

MODEL ENGINEER

Vol. 190 No. 4198

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This fascinating series draws to its
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Boiler fittings continue with clack and
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aerosol cans newly introduced by
Phoenix Precision Paints.
PAGE 735

BOLT END TRIMMER TOOL

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guarantees a neat and uniform appearance
to threaded fasteners.
PAGE 736

IMLEC 2003 at BRISTOL

Arrangements at Ashton Court Miniature
Railway for 12/13 July when the event will
be hosted by members of Bristol SMEE.
PAGE 737

ROAD STEAM: SAVAGE'S LITTLE SAMSON in 3in., 4in. (and other) Scales

Another look at the grate and ashpan
prompts a few words on maintenance
before dealing with backhead fittings.
Part XXXVIII.
PAGE 738



On the cover ...

All ready for the off and the last run of the
contest hosted 6/7 July 2002 by members
of Leeds SMEE at their Eggborough track
in North Yorkshire, Geoff Moore pauses
for your Editor's camera at the controls of
his superb Sin. gauge LNER B1 4-6-0
No. 8303 Impala with a gang of fellow
Guildford MES supporters to provide
his load, and John Hunt to keep an eye
on the instrumentation.
Geoff built his model with reference to
drawings of the full size locomotive and
tender and was awarded a Gold Medal
and the Crebbin Memorial Trophy at the
2000 Model Engineer Exhibition.
Our report begins on page 718 in this
issue and details the events of a most
enjoyable weekend in which nineteen
drivers competed for the coveted
Martin Evans Challenge Cup.

(Photograph by Mike Chrisp)

REPLICA 18th CENTURY HOODED WALL CLOCK

Depthing the wheel work, laying out the
escapement and making the pallets for
this attractive and unusual clock. Part IV.
PAGE 742

EUROPEAN CANALS, SHIPLIFTS AND LOCKS

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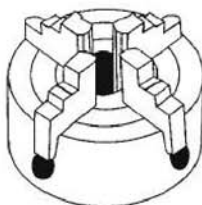
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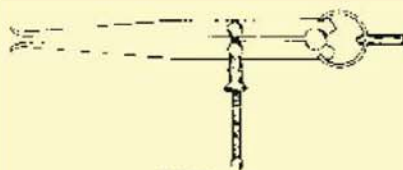
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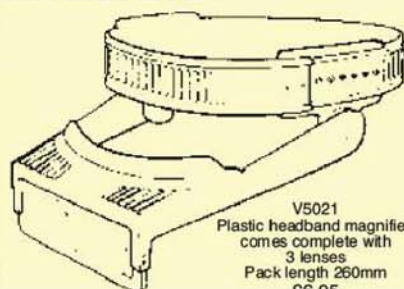
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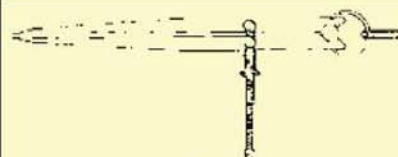
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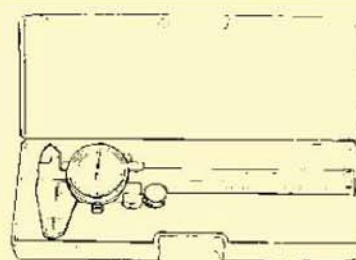
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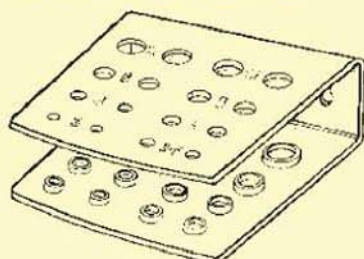
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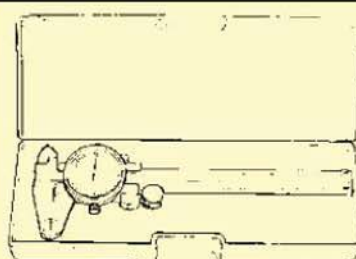


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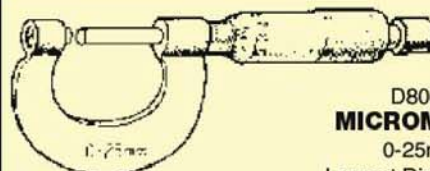
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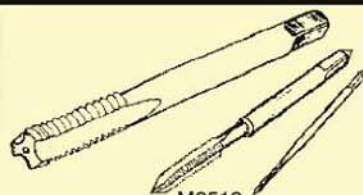
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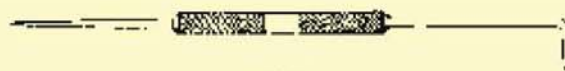


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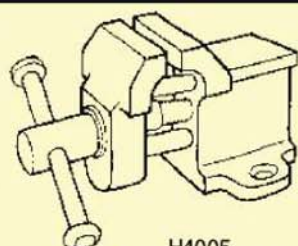
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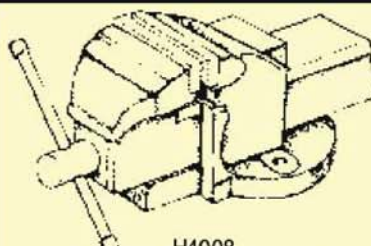


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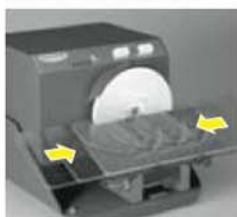
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5" 0-6-0 Boxhill Tank Loco
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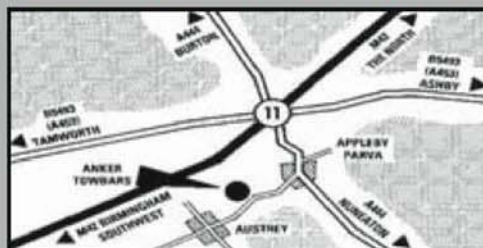
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SMOKE RINGS

With the Editors

Thanks Stan!

Readers will recall that not long ago in this column (*M.E.* 4181, 21 March 2003) we announced Stan Bray's wish to step down from his role as Club News Editor for this magazine. We took the opportunity to invite applications from readers interested in taking on the work.

This issue sees the last of Stan's contributions as Club News Editor and on page 752 he has prepared a brief resumé of his work with this and other magazines. It is recorded that the late Lawrie Lawrence and Stan Bray took over as Editor and Associate Editor of *Model Engineer* from the issue cover dated 3 August 1979 (*M.E.* 3614). A few weeks later, in the issue for 21 September, Laurie introduced himself and Stan, looked back briefly at the early years of the magazine with particular emphasis on club activities, and set out their aims and objectives for the future. Although very nearly 24 years have passed since Lawrie wrote his preamble, and some still express concern for the future of this most satisfying of hobbies, little seems to have changed.

The year 1979 also saw the launch of *Engineering in Miniature* for which Stan was the first Editor and in the very first issue, published in April, he discussed his own aspirations for the future of the then new magazine and the hobby.

Since joining *Model Engineer*, Stan has been a constant and indomitable member of a team which has waxed and waned over the years during which times have inevitably changed, as have editorial staff, readers, and perhaps most significantly, owners and publishers. We have had our problems, some quite beyond editorial control and which remain to be resolved, but thanks to all our illustrious and knowledgeable contributors and the general encouragement which we now receive from so many readers, we continue in good heart. That said, we have no illusions and are constantly endeavouring to 'improve the product' if such jargon is permissible in this column! Contributions from readers are always welcome, particularly when they concern present and future developments in matters in which we believe most readers will be interested.

Stan proposes to continue his involvement with *Model Engineer* by contributing short articles and small projects which we are sure will meet with approval from his many friends and followers who have enjoyed his writings for nearly a quarter of a century. We record here our appreciation of his efforts on our behalf, wish Stan a long, enjoyable and productive retirement from the pressures of a fortnightly publication schedule and hope that he and Dot will now be able to spend much more time together and with their family.

Calling Mr. R. J. Henville

We recently received a letter from Ken Surrey in Berkshire who wished to contact Mr. Henville about his harmonic motion device, an account of which, together with copies of some of the patterns it produced, was published in *M.E.* 4104, 8 October 1999. At the end of his short article Mr. Henville sought readers' advice on several matters concerning the device.

If Mr. Henville cares to get in touch, we would be pleased to introduce him to Mr. Surrey.

The International Model Locomotive Efficiency Competition

Readers will note that this issue is concerned rather more than usual with steam locomotives both large and small. We hope that those with minimal interest in this particular topic will not begrudge the steam boys their special issue!

We much regret the delayed publication of the report on IMLEC 2002 which was held at the Eggborough track of Leeds SMEE last July. After some considerable delay, the contributor who originally agreed to detail the runs eventually declined to prepare the necessary material. Aware that last year's results had to be published before this year's contest took place, we have taken the opportunity to 'preview' the event to be held at the Ashton Court Miniature Railway of Bristol SMEE 12/13 July next with details of the competition at Leeds. This latter has been assembled from information provided by the owners and drivers and from my own notes, fortunately made as the weekend proceeded. Under the circumstances, we hope that those who know better will forgive any errors and/or omissions and perhaps let us know if anything serious has slipped through.

Concerning this year's competition, most of the arrangements for IMLEC 2003 are now in place and we can look forward to a most enjoyable weekend in Bristol. Our thanks are due to Don Cordall and his team of BSME stalwarts who have already done so much to prepare for this important event in the model engineering calendar. Some competitors in the past have admitted that they're not too bothered about winning but they most certainly enjoy being the centre of attention for half an hour of continuous running during which they can haul the load of their choice with unrestricted access to a clear track in good condition!

Others, of course, have been intent on demonstrating the efficiency of their miniature



The magnificent Martin Evans Challenge Cup for which IMLEC contestants compete each year.

locomotives and their own effectiveness as drivers. At the time of writing, we understand that there is still room in the schedule for a few more entries. If you would like to 'have a go' even at this late stage, please contact Don Cordall on 0117-962-4073 (e-mail: doncordall@blueyonder.co.uk) and he will do his best to accommodate you. Please note that all applications will be considered.

We look forward to an excellent weekend among friends at their Ashton Court Miniature Railway, hosted by members of Bristol SMEE 12/13 July next. See you there!

