, fit the cap and turn the seat for the centre drill. You can machine for a collet system if you wish to enable different sizes to be fitted or just bore for one size and use a grub screw to lock the drill in position. Centre drills can be cut in half or you can give fresh life to an old, broken one.

Note that the small centre hole must be deep enough to provide an oil well for the centre and avoid the point of the centre bottoming in the hole. New centre drills have a sufficiently long tip to allow resharpener a number of times. However, when the tip gets too short the centre point will foul the bottom of the hole.



Two 4in. long tweezers kept solely for removing splinters. A good magnifier is useful too.



The spanner storage devices fitted to the author's vertical milling machine.



An improvised wing headed screw made by fabrication methods.

WINSTON CHURCHILL IN 5in. GAUGE

Ray Corton

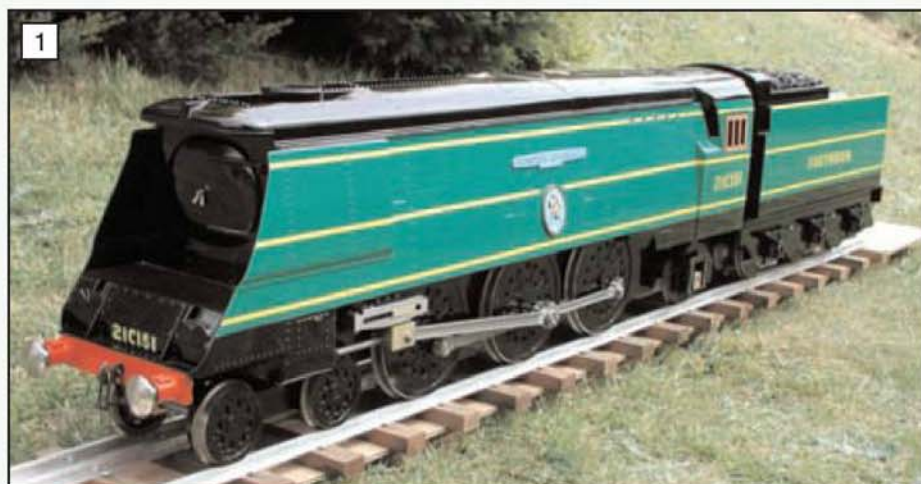
describes improvements he made to a Battle of Britain class locomotive kit from SR Locomotives.

●Part I

I suppose, like most of us I have been a fan of railways almost as long as I can recall. I remember my delight as a child watching a 0-4-0T Hornby tinplate my father had set up going round and round until the spring had run down. Over the years I have tried building layouts from N gauge to 16mm but the older I get so the scale of the railway increases and I now model in 5in. gauge. As a boy having seen steam locomotives in action through the passing of time I have never lost the magic of seeing a Pacific thundering down the track. Therefore, when I saw an advertisement by SR Locomotives, Robin Neighbour and Steve Glover, for a 5in. gauge Battle of Britain class locomotive powered from batteries I became intrigued, **photo 1**.

Some of you may have seen a previous article I wrote in *Garden Rail* (October 2002) about the modified Maxitrak *Victoria* (**photo 2**) in which I enthused about the delights of live steam and will therefore be left wondering why battery power? It's simple, while live steam is wonderful it's not instantaneous and has a high maintenance requirement.

In the following series of articles I will endeavour to describe the improvements, visually and environmentally, of the initial kit into a detailed model. Now when I say a detailed model, I have to say this is not a scaled-down copy of the original because that's not the way I work. My preference is to create the right visual image. So yes, please don't come along and count the rivets! The article is described in the



The basic Battle of Britain 5in. gauge kit as built up by SR Locomotives.

following series of sections: Part I - Initial building work; Part II - Engine and tender detail; Part III - Sound, light, painting and using.

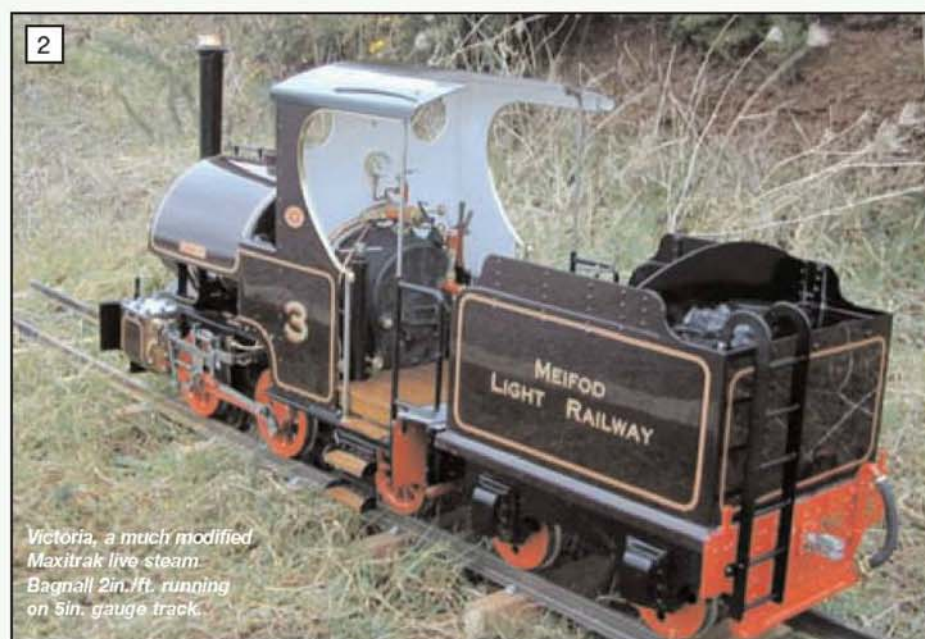
Introduction

There are those around who get their satisfaction from using their expertise to building complete working scale model railways, for which I have total admiration, but I get a great deal of satisfaction from the engineering of building and adding detail to locomotives and rolling stock. I have to say I have reached the stage in life when I'm not looking for a lifetime project as 5in. gauge locomotives normally are. I therefore chose to build the Battle of Britain from the supplied basic kit. The kit is very impressive and professionally produced with a fully detailed one-piece fibreglass engine and tender bodyshell which have been constructed from several