Cheltenham SME 65th Anniversary

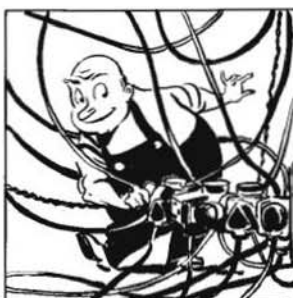
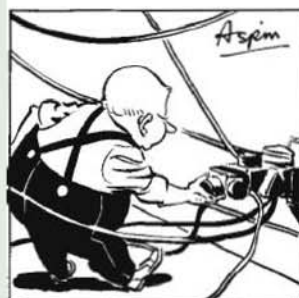
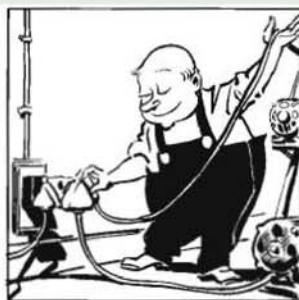
Readers are reminded that this coming weekend 28/29 June will find members of Cheltenham SME combining with Cancer Research UK at their Hatherley Lane site to celebrate the 65th Anniversary of the founding of their society.

Organiser Graham Gardner says "Everyone is welcome to join us for this running weekend with locomotives, traction engines, stationary engines, a model tent, catering and many other attractions."

Please note that for once, visiting locomotives are not required — just come and enjoy a day out!

CHUCK the MUDDLE ENGINEER

by B. TERRY ASPIN



POST BAG

Ultimate efficiency

SIRS, - On reading Mr. John Olsen's very interesting account of water-saving locks in *M.E.* 4192, 4 April 2003, it suddenly struck me that the water-saving lock with an ever-increasing number of reservoirs provides a wonderful concrete (no pun intended) example of the concept of reversibility so beloved of thermodynamicians. A theoretically most efficient thermodynamic process, like expansion of steam in a cylinder, must be reversible. This implies that if the steam expands and pushes the piston a little, the same little push back on the piston restores all the energy that the steam lost in pushing the piston. (It is assumed that no heat is lost from the steam through the cylinder walls or the piston.) A corollary of this is that the steam must always be in equilibrium within the steam space, i.e. in no part of the space must the pressure be higher or lower, even momentarily, than anywhere else. The final outcome of this is that the piston must move, or be moved, infinitely slowly.

Going back to the water-saving lock example, as the number of reservoirs increases one can get closer and closer to achieving the ultimate in efficiency, i.e. never needing to top up the water needed for operating the lock. As well, as the available head of water from each reservoir gets less and less, the process of filling or emptying the lock gets longer and longer, as Mr. Olsen points out. The equilibrium condition that is approached is that as the number of reservoirs rises the difference in water levels between each reservoir and the level in the lock while this particular reservoir is being filled approaches nil. In tandem, the outside pumping energy needed to operate the lock also approaches nil.

John Bauer, Ontario, Canada.

Kennedy hacksaw machines

SIRS, - Owners of Kennedy 60 and 90 hacksaw machines may be interested in the source of spares for these machines since Charles Taylor ceased production.

Jaco Sumal are a small engineering firm which took over the rights to the machine and the existing spares and some castings. They are prepared to supply these while stocks last and were most helpful when I needed parts for my ancient machine.

I understand that they are currently looking into the

possibilities of producing a new small hacksaw machine. Jaco Sumal may be contacted at 8 Edwards Road, Erdington, Birmingham, B24 9EP; tel: 0121-373-6988.

Iain Leitch, Middlesex.

Hints, tips and alcohol

SIRS, - Having been a regular reader of *Model Engineer* since the early 1950s and occasionally before that, two recent issues have carried letters which I have found to be of particular interest.

First, regarding Mr. Heppenstall's special tools (*M.E.* 4193, 18 April 2003), I too have made a small 'shovel' for swarf except that I used sheet light alloy. However, I find that the greatest use mine gets is for catching small parts as they are parted off. If made a suitable size, it can be held under the chuck so that the part falls into it. This saves a lot of time in not having to search for a possibly hot little component in a mass of dirty, sharp swarf.

Although I have used a brush for cutting oil as Mr. Heppenstall suggests, I now find that one of the pump oil cans with a flexible spout is much more useful, particularly when drilling in the lathe. These are so cheap nowadays that they are well worth the small outlay.

While on the subject of small tools I do not recall having seen a mention of the usefulness of a small, accurate spirit level when setting work in a machine vice or on an angle plate or similar situation. I have a small Starret metal cased spirit level about 2in. long which can save a tremendous amount of time, provided of course, that the machine itself is level.

In the same issue I am reminded of the series on the Gnome engine. My particular interest in this engine is because I have recently rebuilt and fabricated the missing valve gear for an original engine at the Fleet Air Arm Museum. This engine is now fitted to an aircraft and is on display.

The other letter on which I would like to comment was published in *M.E.* 4194, 2 May 2003, in which Mr. Gascoyne appeals for information about the items shown in his photograph. These appear to be some weights from a Sykes Hydrometer. This instrument is used largely by Customs and Excise to determine the specific gravity of spirits and thus their alcoholic value. I include a photograph of my own instrument. Although there is a slight difference



in style the principle is evident. It will be seen that the numbers refer to the serial number of the instrument and have been repeated on the actual hydrometer. There is also a book of tables to accompany the instrument but I have not included this in my photograph.

I hope that the above is of interest to other *M.E.* readers.

Derek Moxley, Somerset.

Read all about it!

SIRS, - I was very pleased to read of one young man's interest in things mechanical (John Wilding's letter *M.E.* 4196, 30 May 2003).

I am sure that joining a model engineering society as a junior member is the best way forward, but when I was growing up there was no such local society. In my experience, the key to a satisfying introduction to model engineering is by way of the amateur's lathe. I'll explain what happened to me.

At about the same age as this young man (10) I was introduced to the late Basil Davenport who built his own racing cars. He was famous for having a battered old car called *Spider* (a GN Special) which went like greased lightning! I was thrilled by a tour of his workshop and garage. The important words however were spoken by a friend of Basil's who was staying at the time. He said "There's plenty of time later on for cars, but persuade your Dad to get you a lathe."

I didn't get very far by pestering, so I went to my uncle who actually owned a Myford ML7 lathe. He lent me a copy of L. H. Sparey's book *The Amateur's Lathe* and this was the turning point. I was fascinated by the versatility of this 'maid of all work' and resolved to get a lathe and a workshop myself. I was also catapulted into a career in mechanical engineering which later on saw me designing jet engines, machine tools and nuclear plant.

My advice to any young man or woman would be to read as much as possible about practical workshop activities, especially lathe work, and take out a subscription to *Model Engineer* magazine!

Neil Heppenstall, Cheshire.

Fluted rods

SIRS, - I was interested to read Denis Monk's comments about Alan Priest's Britannia in 7 1/4in. gauge (*M.E.* 4192, 4 April 2003), but I'm a bit mystified by his reference that the "...motion rods were only fluted at the front."

The first 25 Britannias had fluted coupling rods but following problems with wheels becoming loose on their axles, one of the changes made was to plain rods. As one of the later locomotives built, No. 70045 would therefore have had plain rods from new, so Alan is correct. Maybe my old friend's memory has let him down?

Happy steaming

Mike Johns, by e-mail.

Dennis Monk replies:

With reference to Mike Johns' letter concerning my comments on Alan Priest's Britannia, my memory has not let me down this time. You will note that I said 'motion rods' not 'side' or 'coupling rods'. This was deliberate, for as will be seen in the photograph on Page 359, *M.E.* 4192, 4 April 2003) the correct flat coupling rods were fitted. It was the connecting, return crank and radius rods which were fluted and on the model these were only fluted at the front. Builders do tend to flute only the front — if they have used bright bar, they must have to straighten them after machining. When it is pointed out they say "well you don't see the back". However, in competition, those that flute both sides have the edge over those that don't. Even the two wood and plastic model in this year's exhibition have rods fluted front and back.

I remember the saga of the shifted wheels on the Britannias; in fact in 1951 as a young draughtsman, I went over to Crewe with my Chief, Frank Carrier to 'hold the tape', when the first engine, No. 70014, *Iron Duke* shifted her (or should it be his?) coupled wheels after a high speed slip (or in modern parlance, had 'done a Blue Peter').

The engine was in a sorry state. One connecting rod had broken and the remaining 3ft. still attached to the crankpin had flailed the

717



Run 1: Martyn Chapman.



Run 2: Simon Holroyd.

IMLEC 2002 at LEEDS

We were particularly fortunate that members of Leeds Society of Model and Experimental Engineers agreed to host IMLEC 2002 on their fine track in the grounds of Eggborough power station in North Yorkshire. Their excellent 1028ft. 3½ and 5in. gauge railway is laid with aluminium alloy rail on wooden sleepers set on concrete beams supported on concrete piers. Access to the track is by way of a traverser which serves a ten road steaming bay adjacent to a convenient club house with workshop and storage areas, washing and toilet facilities. Vehicular access to the track site is via a perimeter road around the power station, past the nearby well appointed Social and Sports Club. Locomotives can be manoeuvred from car or van to the track by means of a hydraulic lifting traverser and an access road into the steaming bays. Members of Leeds SMEE have gone to considerable trouble to plan and create an excellent facility which they were prepared to share with us during the weekend 6/7 July for IMLEC 2002.

Maintained by power station staff, the grounds are well kept, and the grass trim. Marquees for reception and exhibition/catering had been put up, and stalls set out for a number of traders who attended for the weekend. A great deal of preparatory work had been done to ensure that IMLEC 2002 ran smoothly and provided visitors with opportunities to enjoy not only the competition, but also an exhibition of fine models plus cars, motorcycles and full size steam together with the chance to spend some money with suppliers and on good food and drink, for which latter we are specially grateful to the ladies of the society. Something else for which we must thank Leeds SMEE members was their ability to arrange a fine weekend for the event!

Run 1: Martyn Chapman

Representing Scunthorpe MES with his 3½in. gauge 2-6-2 locomotive *Betty* to the design by LBSC, Martyn Chapman made the first run of the weekend. He inherited the engine from long standing friend, joiner Frank Knight of Brigg in North Lincolnshire who built it in the 1970s and passed it on when he became ill, knowing that the engine would be run and enjoyed rather than left unused and unloved. Martyn has had a long term affection for steam in all its forms and hopes his young family will follow in his footsteps. A prolific builder, member of several model engineering societies and enthusiastic visitor to model engineering events, Martyn made a very good, controlled start right on schedule with four up, including himself and his observer, managing the locomotive well throughout his run.

Lineside observers would have noted a certain 'bounce' in *Betty's* gait! Perhaps it was this liveliness, or perhaps it was that the front bogie only carried 9lb. of the total 100lb. engine weight that caused it to derail several times. Martyn managed to correct the problem each time without stopping the train. He slowed, jumped off, re-railed the bogie, re-mounted the driving car and continued unperturbed! Pausing once for a blow, he covered a total distance of 3.13 miles, burnt 1.47lb. of coal and recorded an efficiency of 0.54%. Delighted with his run, Martyn said that it had been a privilege to participate!

Run 2: Simon Holroyd

Representing Brighouse & Halifax SME, Simon Holroyd took the regulator of the 3½in. gauge Britannia class locomotive No. 70054 *Dornoch Firth* built to LBSC's design by his father Philip. Work on the engine started in 1956 and the first

tests took place ten years later. Piston valves were fitted in 1971 and the side rods re-bushed. Philip has been a steam enthusiast since an early age and his long service as a fitter in the machine tool industry has stood him in good stead as a model engineer. Simon's interest in steam has also been with him since he was small.

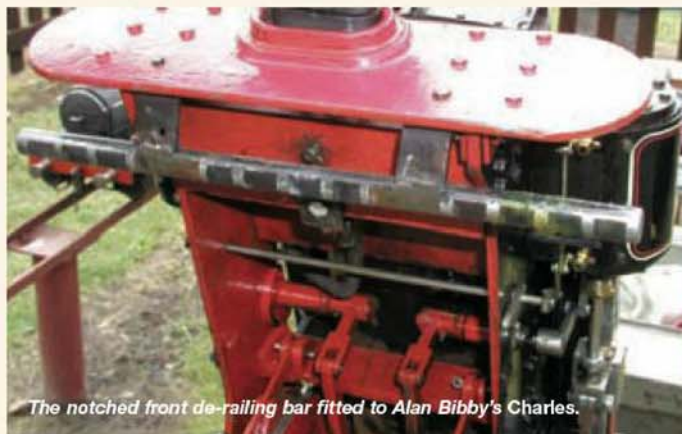
Now that the morning was into its stride, a good number of spectators witnessed Simon's well controlled and slip-free start as he pulled away with five up including himself and his observer. Adapting his style to the circumstances, pressure falling to 20psi during the first couple of laps, Simon ran with full gear and full regulator to bring the fire up and regain pressure. "When she gets to 9mph she won't go any faster, so I just let her alone!" Firing little and often and with a keen eye on the pressure gauge Simon then settled into his run, covered 3.32 miles on 1.61lb. of coal and recorded 0.65% efficiency. Although lubrication was clearly effective, Simon, his passengers and the Brit. were almost as pristine when they finished as they were when they set out.

Run 3: Alan Bibby

Alan Bibby represented Leyland SME with *Charles*, his 3½in. gauge Hunslet to the Blackgates design purchased as a 'non-rolling' chassis at a club sale some 7 years ago. Considerable work was required to correct, complete and bring the locomotive into running order, work which was facilitated by reference to a photograph of the prototype in Penrhyn Castle Museum. A prolific model engineer, Alan took early retirement ten years ago and manages to balance his model engineering activities with several other interests.



Run 3: Alan Bibby.



The notched front de-railing bar fitted to Alan Bibby's *Charles*.



Run 4: Ian Jaycocks.



Run 5: John Richardson.

Alan set off with eight up including himself and his observer and a short burst of slipping was quickly brought under control. Like Martyn Chapman's *Betty* before him, a lineside observer would have noticed a definite 'bounce' in *Charles*' gait and the locomotive derailed several times. Fortunately Alan has designed and fitted notched derailing bars front and back of the locomotive which prevent damage to either it or the track in the event of a derailment. One of the derailments caused Alan to temporarily misplace his firing shovel: firing by hand and the fact that the coal supplied was smaller than Alan normally burns caused further problems. Alan eventually had to ask his passengers to find their own way home and finished his run having covered 2.34 miles, burnt 2.21lb. of coal and recorded an efficiency of 0.61%.

Run 4: Ian Jaycocks

With his Canadian National type 2-8-0 Consolidation *Buffalo* to Martin Evans' design published in 1963 which the designer based on his 0-8-0 switcher *Caribou* by lengthening the frames and introducing the front pony truck, Ian Jaycocks was our final 3 1/2in gauge entry for this first day of competition. A research and development engineer with the precious metals industry, Ian has been concerned mainly with resistance welding techniques and has had much to do with the development of components for switchgear and contactor mechanisms. He purchased his locomotive from a Bristol SMEE member and believes it to have originated in the west Leicester area. Ian is gradually rebuilding the locomotive, concentrating first on the Baker valve gear and "... adding bits and pieces for detail and weight".

Representing Peterborough SME, Ian made an excellent start with six up all told and drove his locomotive quite hard, controlling occasional bouts of slipping with confidence. A first-time entrant in IMLEC, Ian often allowed some of his

precious steam to escape from the safety valves. Having dropped off three passengers, he finished after a 32.22 minute run during which he travelled 2.15 miles, burnt 1.75lb. of coal and recorded 0.49% efficiency.

Run 5: John Richardson

The first of our 5in. gauge locomotives was next onto the track. With his black liveried 0-6-0 locomotive to LBSC's *Minx* design, John Richardson is a member of Brighouse & Halifax SME. Completed in 1974, *Minx* is the first of John's locomotives. Having refurbished the chassis twice and replaced the boiler, John considers it may be time for this hard-working locomotive to be refurbished again!

Setting off with eight up, John had to fight wheel slip to embark upon a fast few first laps. A lineside observer would have hardly seen the *Minx* side rods for they were little more than a blur! Regrettably the Leeds coal did not suit this engine for John lost his fire, stopped to recover his breath and had to ask his passengers to walk home while he finished his run alone with his observer. Later, John explained that about 20 minutes into his run, pressure fell back to about 40psi and the fire had gone "all orange." Following this he had to fire on top and the anthracite wasn't letting much air through the fire which never properly recovered. His rate of progress may be judged from the fact that John covered 3.32 miles in 26.75 minutes, burning 2.97lb. of coal and recording 0.54% efficiency.

Run 6: Steve Eaton

Representing Chesterfield DMES, our next competitor was Steve Eaton with his 5in. gauge GNR Stirling Single wheeler named *Frederick* in honour of his late father. This, Steve's first 5in. gauge locomotive, was finished in 1996 after only 18 months in construction. He began building locomotives at the age of 14 years and

has completed 13 to date. Steve enjoys the challenge of running small locomotives and has previously won 'Best 3 1/2in. gauge Engine' with his *Juliet* at Leeds IMLEC in 1992 and with *Bantam Cock* at Llanelli in 1997.

Concerning today's run, the remarkable pop action of his safety valve was immediately evident as Steve reversed this most elegant locomotive light engine to couple up with his train; the valve seemingly snapping open and shut with barely a few pounds of pressure between. Setting off with four up, Steve demonstrated his experience by controlling his start with great skill and soon had this graceful greyhound loping around the track in the sunshine. Despite appearances, Steve had a few problems with the front bogie: "...we came off three times and I had to bounce it back on from the back" he admitted ruefully after his run during which he covered 3.71 miles, burnt 1.60lb. of coal and recorded 0.39% efficiency.

Run 7: Dave Mayall

Another experienced competitor, Dave Mayall was next to run with his 5in. gauge 15xx 0-6-0T locomotive built to LBSC's *Speedy* design. Representing Bracknell RS, Dave is ably supported by his wife Frances, a locomotive owner and driver in her own right. Dave acquired his *Speedy* as a part-built chassis and a box of bits which took him some four years to correct and complete ready for its first run in 2001. This locomotive is Dave's sixth completed in the thirty years he has been building, and he currently has two more under construction. Having first entered 1991 at Bristol, this was Dave's eighth IMLEC entry. He set off with the largest load so far, a total of 15 up. The sound of its exhaust revealed that the engine had been very nicely set up and Dave seemed to have a good run, covering 2.17 miles, burning 1.83lb. of coal and recording 1.15% efficiency, the highest of the event so far. ▶



Run 6: Steve Eaton.



Run 7: David Mayall.



Following his run, Dave admitted that he would have had a better run with fewer passengers. Running notched up most of the time except for full gear for the bank, Dave was pleased that the locomotive ran and recovered happily from 50psi. Nevertheless, he felt that had he run with 12 up, he wouldn't have come to an early stand and had to set back to take the grade.

Run 8: Nick Elliott

Our next competitor was Nick Elliott driving his father Geoff's 5in. gauge LNER B1 built by D. Scott to Martin Evans' *Springbok* design. Representing North West Leicester MES, of which he has been a member for some 30 years, Geoff bought his first engine in 1976 and has been driving ever since. He purchased this locomotive in 1992. Currently building his first locomotive, a Class 4 on which he has been working for some three years, Nick has been involved in the hobby from the tender age of five and learned to drive at 10 years of age.

Nick quickly brought a bout of slipping under control as he pulled away from the start with 11 up, and proceeded to complete 17 laps of the track steadily and seemingly without difficulty. He later said that in this, his first IMLEC he may have been a little heavy on the regulator and the coal may have been a little smaller than he would have preferred, but he couldn't stop the boiler from making steam and had thoroughly enjoyed his run. In just short of his allocated half hour, Nick covered 3.72 miles, burnt 4.33lb. of coal and recorded 0.62% efficiency.

Run 9: Paul Tompkins

Another 5in. gauge *Minx* was next to compete, this one in the capable hands of young Paul Tompkins representing Guildford MES. An apprentice toolmaker, Paul has entered the last six IMLECs having taken to model engineering at an early age. He is currently

building a 7F 2-8-0 to Martin Evans' design. Paul and his uncle Dave Tompkins built the *Minx* very quickly to provide a locomotive to enter in a previous IMLEC. Len Steel built the boiler, the only castings are the *Pansy* wheels, and the locomotive is equipped with radiant superheaters, PTFE gland packings, a screw reverser, a 'brick' arch and two injectors. Paul and Dave recommend the design to anyone requiring an easily made passenger hauling engine.