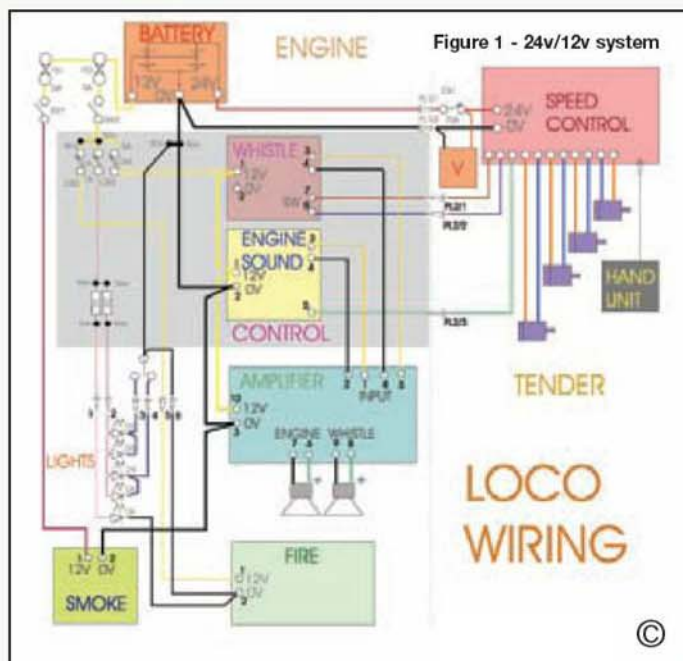
mouldings, a wonderful piece of engineering art. The chassis for the locomotive and the tender are made from laser cut dovetailed 10mm steel plate which is MIG welded together and the general engineering is therefore solid and stable. Every moving part has been bushed or provided with Delrin bearings or Oilite bushes or ball bearings. Both chassis are fully sprung to iron out any track variations. The engine body houses four rechargeable dry cell batteries providing 48Ah at 24V. The tender is driven by four large electric motors which are controlled by a 100A solid state controller with hand held controls. The hand-held control provides controls for the regulator, brakes, reverser and whistle. Adhesion of the drive is adjusted by fitting of up to four weight plates made from 10mm-plate steel to the tender chassis. When assembled the model has an overall length of 72 x 14in. high x 9in. wide. I cannot praise the engineering design and manufacture enough, the competition pales into insignificance against it.

As supplied the kit makes up into a lovely model that you can be proud of with just a little effort and minimal tools. With the information contained in this article it should be possible for those with minimal engineering abilities to produce an excellent workhorse. How far you go with the detailing is entirely up to you. A word of warning, this locomotive is heavy and it is therefore vital that any work carried out is done in a safe manner. All the work detailed in the following articles has been carried out on a dummy track made from MDF clamped to a hydraulic lifting table (Screwfix 15784).

Early on in my ownership there was one fact that became apparent which is a great advantage over building a live steamer. It does not have to be complete, tested and certified before you can use it! Each time I have taken the locomotive to my local club, Pembrokeshire Model Engineers, everybody gathers round to view the latest additions and provide suggestions and encouragement. If I'm lucky I eventually get to drive it myself! Also, once I started making parts



Victoria, a much modified Maxitrak live steam Bagnall 2in./ft. running on 5in. gauge track.



Layout of control system.



The base plate.



Control system plate.

Item	Description	Supplier	Part No	Qty	Remarks
1	Circuit Breaker 70A	SR Locomotives		1	
2	Plug/Socket	SR Locomotives		1	PL1
3	Speed Controller & Hand Set	SR Locomotives		1	Parkside 100A
4	Battery 12V 24AH	Powercare		4	Yusasa Type NPC
5	Whistle	Trax	SWM-2	1	
6	Engine Sound	Trax	CM-2	1	Changed to CM-2A see text in Part 3
7	Smoke Unit			1	To be defined
8	Amplifier Kit	Quasar	1046KT	1	Can be supplied built
9	Flashing LED Kit	Maplin	MK102	2	Used in Fire
10	LED Red	Maplin	UK48	2	Used in Fire
11	LED Yellow	Maplin	UK50	2	Used in Fire
12	Box	Maplin	WY03	1	Used in Fire
13	Box	Maplin	YM91	1	Electronics
14	LED Clear	Maplin	N29AT	5	See text, D2-6
15	Fuse 7.5A			1	
16	Fuse			1	For Smoke Unit
17	Fuse Holder			2	
18	Thermal Cut-out 1A	Maplin	AK07	2	FS1 & 2
19	Thermal Cut-out 5A	Maplin	AK11		
20	Switch on/off	Maplin	FH00	2	SW1 & 2
21	Switch on/off/on	Maplin	FH01	1	SW3
22	Resistor 470R	Maplin		2	R1-2
23	Plug 5 way	Maplin	BV64		PL2
24	Socket 5 way	Maplin	BV66		PL2
25	Plug 7 way	Maplin	HH30		PL3
26	Socket 7 way	Maplin	HH37		PL3
27	Wire Red	Maplin			As Required
28	Wire Black	Maplin			As Required
29	Wire Yellow	Maplin			As Required
30	Wire Green	Maplin			As Required
31	3 Core Flex 1A			2	PL2-Control
32	Grommet Strip				As required
33	Voltmeter			1	
34	Tag Strip	Maplin	FM34	2	
35	Potentiometer		VP96	1	
36	Potentiometer		VP96	1	

Figure 2 - Major components list

for detailing the locomotive it suddenly dawned on me that because there was no high temperature or oily excess it is quite feasible to use materials other than metal. I have made considerable use of inexpensive plastic sheet as it is easy and quick to form.

As I am not that familiar with Southern locomotives it surprises me when I started researching that in such a short period of time (relatively) what little information there is available on this class of locomotive particularly when there are several 'spam cans' preserved. However, while I will end up with a fairly detailed locomotive I am not striving to fit every rivet. It is more an attempt at creating the right overall impression. Lots has been written about Bulleid himself and it's interesting to note that

the outer casing he designed for this locomotive was not an attempt at streamlining but was to provide easy cleaning. During their life the locomotives had various cosmetic changes until British Railways rebuilt several, starting in 1955. I decided that the unmodified Winston Churchill, which is preserved and at present in the National Railway Museum, would be a fitting locomotive to model and as I do not like the Southern Malachite Green, personal opinion, it had to be in British Railways Brunswick Green.

I was fortunate, as this was the first kit off the production line Robin had assembled the mechanics to check the assembly. I decided not to strip, clean up and paint at this stage but to carry on and fit the control system and prove its operation. Note - most of the photographs are taken after painting.

Before I could connect any electrics I had to make some decisions and define the overall circuit diagram (see fig 1). The diagram contains several items which are optional. To improve the visual and sound effects I had the original objectives of fitting: Voltmeter (requirement debatable); Cab lights; Front lights; Locomotive Sound; Steam Whistle; Smoke; Firebox Flicker.

Each of these is to be provided with over current protection and an on/off switch. Figure 2 provides an overall parts list for the proposed major components. This is provided as guidance and having now defined certain suppliers I make all the usual disclaimers.

Wiring should be carried out using insulated flexible conductors having a cross-sectional area sufficient for the current to be carried.

While room is available in the tender for the



The motor wiring.

various electronic items I have taken the view that it is better to minimise the number of electrical connections between engine and tender. Thus the engine contains the batteries and ancillary electronics and the tender the drive system.

Having now established the basic mechanics of the locomotive we can examine each part in detail. This article is not intended as an assembly document although the logic of this is implicit within the document.

Initial building and testing

The object of the initial building and testing is to quickly reach the point where we have a useable locomotive. To carry out initial testing it only requires the installation of the 24V circuit and motor drives, fig 3 refers. At this stage we can put the engine and tender bodies to one side for later modification.

Initial testing requires the electrical items in the drive system to be installed in the tender. It is intended that the Speed Controller is mounted on an aluminium plate provided, which fits over the Weight Plates. If like me you have to transport your locomotive to a track it therefore follows, because of the weights involved, that every time you use the locomotive you will have to move the Speed Controller out of the way to allow fitting of the Weight Plates on their location pins. Cables therefore have to be of sufficient length to allow removal. The long-term problem with this is that cables will eventually be damaged. I therefore decided to convert the aluminium plate into a hinged plate and thus cause the minimum stress to the cables. The general arrangement of this is shown in photo 3, the weight plates fitting under the hinged Control System Plate. The vertical plate on the Base Plate, photo 4, is part of the original aluminium plate provided. Photograph 5 shows the Control System Plate. On metal edges, which may come into contact with the wiring I fitted grommet edging. The nuts and bolts forming the hinge have been fitted with locknuts to ensure they do not undo under operational vibration. I have left a large area adjacent to the upright panel open to allow easy access of the plug and cables from the engine.

All wires associated with the Speed Controller have to be kept as short as possible and therefore the routing is important. The control system was connect up as defined in the Circuit Diagram using the cabling provided. Connections from the motors were left the length supplied and connected to the Speed Control via a 30A connector block as shown in photo 6.

The engine is also fitted with an aluminium

base plate on top of the chassis frames. I fixed location strips made from 1/4in. square mild steel to locate the four batteries, in-groups of two, leaving a space in the middle between the two groups of batteries. The reason for this will be explained in Part II, Engine and Tender Body Detail. Each battery group area has been covered in 0.060in. plastic sheet to reduce scratching of the battery bases as, because of the weights involved, these have to be removed for transportation. Holes were drilled in the plate to allow the wiring to be secured using tie wraps. Photograph 7 shows the above details.

When transporting, to make removal of the batteries easier, I made up some Faston lugs that are left permanently bolted to the batteries. Soldering the Fastons to the wires provides a positive connection and fitting them with boots ensures no battery short circuits can occur. Any short circuit will be very dangerous drawing 100s of amps from the battery and could cause a fire or burns. With care it is possible to ensure that each wire will only reach its designated connection.

Having fitted the power supply connector connecting the engine to the tender at this stage



Locomotive chassis (prior to fitting of 12v system).

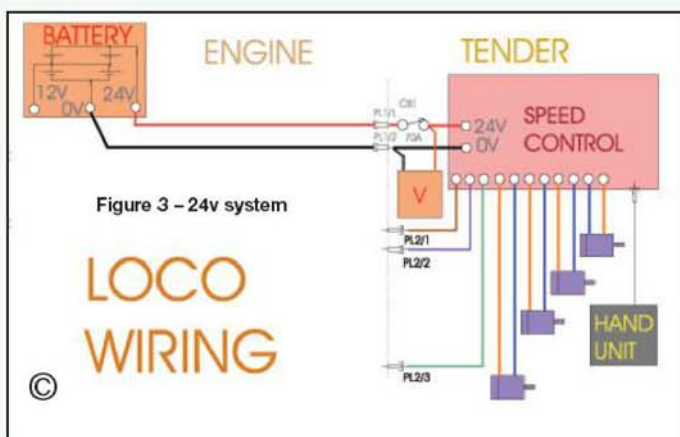


Figure 3 - 24v system

LOCO
WIRING

©

its time to plug the two parts together and find the nearest track for carrying out running tests, photo 8. After oiling the appropriate points I hitching on a driving trolley and switched on. What satisfaction and joy! However, initial testing of my kit showed that the springing of the tender required fine-tuning as the initial springs were too hard. After consultation with Robin, new sets of springs were fitted and further testing carried out to confirm the correct setting.

It is perfectly feasible at this point to skip all the modifications to the various parts and just paint the model, it's your choice. If, however, like me this is not enough then read on.

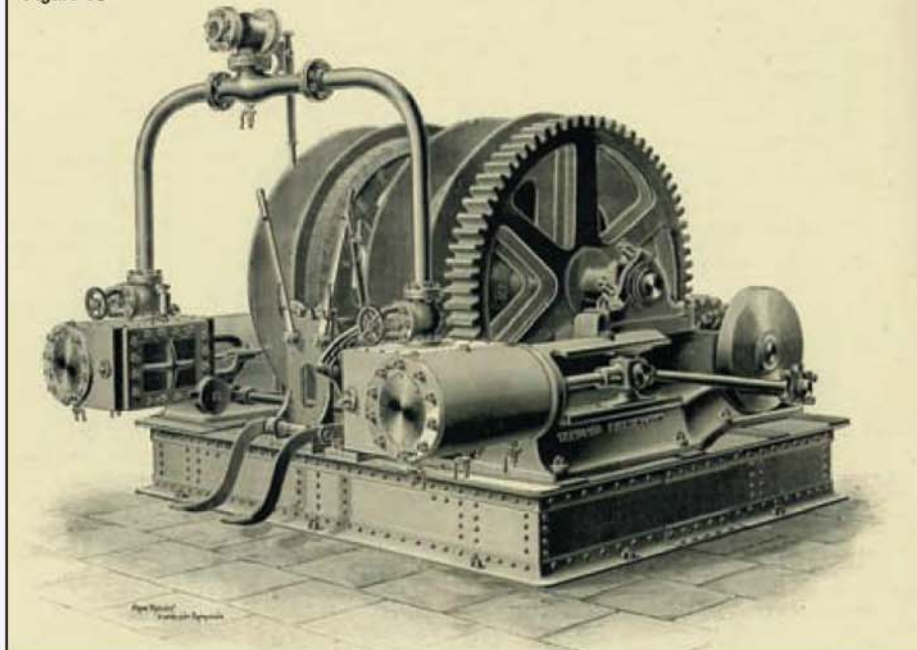
Note - All references to suppliers, documents etc. will be contained in Part III.

●To be continued.



Initial testing of the completed locomotive.

Figure 68



Another variation on the 'trunk guide' theme was this Coupled Hauling and Winding Engine on a wrought-iron frame base. For one-man operation with reversing and braking by hand and foot levers.

THE PRODUCTS OF TANGYES OF BIRMINGHAM 1891

David Piddington

concludes his look at the products of The Cornwall Works.

●Part VI continued from page 99

(M.E. 4278, 21 July 2006)

Returning to the theme of simple expansion engines these, apart from being attached to power plant boilers, were also used for special purposes such as this (fig 68) coupled hauling and winding engine. Single unit machines of similar pattern were also produced. The drums would take a considerable length of wire or hemp rope, for example the smallest engine with 6in. bore x 12in. stroke and a 30in. dia. drum would accept 800 yards of $\frac{1}{2}$ in. dia. wire rope. The 10 x 20in. size with 48in. drum would take 1150 yards of $\frac{3}{4}$ in. dia. rope. All controls were conveniently grouped for the operator, noting the foot pedals for the band brakes set on each drum. The main gear drove directly on to the main shaft, but the drums were loose being engaged by either of two clutches which were of substantial proportion. There were a number of variations on this theme with 'Trunk' or 'Girder' engines and with, or without, attached boilers. There were even portable units (fig 69) shown with a single-cylinder engine and boiler on a wheeled girder frame carriage.