Having survived the trauma of mechanical problems during the week before the event, Paul set off in fine style with 13 up and quickly brought the seemingly inevitable initial slip under control. He soon settled into what began as an excellent run until he had problems with the fire. This locomotive seemed to find the Leeds coal a little indigestible and lost pressure; Paul came to a stand on the rising grade before the tunnel and had to drop his passengers to complete his run during which he covered 2.55 miles, burnt 1.94lb. of coal and recorded 1.30% efficiency.

Run 10: David Gregson

Saturday's final run was by David Gregson with his superb 5in. gauge A1 Peppercorn 4-6-2 *Alcazar* to the design by Michael Breeze. A member of Leyland MES for some 30 years, David entered this competition privately. It was his sixth IMLEC: "I enjoy the event, being part of the competition, meeting good friends and the competitive spirit of the weekend." He started work on his A1 Pacific in 1995 and finished it in July 2001. The boiler is constructed in three sections to achieve the correct profile and features a combustion chamber with cross-tubes. PTFE piston valves and piston rings are fitted. Most components have been fabricated but David had some castings made from his own patterns, including the driving wheels. The locomotive is equipped with steam brakes and the tender is vacuum braked with a train pipe for vacuum fitted working.

Setting off with 13 up, Dave brought initial slip under control and following a slow start picked up speed to lap the track in fine style. All would have been well with *Alcazar* running splendidly, except for a major derailment of engine, tender and dynamometer car some 20 minutes into his run which unfortunately ruined Dave's chances. Fortunately the magnificent blue liveried locomotive suffered no damage and on re-railing Dave was able to finish his run without further difficulty. He covered 3.14 miles, burnt 4.52lb. of coal and recorded 0.82% efficiency.

Interlude

Much debate and deliberation followed the day's events and many took the opportunity to examine the models on display in the marquee and to check the trade stalls before leaving. Chairman Arthur Bellamy had arranged for those who wished to do so, to sit together for an evening meal and a drink in the club's normal meeting room in the power station Social and Sports Club. A splendid session was enjoyed by a great many folk and our thanks are due to Arthur for making it all happen and to British Energy and Eggborough Sports & Social Club for making their facilities available to us.

When visitors and competitors arrived on Sunday morning, the track had already been inspected and cleaned ready for the day's runs. The aroma of cooking bacon hung appetisingly in the morning air, advertising the availability of breakfast for those who had not already eaten or whose resolve may not have been very strong. We were pleased to note that Leeds members had done it again so far as the weather was concerned; while wet underfoot, the weather was still dry and fine!

Run 11: John Brady

The first Sunday morning slot was taken by John Brady representing York DSME with his 3¹/₂in. gauge 0-4-0ST *Conway* to Martin Evans'





Run 11: John Brady.



Run 12: David Kerry.

popular and successful design. This particular locomotive was built by Tim Pearson and named *Brown Owl* as a tribute to Tim's wife Janet who works with her local Girl Guides group. As John works for the National Blood Service, 'Billy Blood Drop' keeps an eye on things from his vantage point on the front right hand locomotive running board.

John set off with two up and made a good start but later explained that despite feeling confident at the outset, within a circuit of the track he had lost both fire and water! Anticipating a stop to restore his equilibrium John was pleased to find that his engine picked up after which he had a good run and completed 12 laps without incident. He covered a distance of 2.54 miles, burnt 1.83lb. of coal and recorded an efficiency of 0.15%.

Run 12: David Kerry

Next on the track with his 3 1/2in. gauge 2-8-0 Stanier 8F to the *Euston* design by Martin Evans was David Kerry, a member of Chesterfield DMES. The locomotive was built by Eric Woodcock who embellished it with additional details and a front pivoting lifting cab roof to facilitate driving. David's first engine, which he built himself, was a 5in. gauge *Simplex*, also to Martin Evans' very popular and successful design. With this he competed in IMLEC at Leeds and Leyland in 1992 and 1993, achieving a respectable 7th place in both events.

David set off with 5 up and experienced some slipping as he pulled away with his load. Despite his experience, David had to drop passengers to complete his run with 3 up having covered 2.54 miles and burnt 0.94lb. of coal to return an efficiency of 0.59%. Finding the locomotive light on its feet David later admitted that perhaps he could have spent a little more time balancing his wheel weights. Having seen yesterday's runs he felt that he should have done better than he did, but he enjoys the driving and the competition.

Run 13: Mike Forman

The diminutive 3 1/2in. *Rob Roy* 0-4-0T is not a common entrant in IMLEC but this year was an exception with Mike Foreman representing North London SME. Mike's interest in model engineering was kindled at school and *Rob Roy* was built between 1960-1975. His workshop is not large but contains a Boxford ME10 lathe, Fobco bench drill and a belt Linisher. With interests ranging from 00-gauge to full size, Mike's tastes cover a broad spectrum. He has also built a Dan Jeavons Class 20 diesel with additional facilities and detail and is presently working on a Clarkson *Green Arrow* in 3 1/2in. gauge, also with additional detail from works drawings. *Rob Roy* is fitted with radiant stainless steel superheaters, features an improved smokebox design with an internal spark arrestor (inserted when required). She runs with needle roller bearing axleboxes, the boiler has been re-tubed once and she is on only her second mild steel grate despite having run well in excess of 1000 miles.

Mike set off with 4 up and astounded the natives with his excellent start and good run at good speed. With an eye on efficiency, Mike was careful with the coal, which he liked, but noticed the pressure falling to 50psi about 15 minutes into his run and had to stop for the first of three blows. He completed his run having dropped one of his two passengers, covering 1.56 miles on 1.1lb. of coal and returning 0.29% efficiency.

Run 14: John Peterson

The first of Sunday's group of 5in. gauge locomotives took to the track next. John Peterson represented Norwich DSME with his attractive North London Railway 4-4-0 Adams tank. A member of Norwich DSME for some 23 years, John has built locomotives in both gauge 0 and 5in. gauge. His previous engine was a North London 0-6-0 in LMS livery which took 19 years to complete. The prototype for the competing

locomotive was built in 1867 by the North London Railway to a design by Adams. This class was the first to use the Adams bogie which the model accurately replicates, complete with rubber side control springing. Building began in 1994 to John's own design and has taken 7 years to completion. John made the injectors and pressure gauge as well as the patterns from which most of the castings have been produced. With a nod towards LBSC's *Maisie*, the boiler features a combustion chamber and is pressed to 100psi to feed the inside cylinders which are controlled by Stephenson's gear with launch type links.

John's excellent start with 7 up was observed by a growing group of spectators. John's run progressed well up to the point when pressure fell due, he said later, to letting the fire burn too low and being unable to build it up in good time for the grade. Like some others before him this weekend, John found the coal a little small for his grate. Nevertheless, John completed a very respectable 17 laps, covered a distance of 3.41 miles, burnt 1.63lb. of coal and recorded a very commendable 0.97% efficiency, returning almost as clean as when he set out.

Run 15: Glyn Winsall

Glyn Winsall represented Rugby MES with his 5in. gauge 2-4-0T locomotive to the *Metro* design by Martin Evans. Glyn enjoys the competition but has lost count of the number of times he has entered IMLEC since his first time at Newcastle when he came second. Since then he says he's "...been going downhill ever since!" Glyn's father Fred is well known on the IMLEC circuit and Glyn's hopes his own young son George will "...show us how to win again!" Glyn's *Metro* was built between 1974 and 1976 while he was still at school. Fed by two injectors and a recently fitted crosshead pump, the boiler is pressed to 120psi, and is fitted with a stainless steel 'brick' arch. The



Run 13: Mike Foreman.



Run 14: John Peterson.



Run 15: Glyn Winsall.



Run 16: Philip Moore.

iron cylinders have proper piston rings. The locomotive has recently undergone a major mechanical overhaul during which all the rods were re-bushed, the valve faces renovated and new pistons, rings and rods fitted.

Glyn set off with 7 up and made a very clean start to an excellent run in the sunshine. He covered the greatest distance of all competitors in this particular event, 3.64 miles during which he burnt 1.27lb. of coal and returned 1.02% efficiency.

Run 16: Philip Moore

At the regulator of John Coomber's 5in. gauge LNER 2-6-2T V3 locomotive to Martin Evans design Philip Moore represented the home club. John completed this 3-cylinder locomotive some 12 years ago and in recent years it has been a stalwart performer at Eggborough steaming days. Philip set off with 10 up, bringing his slipping start quickly under control. Not long into his run, he slowed but seemed to pick up pace again. Regrettably this was not to continue and Philip eventually came to a stand and retired from the competition.

Run 17: John Hurley

Next onto the track was John Hurley, representing Kinver & West Midlands SME with his 4-6-0 LMS Stanier Jubilee No. 5703 *Thunderer*. John has spent a lifetime working on the railways and as a cleaner in 1950 he used to clean the full size prototype for the miniature locomotive which he designed and built himself. John joined the Severn Valley Railway when it started, passed out as a driver in 1971 and drove until 1984. He prepared his own drawings from the full size locomotive No. 5690 *Leander* when

it was at the Severn Valley Railway for overhaul. *Thunderer* took John nearly 15 years to build, was ready to run in 1994 and was finally finished and painted for the 1996 season.

John set off with 18 up, the largest load of the day. He got away from a slippery start and turned in some good laps before slowing to a stand on the rising grade before the summit. The reach across the dynamometer car and tender was too much to allow John to notch up, so he was running in full gear throughout his run. He also found the coal a little small compared to what he normally burns but sympathised with the Leeds club, knowing all too well how difficult it is to obtain good fuel these days. John dropped four passengers and set back to get away again but still found it difficult to maintain his pace without a touch of sand on the alloy track and eventually had to abandon all his passengers, returning with only his observer after travelling 2.42 miles on 2.53lb. of coal to record an efficiency of 0.77%.

Run 18: Alan Crossfield

The penultimate run of the day was by Alan Crossfield representing Leyland SME with his 5in. gauge GNR 2-8-0 to Martin Evans' *Nigel Gresley* design. A very successful and dedicated competitor, Alan has been an active railway



Run 17: John Hurley.

modeller since 1970 and a model engineer since 1977. His other locomotives, also in 5in. gauge are a Stirling single and a GWR Manor, and he has built several items of rolling stock in 5in. gauge. Alan's current project is a Large Prairie in 5in. gauge, a GWR 51xx tank engine. *Nigel Gresley* was built between 1977 and 1981 and competed in the 1982 IMLEC at Leyland when it suffered damage as a result of a derailment. Later successful runs at Urmston and Bournemouth were followed as 'runner up' at Birmingham in 1987. Fitted with new rear axleboxes and re-painted in 1977, the locomotive is used extensively for passenger hauling on the Leyland track.

Alan set off with 14 up and quickly brought the initial slip under control to settle down to a fine run well notched up, at good speed and without incident. Alan enjoyed his run, travelled 2.94 miles, burnt 2.00lb. of coal and returned a very creditable efficiency of 1.69%.

IMLEC 2002 at EGGBOROUGH, NORTH YORKSHIRE, JULY 6/7 2002

Final Placing	Run No.	Locomotive Type	Gauge (in)	Wheel Config.	Owner	Society	Driver	Observer	Passengers Including Crew	Laps	Coal Used (lb.)	Distance Run (ft.)
1	19	B1	5.0	4-6-0	Geoff Moore	Guildford MES	Geoff Moore	John Hunt	11+3	16	2.486	18560
2	18	<i>Nigel Gresley</i>	5.0	2-8-0	Alan Crossfield	Leyland SME	Alan Crossfield	Alistair Bootland	14	14	2.002	15510
3	9	<i>Minx</i>	5.0	0-6-0	Paul Tompkins	Guildford MES	Paul Tompkins	Philip Turner	13+4	13	1.936	13440
4	7	<i>Speedy</i>	5.0	0-6-0T	Dave Mayall	Bracknell Rly. Soc.	Dave Mayall	Alf Bamfield	15	11	1.826	11480
5	15	<i>Metro</i>	5.0	2-4-0T	Glyn Winsall	Rugby MES Ltd.	Glyn Winsall	Alf Bamfield	7+2	18	1.265	19240
6	14	NLR Adams	5.0	4-4-0T	John Peterson	Norwich DSME	John Peterson	Colin Abrey	7	17	1.628	18010
7	10	A1 Peppercorn	5.0	4-6-2	David Gregson	Leyland SME	David Gregson	Alistair Bootland	13+4	16	4.521	16590
8	17	Jubilee	5.0	4-6-0	John Hurley	Kinver & West Midlands	John Hurley	Philip Turner	18	12	2.530	12780
9	2	Britannia	3.5	4-6-2	Philip Holroyd	Brighouse & Halifax SME	Simon Holroyd	Jim Mitcheson	5	17	1.606	17530
10	8	B1	5.0	4-6-0	Geoff Elliot	North West Leics. MES	Nick Elliot	Colin Abrey	11	17	4.334	19620
11	3	<i>Charles</i>	3.5	0-4-0T	Alan Bibby	Leyland SME	Alan Bibby	Colin Abrey	8	12	2.211	12370
12	12	8F Euston	3.5	2-8-0	Dave Kerry	Chesterfield DMES	Dave Kerry	Philip Turner	5	13	0.942	13400
13	1	<i>Betty</i>	3.5	2-6-2	Martyn Chapman	Scunthorpe MES	Martyn Chapman	John Hunt	4	15	1.474	16540
14	5	<i>Minx</i>	5.0	0-6-0	John Richardson	Brighouse & Halifax SME	John Richardson	John Hunt	8	17	2.970	17550
15	4	<i>Buffalo</i>	3.5	2-8-0	Ian Jaycocks	Peterborough SME	Ian Jaycocks	Philip Turner	6	11	1.749	11360
16	6	Stirling Single	5.0	2-2-2	Steve Eaton	Chesterfield DMES	Steve Eaton	Jim Mitcheson	4	18	1.595	19580
17	13	<i>Rob Roy</i>	3.5	0-6-0T	Mike Foreman	N. London SME	Mike Foreman	John Hunt	4	8	1.100	8250
18	11	<i>Conway</i>	3.5	0-4-0T	John Brady	York DSME	John Brady	Jim Mitcheson	2	12	1.826	13420
-	16	V3	5.0	2-6-2T	John Coomber	Leeds SMEE	Philip Moore	Jim Mitcheson				RETIRED



Run 18: Alan Crossfield.



Run 19: Geoff Moore.



IMLEC 2002 winner Geoff Moore receives the Martin Evans Challenge Cup from Geoff Bird (retired Shed Manager, York) under the watchful eye of a sartorial Leeds SMEE Chairman, Arthur Bellamy

Run 19: Geoff Moore

And so we reached the final run of the event: Geoff Moore of Guildford MES with his 5in. gauge LNER B1 4-6-0 *Impala* inspired by Martin Evans' published design. A model engineer for 55 years Geoff was a member of Buckhurst Hill MES when he started work on *Impala* but has since transferred to Guildford MES where he has been an active member since 1968. Geoff has built two other locomotives, a *Minx* and a GWR 1661 class saddle tank, both of which have been reasonably successful in IMLEC. Construction of *Impala* started in 1963 and to drawings provided by British Railways. Geoff has gone to great lengths to ensure that his locomotive is as good as he could possibly make

it. Steel tyres are shrunk onto the driving and coupled wheels, a four element radiant superheater is fitted, the valve gear was designed according to Don Ashton's advice, and the tender is fitted with a working water scoop. The model is finished with green and red paint from the full-size LNER paint shops according to the LNER Painting Diagram. There is much more to tell, but Geoff is just about to start his run.

Spectators gathered at the start point to see Geoff set off with 11

up, a good fire and a full head of steam. Following a faultless start, Geoff settled into his first lap following which he took advantage of a local rule that extra passengers could be taken on. Three colleagues were primed and waiting and climbed aboard after the first lap, by which time the fire had burned through and the locomotive had settled into full running mode. From this point on Geoff ran lap after lap of the Leeds track with no sign of superfluous steam and in complete charge of the engine. He found that the coal suited the engine and was very pleased with his run which touched 11mph at one point. After covering 3.52 miles and burning 2.49lb. of coal, Geoff returned a figure of 1.82% efficiency. Could one of the reasons for the success of his run have been the copious

lubrication to which the locomotive, driver and passengers had been subjected?

Presentation and thanks

The competition over, spectators and supporters alike studied and discussed the results board while final calculations were made, certificates signed and arrangements made for the presentation. The certificates and cash prizes were presented by Geoff Bird, Shed Manager York (retired) who addressed the gathering, and all competitors were presented with a cast brass plaque as a memento of the event. Thanks were offered to all who had made IMLEC 2002 the success that it undoubtedly had been and folk began to make their way homeward.

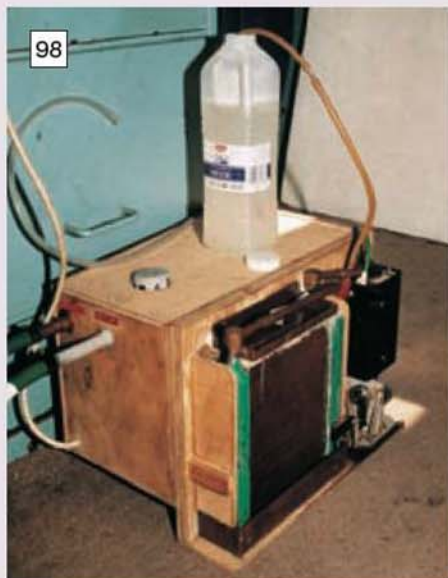
Our special thanks are due to Arthur Bellamy and to each and every one of his team of hard working stalwarts, including the ladies, who made such a superb job of staging IMLEC 2002. Arthur's informative and friendly commentary kept everyone in the picture throughout the weekend. Our thanks go to Nigel Bennett for his excellent photographs of the competition, and to Bristol SMEE and Birmingham SME for the loan of their dynamometer cars for the event. We are grateful to British Energy and Eggborough Sports and Social Club for allowing us to use their facilities throughout the weekend.

Wakefield Movie Makers produced an excellent record of the event in the form of an 85 minute VHS video programme. Roger Spence's camera work and Graham Carter's editing were excellent. Copies of the programme are still available from IMLEC Video c/o 31 Yew Tree Lane, Colton, Leeds, West Yorkshire LS15 9JD. The cost of the tape is £12.50 and cheques should be made payable to Leeds SMEE.

See you at Bristol 12/13 July 2003!



Work Done (ft.lbf.)	Running Time (min.)	Average Drawbar Pull (lbf.)	Average Drawbar HP	Coal Consumption Rate (lb./hr.)	Specific Coal Consumption (lbf./dbhp/hr.)	Thermal Efficiency (%)	Axle 1 Weight (lb.)	Axle 2 Weight (lb.)	Axle 3 Weight (lb.)	Axle 4 Weight (lb.)	Axle 5 Weight (lb.)	Axle 6 Weight (lb.)	Axle 7 Weight (lb.)	Total Weight (lb.)
525500	27.570	28.314	0.578	5.410	9.367	1.823	26.00	26.00	74.00	71.00	69.00	-	-	266.00
391400	28.033	25.235	0.423	4.285	10.128	1.687	10.00	38.00	43.00	35.00	28.00	-	-	154.00
291300	25.850	21.674	0.341	4.494	13.159	1.298	-	-	-	-	-	-	-	-
244100	26.200	21.263	0.282	4.182	14.811	1.153	38.00	56.00	52.00	-	-	-	-	146.00
148900	32.033	7.739	0.141	2.369	16.821	1.015	18.00	46.00	41.00	-	-	-	-	105.00
183200	32.050	10.172	0.173	3.048	17.595	0.971	12.00	12.00	59.00	52.00	-	-	-	135.00
429600	31.500	25.895	0.413	8.611	20.837	0.820	10.00	18.00	75.00	119.00	119.00	42.00	-	383.00
226200	27.383	17.700	0.250	5.544	22.146	0.771	6.00	19.00	104.00	84.00	43.00	-	-	256.00
120200	31.200	6.857	0.117	3.088	26.455	0.646	12.00	8.00	35.00	38.00	28.00	14.00	-	135.00
312300	29.400	15.917	0.322	8.845	27.478	0.622	12.00	17.00	72.00	70.00	59.00	-	-	230.00
157000	28.600	12.692	0.166	4.638	27.884	0.613	56.00	60.00	-	-	-	-	-	116.00
64500	26.650	4.813	0.073	2.121	28.917	0.591	6.00	15.00	22.00	20.00	14.00	-	-	77.00
92600	28.817	5.599	0.097	3.069	31.517	0.542	9.00	29.00	21.00	35.00	6.00	-	-	100.00
185200	26.750	10.553	0.210	6.662	31.753	0.538	46.00	52.00	29.00	-	-	-	-	127.00
99800	32.217	8.785	0.094	3.257	34.700	0.492	34.00	24.00	9.00	36.00	-	-	-	103.00
72300	28.400	3.693	0.077	3.370	43.680	0.391	17.00	73.00	12.00	-	-	-	-	102.00
36400	27.567	4.412	0.040	2.394	59.835	0.285	21.00	21.00	33.00	-	-	-	-	75.00
30700	31.950	2.288	0.029	3.429	117.768	0.145	40.00	40.00	-	-	-	-	-	80.00



The water cooling arrangements now used with the burnt air engine.