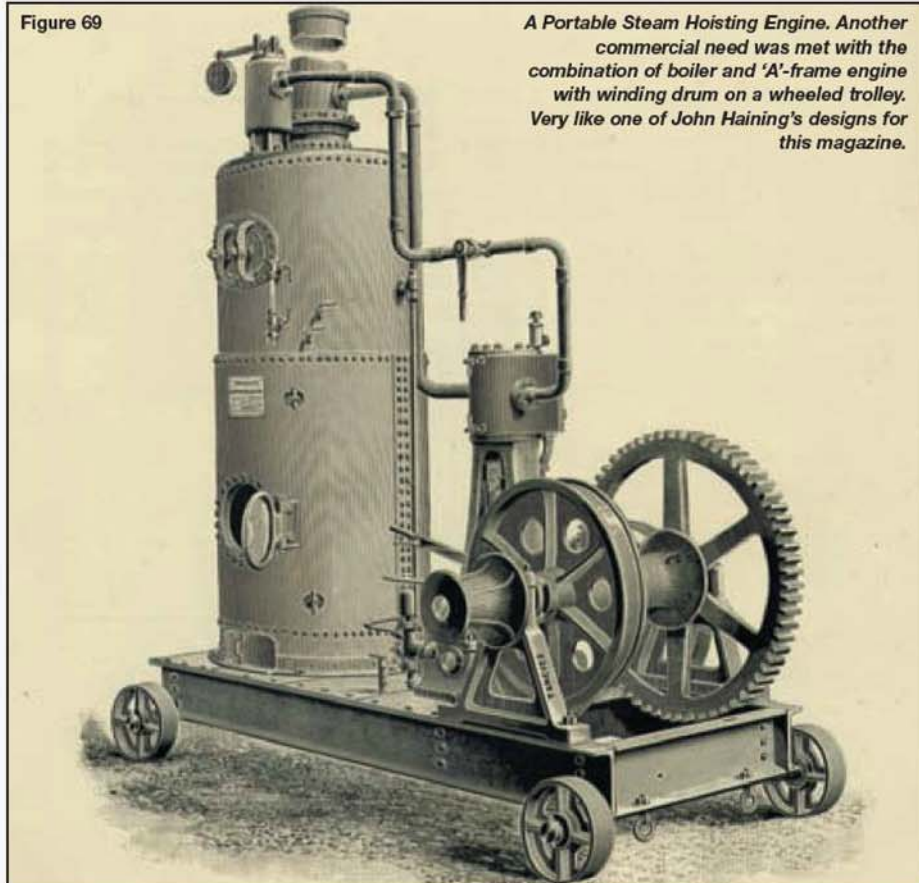
They also made a triple expansion engine (fig 70) but, apparently, only in one size according to the 1891 catalogue. It had cylinders of 8, $11\frac{1}{2}$ and $16\frac{1}{2}$ in. bores with an 18in. stroke. The

intermediate and high pressure cylinders were cast in one, the high-pressure cylinder was bolted on during assembly. All valves were of the slide type, those of the intermediate and low pressure being of the 'Trick' double-ported type. The HP cylinder was fitted with a 'Porter' governor and a sight feed lubrication system. Another 'modern' material is noted in the specification - 'plastic metal' lined the gunmetal crankshaft bearings, and connecting rod big and little end bearings. At 100rpm and a maximum of 160lb/sq.in. pressure this engine indicated 100hp, so its potential was considerable.

For a small factory where space was at a premium the steam engine could be fastened to a wall (fig 71) though the wall must have been considerably strengthened beforehand. This was, effectively, a twin-cylinder horizontal engine with a special baseplate adapted for wall mounting. It was available in three sizes, 4in. by 8in. stroke, 5in. by 10in. and 6in. by 12 inch. If you have a back number copy of *Engineering in Miniature* for June 1988 you may read an extended account of how this would make an interesting model.

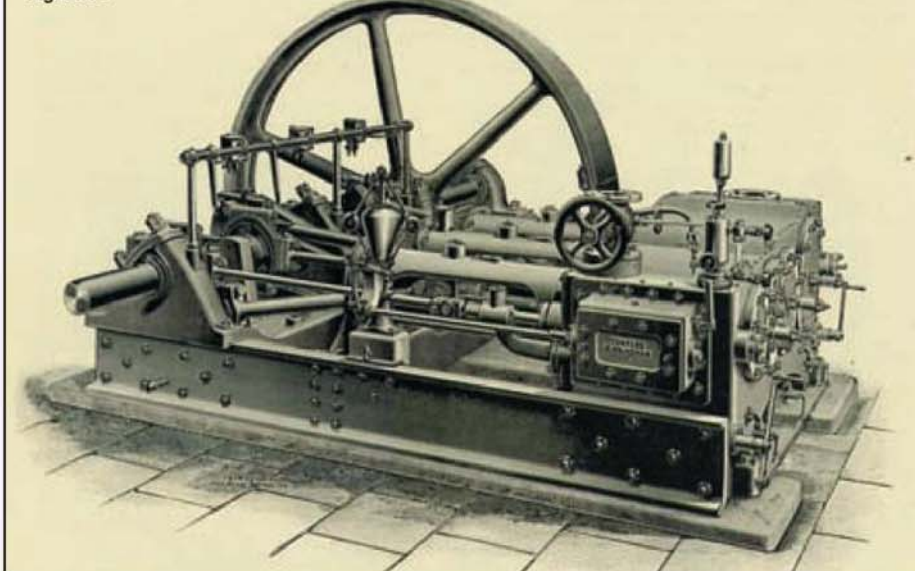
Remembering that at that time of over a century ago when Great Britain was the industrial powerhouse of the Empire, Tangyes were, with their numerous international branch offices, considerable exporters of engines, machinery, tools and equipment of which one of the best examples is this 'Colonial' engine, built in a number of sizes, readily transportable in pieces, and assembled on a far away site with minimum expertise, and operated by less well educated persons. I will conclude this series by

Figure 69



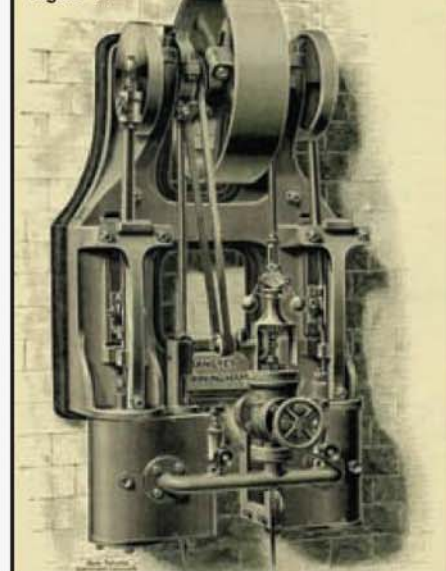
A Portable Steam Hoisting Engine. Another commercial need was met with the combination of boiler and 'A'-frame engine with winding drum on a wheeled trolley. Very like one of John Haining's designs for this magazine.

Figure 70



Tangye's Triple Expansion Engine made in only one size but could be supplied right, or left-handed, and with a flywheel at both sides for two separate power take offs.