Frank Taylor

concludes this series of articles with a discussion of the data collected so far.

●Part XII continued from page 607 (M.E. 4196, 30 May 2003)

When I first started saving data I was not objective and there were still some problems with the engine which made the data unreliable. The information obtained had the single use of helping me get the engine to run in a reliable, predictable and repeatable way. Today the information can be used to learn something about hot air engines and to make improvements in a measured and logical way (Table 1).

Photographs of the computer screen display were not good enough for serious viewing of the data so I have copied the figures and kept the screen layout (of the first set) to show what it looks like. Screen space is at a premium and many abbreviations have had to be used which I hope readers do not find too irritating.

Abbreviations

All temperatures in degrees Celsius.

HT = Heater Temperature

WI = Temperature of cooling water going into engine

WO = Temperature of cooling water coming out of engine

TQ = Torque Output in ounce-inches

RPM = Revolutions per minute

P = Crankcase pressure in atmospheres

W = Watts output.

AMB = Ambient temperature

HO = Humidity

IN = Timing interval between readings in minutes

Run T display

Basic information about the run and objectives are entered when called for during setting up at the start; these are placed in the first two lines of the display. At the bottom is the instant read facility. By pressing R a read out appears below the instruction. If 'R' is held down you get a reading every second which is very useful for adjustments.

A study of the heater temperatures reveals that

THE BURNT AIR ENGINE

the shocking 40deg. C hysteresis in the metal mass of the heater has been eliminated by the program. The brake load, and thus the torque, are controlled manually with the object of keeping the engine nearest to its best TQ/RPM ratio which varies, as the oil heats, from 160rpm at start up to just under 200rpm after a run of one hour. These coarse manual adjustments reflect in the Watts column.

Improvements to external cooler unit

The hot water from the engine goes to an external cooler unit, which uses evaporation of water to get rid of the heat. I made an improvement to the fan which increased the air flow through the unit.

Before doing this I did RUN 'T' that you have just seen and, after the modifications, a further run called RUN 'V' (Table 2). All significant runs are allocated a number or letter so that they can be saved and retrieved easily.

This is a lovely stable set of figures which makes all the effort worth while. So, cutting short the basking in glory, what did it tell me? If we take WI, WO, and W figures from both runs, find the average for each set of 14 figures and make a subtraction we can see what the modification to the cooler was worth.

Looking at the last line of Table 3 we see the benefits of the improvements to the external water cooling unit. The water temperatures into and out of the engine were lowered by 6.7 and 8.4 degrees respectively. It was pleasing to see that there was some reflection of this in the Watts column with a gain of 0.6 watts. Not all improvements produce an increase in output as we shall see in the next case presented

Direct heater to cooler loss

The cooler being considered here is the engine cooler, not the external water cooler as in the previous case.

It was my opinion that the above loss was a major factor in limiting the engine performance and I set about trying to improve the situation. Once again, before and after measurements were taken. Changes were made to the multitude of bolts in the displacers to reduce the conduction of heat. The set up for the measurements, which quantified the improvement, is shown in fig 11.

In this set up the engine is stationary and the external cooler has been disabled such that its function is just to circulate the fixed quantity of water in its storage tank. The heater was supplied by a fixed heat value chosen from the program.

As the engine is not running, the heat that passes from engine heater to engine cooler is the loss that we are trying to measure and reduce.

Heat is absorbed by the mass of the engine cooler and the quantity of water circulating through it. The temperature rise of the heater will be dependent upon the fixed heat chosen and the direct heater/cooler loss. Timed readings of five minutes were chosen and the time taken for the heater to reach a particular temperature gives a measure of the loss, as we shall see

Analysing the data in Table 4 it can be seen

TABLE 1 - COPY OF RUN T DISPLAY

INT 5 15/12/98 RUN T PRIOR TO EXTERNAL COOLER MODS HT220 AMB18 HG80

HT	WI	WO	TQ	RPM	P	W
223	37	41	28.7	191	5.1	4.1
221	40	43	30.4	184	5.2	4.1
221	41	44	30.6	198	5.1	4.5
221	40	44	29.8	205	5.1	4.5
222	40	44	31.1	200	5.3	4.6
221	40	44	33.0	203	5.4	5.0
222	40	45	35.1	167	5.4	4.3
221	40	44	33.0	192	5.3	4.7
220	41	45	32.3	204	5.4	4.9
221	41	44	34.3	202	5.4	5.1
222	42	45	34.1	196	5.4	4.9
222	41	45	33.4	192	5.3	4.7
223	40	45	33.0	191	5.3	4.7
222	41	45	32.3	197	5.3	4.7

FOR INSTANT READ PRESS R

TWO LINES EXCLUSIVE FOR COMPUTER PROMPTS AND INFORMATION

TABLE 2 - COPY OF DATA FROM RUN V

INT 5 15/3/99 HT220 AMB15 HG50 RUN V MODIFIED EXT COOLER COMPARE RUN T

HT	WI	WO	TQ	RPM	P	W
219	32	34	28.7	210	5.4	4.5
220	33	35	31.1	212	5.4	4.9
222	33	35	39.9	181	5.4	5.4
221	34	36	39.8	182	5.3	5.4
221	34	35	38.8	187	5.3	5.4
218	33	36	38.4	191	5.2	5.4
221	33	35	37.5	194	5.3	5.4
219	34	36	37.7	196	5.3	5.5
221	34	36	36.6	199	5.4	5.4
219	34	36	37.3	193	5.3	5.3
222	34	36	37.5	186	5.3	5.2
221	34	36	36.6	192	5.3	5.2
221	35	37	36.6	190	5.3	5.2
220	34	37	36.4	196	5.2	5.3

TABLE 3

	WI	WO	W
AVERAGE RUN V	33.6	35.7	5.2
AVERAGE RUN T	40.3	44.1	4.6
V - T	-6.7	-8.4	0.6

that run Q reached a heater temperature of 171deg. C ten minutes before run K. The faster time of run Q was due to less heater load owing to a reduction of direct heat loss to the cooler, resulting from the bolt modifications.

The energy saved in the 45 minute run is thus 650 watts for 10 minutes or 108 watt-hours. This is a significant saving and a useful reduction in load on the external cooler. There was no

Figure 11

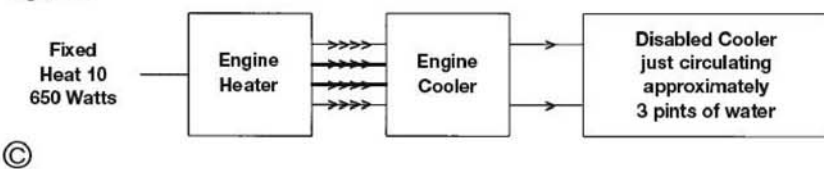


TABLE 4

HEATER TEMPERATURE		WATER IN TEMPERATURE		WATER OUT TEMPERATURE		REMARKS
K	Q	K	Q	K	Q	
45	46	21	21	22	22	K READINGS ARE THOSE READINGS TAKEN BEFORE BOLT CHANGES
82	86	22	23	24	24	
107	115	25	25	27	27	
127	138	30	29	31	31	
142	153	33	34	34	35	Q READINGS ARE THOSE READINGS TAKEN AFTER BOLT CHANGES
153	163	37	37	38	40	
160	171	40	41	43	43	
166		45		47		
171		48		51		

measurable effect on the output of the engine. This might suggest that to use the output only as a means of gauging improvement is unreliable. The explanation might be as suggested in the following paragraph.

Consider that the output is limited by A, B, C, D, E, F, G ..., if we improve A then the output will be limited by all the others. If the improvement is small compared with all the others put together then it could be that it will make little difference to the output. When some of the other masking parameters are improved then the improvement made in A will be revealed. This is the value of measurement. Each individual parameter can be improved independently to make its own contribution to the output in the end.

Sounds good! Well, it is not so good because some of the parameters are fixed by laws and properties that cannot be changed. However, it does mean that if measured output is all you have to work with, do not be discouraged if your attempts at improvement do not produce immediate results. Just keep plodding on.

Program error?

If you have not spotted it already, run your eye down the third column of numbers in Table 4. Note the increment between each of the numbers. It goes 3, 5, 3, 5 ... Something is not quite right. The progression should be even. I did not notice this until I came to write up these notes. The present program has been checked for timing and heat errors and nothing can be found to cause this cyclic oddity.

My guess is that it was a program error which has been subsequently cleared during later modifications. Fortunately, the two runs were done with the same program so they were treated equally keeping the general conclusion valid.

In the light of this, the savings could be a little different to those stated. I would have preferred to present figures without this defect but I cannot have a re-run as there are no bolts to the original design.

At present I am looking into the maximum and minimum dynamic cylinder pressures, a mouthful meaning that I have a pressure gauge on one cylinder which waggles to and fro when the engine is running. It is easy to see the limits of the needle movement. As a temporary measure the computer gives me a buzz when it wants me to take the readings which are included with

those that it takes. These pressures look interesting and I had hoped to include them but as yet I am still learning.

If this is a fruitful area for exploration I will put

a proper sensor on the cylinder. Hopefully I could do a bit of dabbling in machine code for a program that would occupy the computer for the period of one revolution of the engine. During this time it would take some 250 or 500 pressure readings and put them in store. From here it would be easy to plot an indicator diagram showing all the pressures, and the indicated 'mouse' power.