Figure 71



Yet another Tangye product requiring a substantial brick or masonry wall.

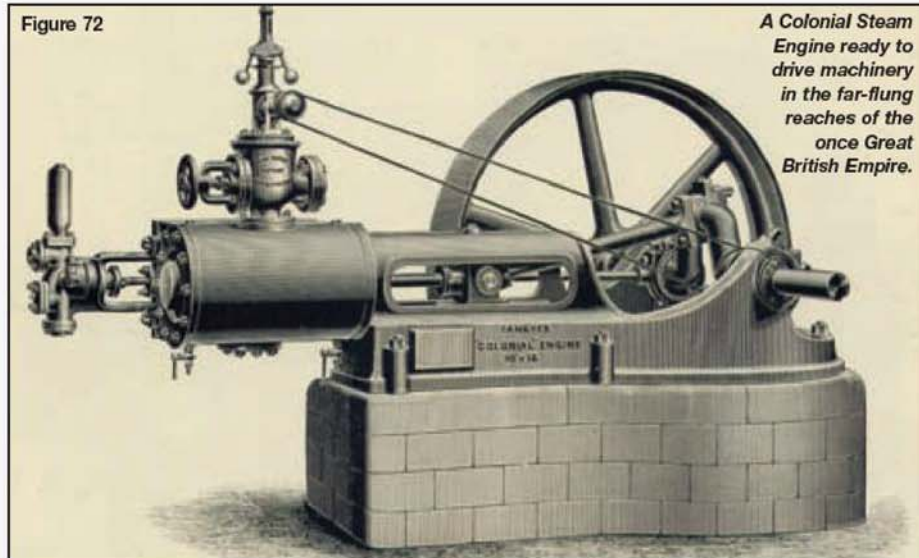
drawing for you a mental picture of a Tangye engine fig 72. coupled by a belt to a wood-burning semi-portable boiler chuffing away in the depths of a jungle powering a saw mill, or other machinery, all to the benefit of the once Great British Empire.

As postscripts may I add further contemporary information? I was at one time in contact with one Terry Paton, proprietor of a potential Tangye museum in Queensland, Australia. He told me that many Tangye items still exist out there and I had one cheerful letter from him after he had acquired one of the lathes described in fig 36 (M.E. 4274, 26 May 2006). I have heard nothing of this project for some years and perhaps we have a reader who can tell us more?

It is believed that the Birmingham Museums authorities may still have many Tangye records in their possession, though just what is there is uncertain at this time. Perhaps all that is needed is an archivist and the money to pay such a person.

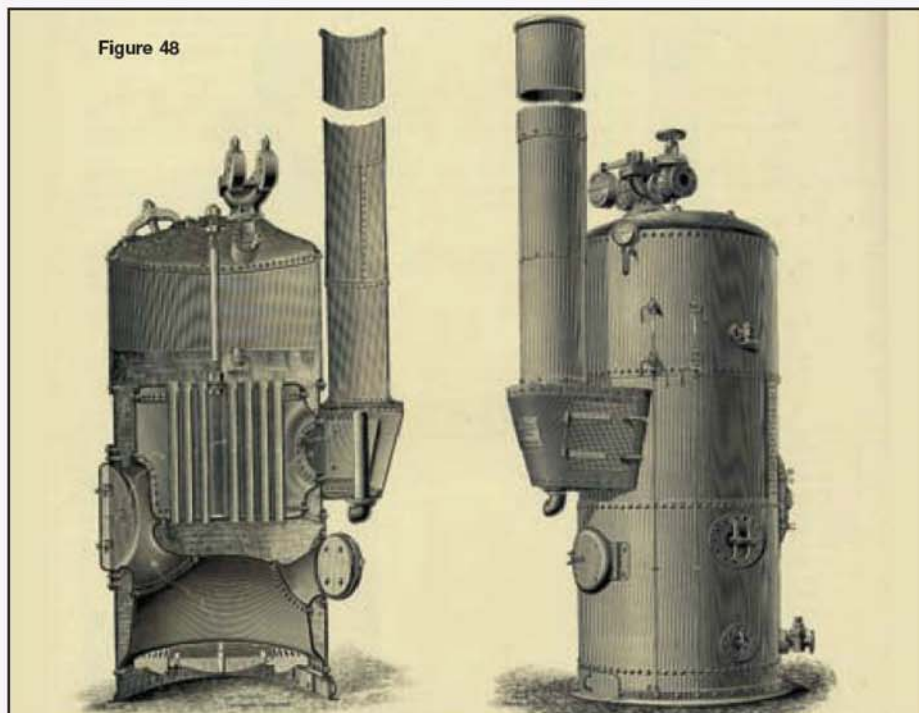
Copies of Tangye 1891 catalogues may be obtained on CD-ROM from Phoenix Publications, PO Box 228, Wroxham, Norfolk NR12 8WY, or on Internet at www.phoenixbooks.org I was half way through re-typing this manuscript when I thought of looking for 'Tangye' on the Internet and with some dismay, discovered that Phoenix were actually selling a CD-ROM of the Tangye 1891 catalogues. Knowing that I might have difficulty in proving that my source of photographs was not from their CD-ROM, I contacted Phoenix and explained the situation. Mr. Richard Adamek, owner, has given me every encouragement to proceed with my articles for which I thank him most sincerely. He also put me in touch with Allspeeds Ltd. to whom I gave due acknowledgement at the start of this series.

Figure 72



A Colonial Steam Engine ready to drive machinery in the far-flung reaches of the once Great British Empire.

Figure 48



Due to an unfortunate error, Figure 48, reproduced right, did not appear in Part IV (M.E. 4276, 23 June 2006) The correct caption is below and can now be read in conjunction with that for Figure 49 in the same issue. Apologies to the author, and readers, for the slip.

An interesting project for the amateur boilermaker? A Vertical Multi-Tubular which has water tubes as distinct from the more usual fire tubes.

CLUB CHAT

With Malcolm Stride

We wish Roy success in his new role. Roy can also be reached on e-mail at

rsgwatford@aol.com

UK News

Work continues on the new facilities at Ascot Locomotive Society but has been slower than planned, not least due to the need to provide toilet facilities after the existing facilities provided by the landlords had been condemned by health and safety.

The newsletter of the Fylde SME has the open day dates of the Northern Mill Engine Society in the newsletter. The collection (described as the finest working collection in the UK) is at Atlas Mill, Bolton, Lancashire, and will be open on 27/28 August and 10 September.

Harrow and Wembley SME is holding an open weekend and exhibition on Sunday/Monday 27/28 August to celebrate its 70th anniversary. Further information can be found on the society website at www.hwsme.org.uk or by contacting Brian Tilbury on 020-8248-0442 or Tony Smith at acasmith@dsl.pipex.com. The society has a new secretary in the person of Roy Goddard, 15 Dickinson Avenue, Croxley Green, Rickmansworth, Herts WD3 3EU.

Peter Reynolds of the Ickenham DSME has published details of a useful (and free) research facility for those interested in railways. The facility is the 'Railway Studies Collection' and it is located above Newton Abbot Library, Market Street, Newton Abbot, Devon TQ12 2RJ (tel: 01626-206422). The collection deals with queries by post or by e-mail at Railway.Library@devon.gov.uk. David Sexton recounts the story of a trip to the Forth Bridge in Scotland to see the work involved in maintaining and painting the famous structure. The bridge is now being covered with a special two-pack coating which should last 20 years, so the painting activities will pause for a while.

The Isle of Wight MES has found its site on the photographic map published on the Internet by Google (www.earth.google.com) and can even see a hose across the track in the photograph; such is the level of detail of the satellite photographs used. Other clubs might like to have a look for their own sites but the resolution used depends on the area

you are in. I have found that rural areas are generally at a much lower resolution than urban areas.

Some members of Malden DMES visited Young's Brewery in Wandsworth to sample their products and to see the beam engine. The newsletter Editor is hoping for a report and pictures of the trip "if they can remember what happened!" Several junior members are taking a very active part in club activities and have been involved in selling ice creams, concrete mixing and earth moving and even getting into the workshop to work on locomotives. At the AGM, Junior member Emma Rose was awarded the C. J. Locke Challenge Cup for her efforts for the club, the Annual Award Shield was awarded to Ian Tiplady for his efforts working on the tracks. The Francis W. Bontor Cup went to a group, Bob Walker, Ken Spratt and Stuart Walker for their efforts in completing and commissioning the new Class 47 club locomotive. The Harry James Cup for engineering excellence was awarded to Bert Woodford for the work on his new steam locomotive. Congratulations to all the award winners.

Members of the National 2 1/2in. Gauge Association were entertained by Bob Symes recently

and learnt a great deal about his very interesting and eventful life. Many readers will know of Bob's modelling activities, not least from his television programmes some years ago, but many will not know that he is of Austrian/Scots ancestry and had a bilingual upbringing. Members were also treated to stories about the construction of garden railways "where excavation seemed to owe more to knowledge gained during war service rather than use of a JCB. Several neighbours had to replace broken glass." Several new association locomotive projects are moving forward including some progress on the drawings Lynton and Barnstaple Lew, full size plans for Annie Boddie and drawings for an LMS Crab.

The Northern Association of Model Engineers has decided to put the newsletter on the website at www.normodeng.org.uk to make the content available to a wider audience. A story about Eurostar drivers appears in the latest printed issue; apparently Eurostar drivers are trained to speak French and English in order to be able to converse with controllers and other railway staff. One English driver spotted a large stag close to the line and not knowing the French word for "Stag" reported in his limited

CLUB DIARY

A minimum of 6 weeks notice is required for diary entries. Clubs and Societies are asked to include a telephone number for the assistance of would-be visitors.

AUGUST

- 18 Canvey R&MEC. Meeting. Contact Brian Baker: 01702-512752.
- 18 North London SME. Loco Section Barbecue. Contact David Harris: 01707-326518.
- 18 Rochdale SMEE. Video Night. Contact Mike Foster: 01706-360849.
- 18 Romford MEC. Track Maintenance. Contact Colin Hunt: 01708-709302.
- 18-20 Bristol MES Show, Thornbury, Nr. Bristol. Contact 0117 967 5878.
- www.bristolmodelengineers.co.uk
- 19/20 Basingstoke DMES. Gala Weekend. Contact Guy Harding: 01256-844861.
- 19 Canvey R&MEC. Members' Running Day. Contact Brian Baker: 01702-512752.
- 19 Chesterfield MES. Public Running Day. Contact Mike Rhodes: 01623-648676.
- 19 National 2 1/2in. Gauge Ass'n. Northern Area Autumn Rally. Contact Clive Young: 01233-626455.
- 19/20 Nottingham SMEE. Miniature/Model Rail Event. Contact Graham Davenport: 0115-8496703.
- 19 Romford MEC. Trackside Afternoon. Contact Colin Hunt: 01708-709302.
- 20 Birmingham SME. Simply Trains Day. Contact John Walker: 01789-266065.
- 20 Bournemouth DSME. Charity Day. Contact Dave Fynn: 01202-474599.
- 20 Frimley & Ascot LC. Club Running. Contact Bob Dowman: 01252-835042.
- 20 Guildford MES. Public Running. Contact Dave Longhurst: 01428-605424.
- 20 Leicester SME. Club Competition Day. Contact Raymond Wallis: 0116-285-8824.
- 20 Plymouth MSLS. Public Running. Contact John Brooker: 01752-671722.
- 20 Rugby MES. Public Running. Contact David Eadon: 01788-576956.
- 20 Saffron Walden DSME. Running Day (public running after 2pm). Contact Jack Setterfield: 01843-596822.
- 20 Guild of Model Wheelwrights. Mid-Somerset Show, Shepton Mallett. Contact Biddy Hepper: 01492-623274.
- 21 Model Steam Road Vehicle Soc. Vintage Motorcycles. Contact Geoff Miles: 01869-247602.
- 21 Peterborough SME. Barbecue & Drive-a-Loco Evening. Contact Ted Smith: 01775-640719.
- 22 Hornsby ME. Social Night. Contact Ted Gray: 9484-7583.
- 24 Sutton MEC. Busy Night. Contact Bob Wood: 0208-641-6258.
- 24 Worthing DSME. John Rea: Workshop Ideas. Contact Bob Phillips: 01903-243018.

- 25 Hereford SME. Meeting. Contact Nigel Linwood: 01432-270867.
- 26 Bedford MES. Club Running Day. Contact Ted Jolliffe: 01234-327791.
- 26-28 Harrow & Wembley SME. Open Weekend. Contact Roy Goddard: e-mail RSGwatford@aol.com
- 26 Hornsby ME. Family Day & Boiler Inspection. Contact Ted Gray: 9484-7583.
- 26-28 Tyneside SMEE. Annual MEA. Contact Malcolm Halliday: 0191-2624141.
- 27 Amnerfield Miniature Railway. Public Running. Contact David Jerome: 0118-9700274.
- 27/28 Bedford MES. Bank Holiday Running. Contact Ted Jolliffe: 01234-327791.
- 27/28 Bristol SMEE. Public Running. Contact Trevor Chambers: 01494-438761.
- 27 Cambridge MES. Members' Steam-Up. Fulbrook Road. Contact Rex Mountfield: 01284-386128.
- 27/28 Cardiff MES. Summer Bank Holiday Open Days. Contact Don Norman: 01656-784530.
- 27/28 Claymills Pumping Engines. Open Days. Contact B. Eastough: 01283-812501.
- 27 Edinburgh SME. Track Running Day Steam & Diesel. Contact Robert McLucke: 01506-655270.
- 27 Guildford MES. Members' Running Day. Contact Dave Longhurst: 01428-605424.
- 27 Hereford SME. Public Running. Contact Nigel Linwood: 01432-270867.
- 27 High Wycombe MEC. Public Running. Contact Eric Stevens: 01494-438761.
- 27/28 Malden DMES. Public Running. Contact John Mottram: 01483-473786.
- 27/28 Northern Mill Engine Society. Open Days. Contact John Phillips: 01257-265003.
- 27/28 Nottingham SMEE. Public Running. Contact Gerry Chester: 0115-9259096.
- 27/28 Papplewick Pumping Station. Steaming Days. Enquiries: 0115-963-2938.
- 27/28 Romney, Hythe & Dymchurch Railway. Day of Syn Festival. Information: 01797-362353.
- 27 Staines SME. Public Running. Contact Stan Bishop: 01784-241891.
- 27 Taunton ME. Public Running. Contact Don Martin: 01460-63162.
- 27 Worthing DSME. Public Running. Contact Bob Phillips: 01903-243018.
- 27 York City & DSME. Running Day. Contact Pat Martindale: 01262-676291.
- 28 Frimley & Ascot LC. Public Running. Contact Bob Dowman: 01252-835042.
- 28 North London SME. Members' Running Day. Contact David Harris: 01707-326518.
- 28 Portsmouth MES. Charity Day, Blind Association. Contact John Warren: 023-9259-5354.