Data presentation

For some time now my engine has been 'moth-balled' after finding the attraction of new short-term projects irresistible. I have been wondering what to do about the data that has been collected. It is a certainty that the presentation of masses of figures would give everyone indigestion and as a result very little would be absorbed.

In view of this some of the data has been used to produce a chart/graph (fig 12) which shows my interpretation of what happens inside my hot air engine. The information is likely to be relevant to other engines and could be useful. Some readers may interpret the information differently which could promote some healthy discussion.

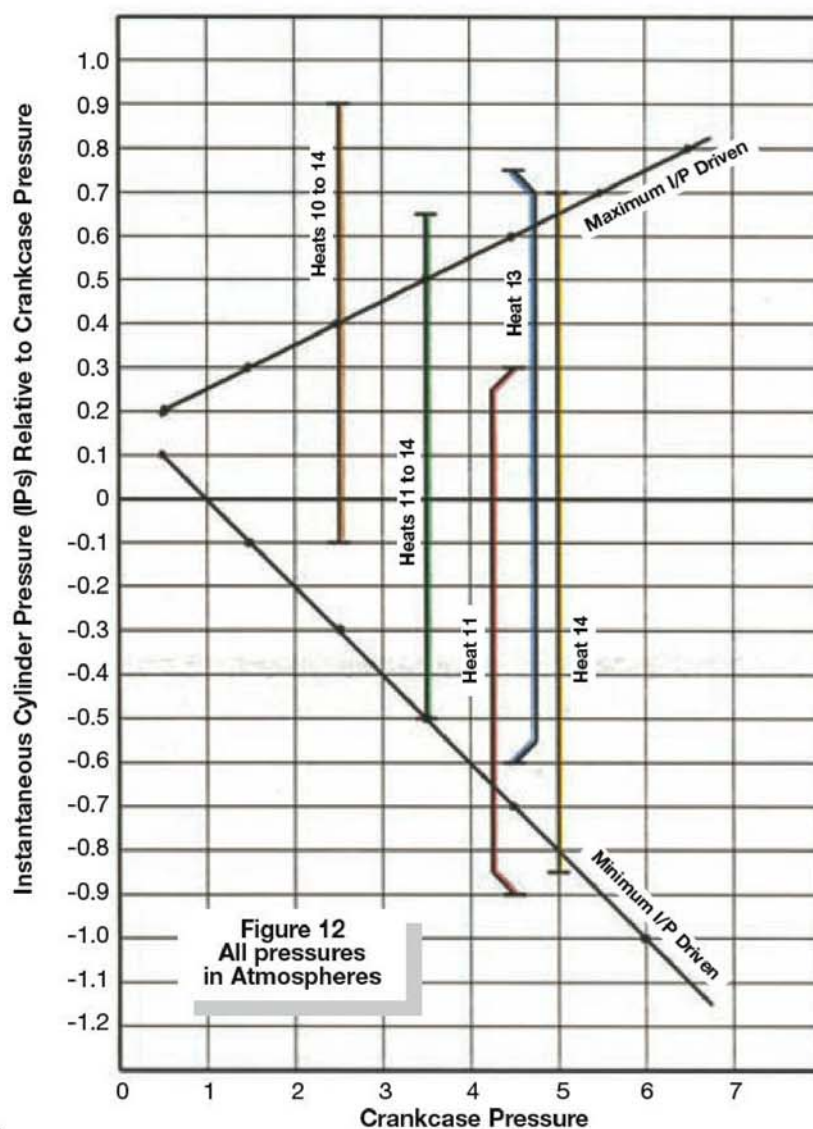


Figure 12
All pressures
in Atmospheres

Instantaneous cylinder pressures (IPs)

If a pressure gauge is connected to a cylinder of the engine in a non-active state and the crank turned by hand the gauge will follow the pressure changes in the cylinder and its reading at any instant is the instantaneous cylinder pressure. If the crankshaft is driven at a constant speed, slow enough for the gauge to follow, the pressure span will eventually settle to steady maximum and minimum values.

These values will depend on the ratio of displacer and cylinder volumes and will vary either side of the crankcase pressure. The two black diagonal lines marked MAXIMUM & MINIMUM IP DRIVEN are a plot of values obtained against selected crankcase pressures. It has been found that best output and efficiency is obtained (when the engine is working) if the IPs are kept within the boundary of the two lines formed.

Dynamic IPs

Crankcase pressure 2.5 atmospheres.

In order to obtain these results a program variant was selected to provide a choice of different heats ranging from 0 to 20 in equal steps from 0 to 1.3kW. Different heats can be requested while the engine is running. Referring again to the graph, the crankcase pressure was set to 2.5 atmospheres and short runs of 15 minutes given on each heat from 10 to 14. There is considerable heat difference between 10 and 14 but the IPs were almost the same for all heats and are shown by the brown coloured vertical line. The pressure change from maximum to minimum is the force that works the engine so that the length of this line may be regarded as potential power out. Why is the output low and why doesn't increasing heat give more output? Output is dependent on heat flow. Heat flow is low because there is insufficient

working gas to carry the required flow of heat through the engine

The quantity of gas being worked is directly related to the crankcase pressure and in this case the pressure is too low. At the time of taking readings, the monitor screen showed a significant rise in heater temperature due to the heat not being taken up by the worked gas. One has to be watchful with this program as under these conditions the heater temperature can exceed the maximum of 220deg.C. For normal running conditions, the heat input is controlled to maintain the heater constant at a desired temperature

Crankcase pressure of 3.5 atmospheres

The IP pressures are indicated by the green line. Things to notice are that the line is longer, even though the range of heat input is smaller. The line has moved closer to the confines of the two black lines. Efficiency is better but output is still limited by insufficient working gas. The monitor screen showed a very small rise in cooling water temperature in response to an increase in heat flow. There is a need for raising the pressure further.

Crankcase pressure 4.5 atmospheres

The engine becomes responsive to change of heat and for this reason I have shown to two heats separately. Heat 11 is shown red and heat 13 in blue. Heat 12 gives a perfect fit to the confining black lines but I have shown 11 and 13 as they illustrate the effect of a small change in heat when the engine is approaching its best performance.

Note the difference in length between the red and blue lines showing that the engine is able to respond to the higher heat. Cooling water temperature increases showing the increased heat flow. A smaller pressure increase is needed now as the engine is getting a bit fussy.

Crankcase pressure 5 atmospheres

Here the point has been reached where the amount of gas being worked is just right for all the other parameters in the engine and, like all things in electrical and mechanical engineering, they are right if a response is given to a small adjustment. The yellow line indicates the largest pressure span and the best output, using only heat 14. Cooling water is now showing a marked rise and thus offering more resistance to heat flow.

Five atmospheres gives the engine's peak output but if cold water is run through the cooler the pressure and the heat can be increased further giving a higher output. However, it is a shocking waste of tap water!

I would have liked to have carried on above 5 atmospheres pressure using the normal cooler to gather data on effects of over running the cooler and I had a program to take readings automatically over a range of cooler temperatures. Unfortunately this program was not used as above the peak output point the engine suffers from uneven running.

This could be partially corrected by the use of snifters, but that would just make rubbish of the IP readings. This is a characteristic of my engine only and fortunately it is not catching. It is thought to be due to the way the gas routes from the displacers to the cylinders. Two of the displacers have direct access to the cylinders, whereas the other two have to pass the gas through a channel, which adds to the dead space. These cylinders reach their peak before the other two and this results in the unevenness. It is a failure in the design that is not correctable.

I hope I have made a reasonable job of this explanation, and that you have enjoyed the series.



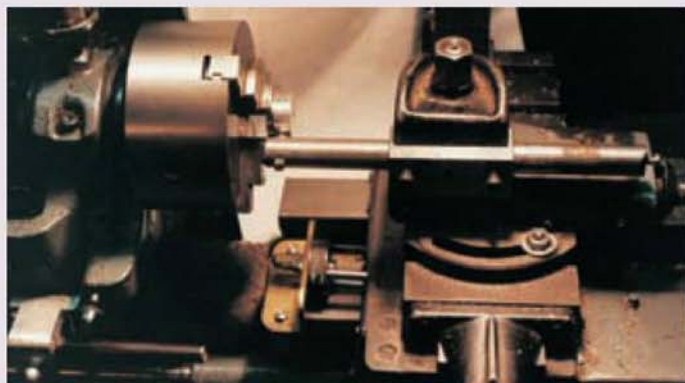
GRADUATE IN STYLE

Terry Lane

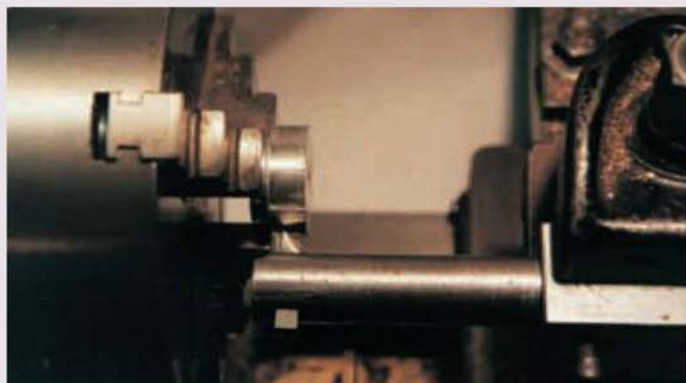
revisits his original article and, prompted by correspondence received, suggests a few enhancements to the technique.

Some time ago (*M.E.* 4108, 3 December 1999) I described the construction of a simple little indexing stop for use when carrying out graduating in the lathe. This prompted a letter from a reader, kindly passed on by *M.E.*, who discovered that, with the stop in place on the front bedway, a gap of some 2in.

remained between the tool and the chuck jaws. The truth of the matter is that when I put this little stop together, it was intended to be used in conjunction with a cutting tool held in a stout boring bar which, of course, allows us to reach back across the gap and cut graduations close to the chuck jaws. Unfortunately, having used this



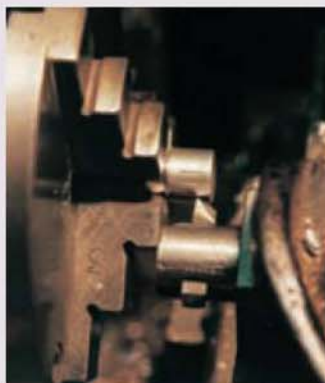
Reaching back; a view of the graduating set up.