In Memoriam

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

French that he had seen "a cow with a pantograph".

Hernia, the Plymouth Miniature Steam club locomotive had a narrow escape recently when following a distinctly off beat sound when running, it was withdrawn and on investigation it was found that one valve was loose on its spindle due to the locking screws having dropped out. One screw was found at the end of the valve chest and the other was lodged in the valve port. As the Editor commented; "Very lucky there!" Both screws were retrieved and the valve reset by eye before the locomotive was back in service. I think that was an amazing escape from potentially an awful lot of work. The society has lost the use of the engineering facilities at the local college following the closure of the workshops. This is yet another loss to engineering education facilities in the UK. Coincidentally I was reading in the paper this morning that James Dyson (of Dyson vacuum cleaners fame) is setting up an engineering education academy to compensate for the lack of skills being taught in the country.

Does anyone else find this situation difficult to understand? Under the heading "Strange Facts",

the newsletter contained the following:

"According to a popular internet search engine, there are some 12,200,000 websites dealing with Railways. If a team of ten people got together and each of them devoted five minutes to each site, in a 50-hour week they would be able to look at some 4,800 sites. If they pursued this continuously, allowing a couple of weeks holiday per year (if they did not go insane first), they would get through about 240,000 each year. The whole task would occupy them for over 50 years. Given these figures and the fact that the internet in its present form, is barely 10 years-old, how many people are there out there doing nothing but write about railways?"

Alan Davidson, writing in *Prospectus* the Reading SME newsletter, has chosen to comment on Brunel's atmospheric railway experiments in recognition of the 200th anniversary of the great man's birth. One of Alan's observations is that the vacuum pipeline which drove the trains had a longitudinal slit sealed by a leather flap. This slit was lubricated by a mixture of "beeswax and tallow which was loved by the rats

that also nibbled the leather flaps. Later a new mixture containing cod liver oil and soap was tried without much improvement." I am not sure what the new mixture did to the rat's digestive systems, all those who were fed cod liver oil at school when they were young will probably understand. Alan also points out that a section of Brunel's broad gauge track with a 22in. atmospheric pipe can be viewed at the Great Western Society at Didcot. There is also a 5in. gauge working model of an atmospheric train running on 100 yards of track at Merton in North Devon.

The St. Albans DMES model show is to be held this year at the Francis Bacon School, Drakes Drive, St. Albans on the 30 September and 1 October and will feature all aspects of model engineering activity including a Meccano exhibition presented by the West London Meccano Society. The show will be open from 10am until 5pm each day.

Following a lot of hard work by the members, Taunton Model Engineers are to be congratulated on the formal opening of the new railway at Creech which took place earlier this year. The new carriage

shed has been named "The Hartnell Carriage Shed" in recognition of the contribution to the club by the late Gordon Hartnell. Mrs. Hartnell unveiled the commemorative plaque in the company of other family members. The society held another successful exhibition this year and made use of a computer database of models in order to ensure that the exhibition is "fresh" each year.

Gary Cooper from Tyneside SMEE cut a new lead screw for his Myford lathe using an ingenious method. A suitable length of steel was held in the tool post of his Harrison lathe with the free end supported by two rollers on the face plate. A woodruff cutter was also mounted on the faceplate and with the lathe running in reverse the lead screw was screw cut drawing the length of bar through the head stock.

World News

South Africa

Errol Koch gave his Avonside Cane locomotive its maiden run at the open day and even had a drive himself towards the end of the day. Other locomotives included two SAR class 15Fs, a *Butch* and a *Scot*. Work carried out includes the main traverser and bypass line ready for trial erection and the clearing and infilling of parking areas.

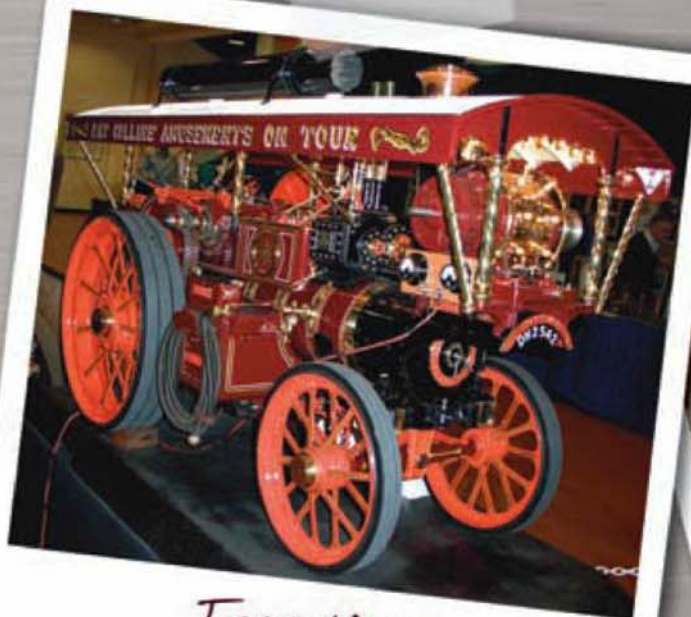
- 28 Stockholes Farm MR. Bank Holiday Running. Contact Ivan Smith: 01427-872723.
 - 28 Surrey SME. Public Running. Contact John Cook: 020-8397-3932.
 - 29 Basingstoke DMES. Meeting. Contact Guy Harding: 01256-844861.
 - 30 Hull DSME. Members' Current Projects. Contact Tony Finn: 01482-898434.
 - 31 Leyland SME. Horological Evening. Contact A. P. Bibby: 01254-812049.
 - 31 Sutton MEC. Evening Steam-Up. Contact Bob Wood: 0208-641-6258.
- SEPTEMBER**
- 1 Aylesbury (Vale of) MES. Track Night. Contact Andy Rapley: 01296-420750.
 - 1-3 Bedford MES. Rally Weekend. Contact Ted Jolliffe: 01234-327791.
 - 1 Canvey R&MEC. Seen on the Table 3. Contact Brian Baker: 01702-512752.
 - 1 Maidstone MES (UK). Evening Run and Fish 'n' Chips. Contact Martin Parham: 01622-630298.
 - 1 North London SME. Work in Progress. Contact David Harris: 01707-326518.
 - 1 North Norfolk MEC. Bits & Pieces. Contact Gordon Ford: 01263-512350.
 - 1 Portsmouth MES. Dave Parsons: Sterling Engines. Contact John Warren: 023-9259-5354.
 - 1 Rochdale SMEE. FAJ Collin: Building a Class 40. Contact Mike Foster: 01706-360849.
 - 1 Romford MEC. Competition Night. Contact Colin Hunt: 01708-709302.
 - 2 Cardiff MES. Steam-Up and Family Day. Contact Don Norman: 01656-784530.
 - 2/3 Chesterfield MES. Open Weekend. Contact Mike Rhodes: 01623-648676.
 - 2/3 Dockland & E. London MES. Public Running. Contact P. M. Jonas: 01708-228510.
 - 2 High Wycombe MEC. Family Day. Contact Eric Stevens: 01494-438761.
 - 2 Ickenham DSME. Public Running. Contact David Sexton: 01895-630125.
 - 2 Isle of Wight MES. Track & Pond. Contact Malcolm Hollyman: 01983-564568.
 - 2 Malden DSME. Families Day. Contact John Mottram: 01483-473786.
 - 2 New Jersey Live Steamers, Inc. Work Day. Contact Karl Pickles: 718-494-7263.
 - 2/3 Romney, Hythe & Dymchurch Railway. A Day Out With Thomas. Information: 01797-362353.
 - 2 SM&EE. Gordon Hatherill & Peter Trinder: An Intro. to Gauge 1 Modelling. Contact David Boote: 01202-745862.
 - 2 South Lakeland MES. Open Day and 10th Anniversary Celebration. Contact Adrian Dixon: 01229-869915.
 - 2 Sunderland (City of) MES. Meeting. Contact Albert Stephenson: 01429-299649.
 - 2/3 Tyneside SMEE. Autumn Rally. Contact Malcolm Halliday: 0191-2624141.
 - 2/3 Guild of Model Wheelwrights. Chatsworth Country Fair, Bakewell, Derbyshire. Contact Biddy Hepper: 01492-623274.
 - 2 York City & DSME. Summer Meeting. Contact Pat Martindale: 01262-676291.
 - 3 Ellenroad Engine House. Rochdale Photographic Society & Display of Vintage Cameras. Enquiries: 01706-881952.
 - 3 Frimley & Ascot LC. Public Running. Contact Bob Dowman: 01252-835042.
 - 3 Guildford MES. Members' Running Day. Contact Dave Longhurst: 01428-605424.

- 3 Malden DSME. Public Running. Contact John Mottram: 01483-473786.
- 3 Northampton SME. Public Running. Contact Pete Jaman: 01234-708501 (eve).
- 3 Nottingham SMEE. Public Running. Contact Gerry Chester: 0115-9259096.
- 3 Pinewood MRS. Members' Steam-Up. Contact Ivan Hurst: 01252-510340.
- 3 Plymouth MSLS. Public Running. Contact John Brooker: 01752-671722.
- 3 Rugeley Power Station MES. Annual Open Day. Contact Derek Moore: 01543-490023.
- 3 Sunderland (City of) MES. LBSC Memorial Bowl Competition. Contact Albert Stephenson: 01429-299649.
- 4 New Jersey Live Steamers, Inc. Labor Day Run. Contact Karl Pickles: 718-494-7263.
- 4 Peterborough SME. Bits & Pieces. Contact Ted Smith: 01775-640719.
- 5 Stamford MES. Talk: Traction Engine Construction. Contact Derek Brown: 01780-753162.
- 5 Taunton ME. Brains Trust. Contact Don Martin: 01460-63162.
- 6 Bradford MES. Meeting. Contact John Mills: 01943-467844.
- 6 Bristol SMEE. John Burgoyne: Building a Scale Model Monitor Agricultural Engine. Contact Trevor Chambers: 0145-441-5085.
- 6 Leeds SMEE. Meeting. Contact Colin Abrey: 01132-649630.
- 6 West Wiltshire SME. Steam-Up. Contact R. Nev. Boulton: 01380-828101.
- 7 South Lakeland MES. Meeting. Contact Adrian Dixon: 01229-869915.
- 7 Sutton MEC. Bits & Pieces. Contact Bob Wood: 0208-641-6258.
- 9/10 Birmingham SME. 17th National Locomotive Rally. Contact John Walker: 01789-266-065.
- 9/10 Isle of Wight MES. Bi-Annual Exhibition with Steam Boats at Riverside. Contact Malcolm Hollyman: 01983-564568.
- 9/10 Leighton Buzzard NG Rly. Steam-Up Weekend. Enquiries: 01525-373888.
- 9 Leyland SME. Running in the Dark plus Fish & Chip Supper. Contact A. P. Bibby: 01254-812049.
- 9 Sunderland (City of) MES. Meeting. Contact Albert Stephenson: 01429-299649.
- 10 Bristol SMEE. Public Running. Contact Trevor Chambers: 0145-441-5085.
- 10 Cambridge MES. Public Running. Fulbrook Road. Contact Rex Mountfield: 01284-386128.
- 10 Canterbury DMES (UK). Public Running. Contact Mrs P. Barker: 01227-273357.
- 10 Edinburgh SME. Track Running Day Steam & Diesel. Contact Robert McLucke: 01506-655270.
- 10 Guildford MES. Driver Training. Contact Dave Longhurst: 01428-605424.
- 10 Harrington LS. Exhibition Day. Contact Peter Tarrant: 01895-851168.
- 10 High Wycombe MEC. Club Running afternoon. Contact Eric Stevens: 01494-438761.
- 10 Hornsby ME. Running Day. Contact Ted Gray: 9484-7583.
- 10 Leeds SMEE. Running Day. Contact Colin Abrey: 01132-649630.
- 10 Northern Mill Engine Society. Open Day. Contact John Phillip: 01257-265003.
- 10 Nottingham SMEE. Public Running. Contact Gerry Chester: 0115-9259096.
- 10 Plymouth MSLS. Members' Running Day. Contact John Brooker: 01752-671722.

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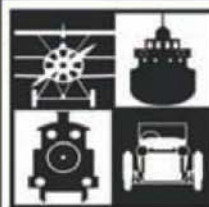
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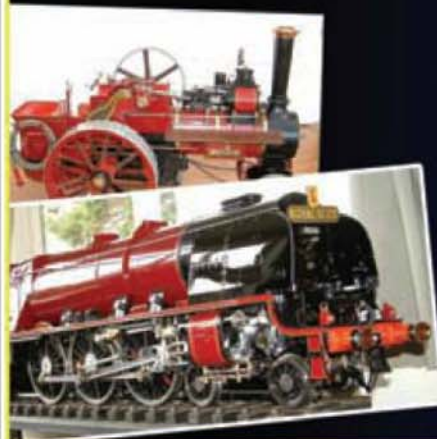
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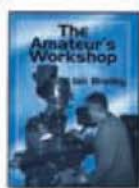
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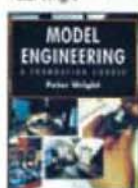
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