A closer look at the set up.



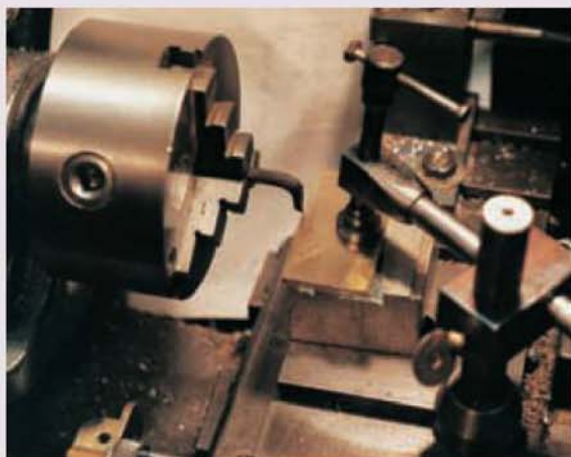
Stripped of its clamps, the device is shown bolted to the regular saddle stop.



Cutting the lines; overall length of the work piece is $\frac{1}{2}$ in.



This $\frac{1}{2}$ in. long test piece was cut as is.



The set up for 'straight line' graduating. Readers of *Model Engineers' Workshop* will know the origins of the clamp.



Cutting a test piece.

method of tool holding for almost all 'planing' type operations in the lathe (internal and external) for the last 20 years I did not think to include this piece of information and, in consequence, some confusion may have arisen. The photos here show the set up and may also help make the mounting position a little clearer.

It was while I had the stop set up on the lathe to take some photographs to pass on to our querist, that the thought occurred to try mounting the gizmo on my regular saddle stop. I had rejected this set up earlier as I did not think it would be sufficiently rigid, however nothing ventured, nothing gained, and so after a few quick measurements the stop was bolted to the end of the $\frac{3}{8}$ in. dia. tube that acts as the saddle stop, and the tube installed in its carrying block.

Hey Presto ... instant fix! With the stop mounted thus it can be withdrawn well back past the face of the chuck and proper alignment with the saddle is easily achieved by rotating the rod in the block.

Setting up is very easy indeed. With the tool just touching the face of the workpiece, hold a piece of material as thick as you want the short lines to be long (e.g. 2.5 or 3mm) against the contact area of the saddle then advance the stop rod with the longest (short line) pin in the working position until it just holds the thickness 'gauge' in place. Lock the rod in position, back the saddle off slightly and remove the 'gauge' piece and you are ready to proceed.

At the time of writing, the stop head, minus its clamps, is still installed on the lathe and is being used as the 'regular' saddle stop as it functions quite nicely and can be either withdrawn or the whole rod can be removed very easily. I had thought to further refine the thing by cutting off

the now redundant ends of the angle body to make it more compact, however, to do so would destroy its capacity to be mounted on the bed way and as there might well be times when the bed mounting is to be preferred, it has not been altered. It is highly unlikely that many readers would have a saddle stop exactly identical to mine, so giving detailed instructions for a head to suit would not be practical; just stick to the original design and modify it to suit your own requirements.

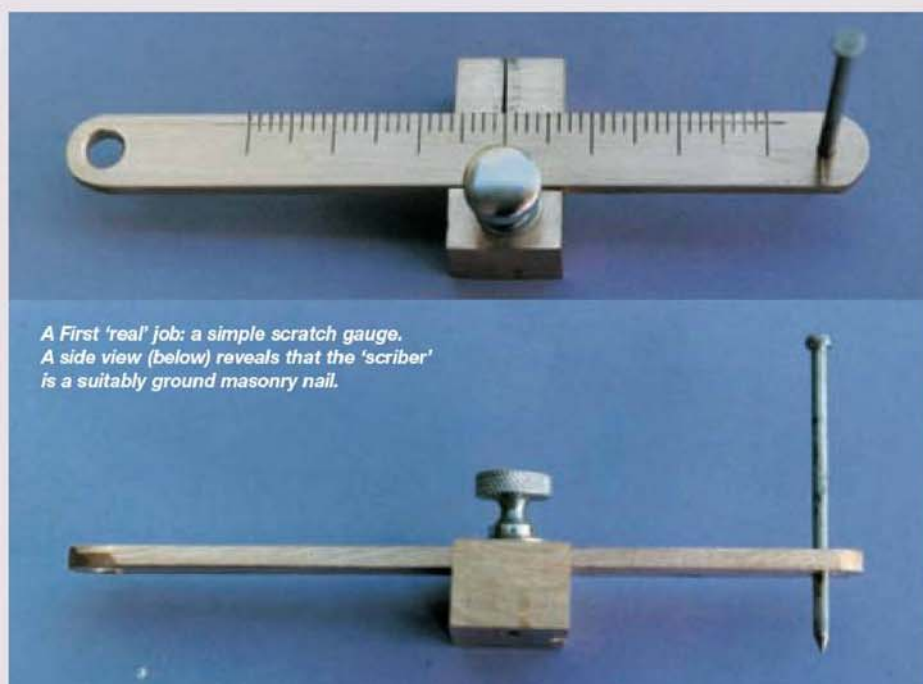
While I was still in 'graduating mode' a

further trial was carried out, this time on straight line graduating. With an oddment of 3mm brass clamped to the saddle with suitable packing (readers of *Model Engineers' Workshop* will recognise the origin of the clamp), a tool was gripped in the 3-jaw chuck and the mandrel locked. The tool in this instance was made from a redundant chain saw file, heated, bent, filed to shape then hardened and tempered. Being a country 'boy' I have a copious supply of these files to hand and I find that they respond well to water hardening.

With the stop set up as above, a series of cuts was made at 0.050in. intervals. In the event, my packing was not quite high enough and a slight downward pressure was required on the tool via my left thumb, but everything worked okay. In the event of a 'proper' job needing this operation coming along I would take the trouble to set the job up on the vertical slide, thus giving complete control over the cutting depth.

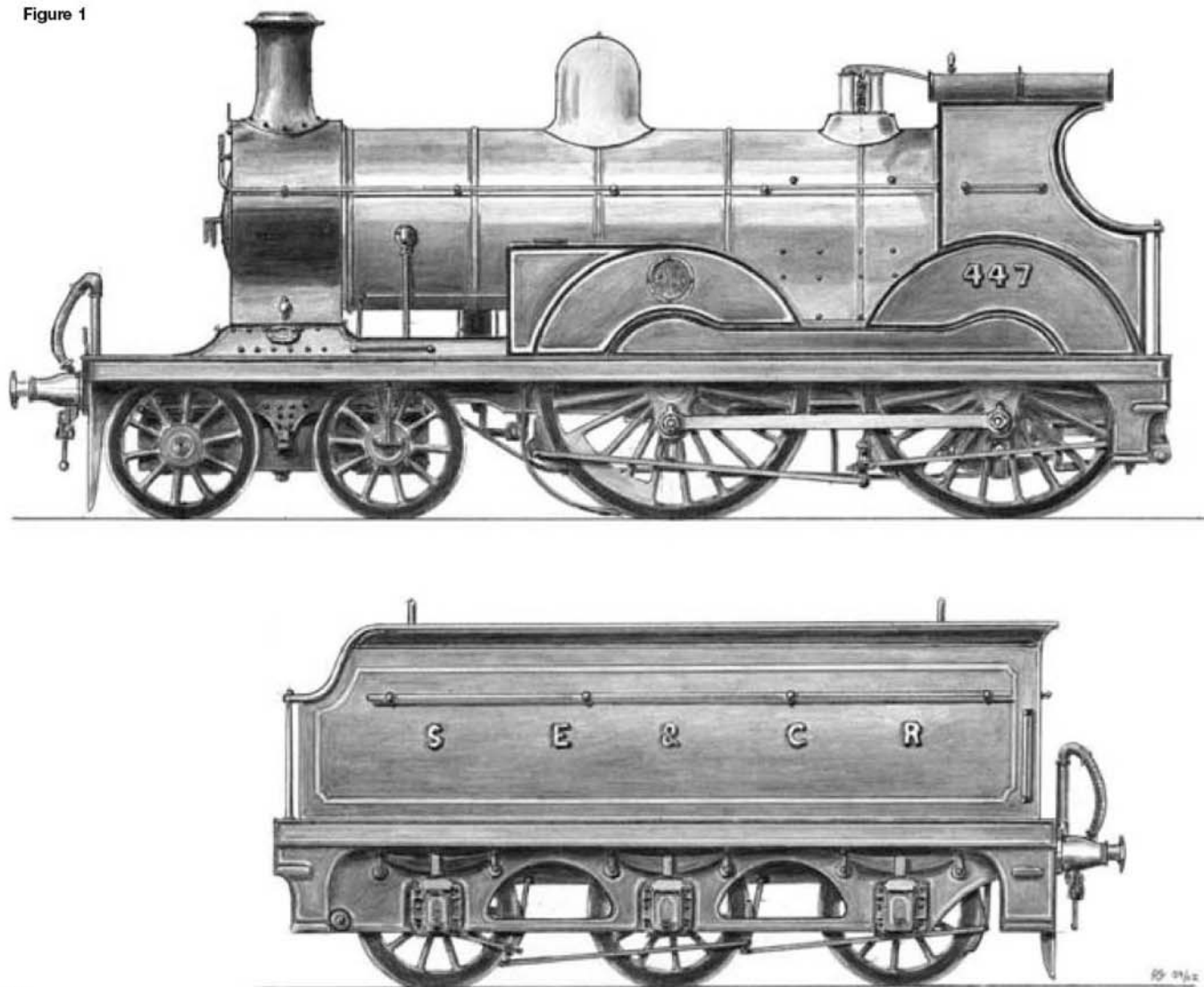
As an extension of this, it would not be difficult, via either a rotary table or dividing head, to cut divisions around the face O/D a circle or an arc, although to date I have done no work along these lines.

And so ended my second close look at the graduating stop, all thanks to a little constructive criticism. It is very satisfying to find that the tool will not only perform the job for which it was designed, but is versatile enough to be used in a number of other situations as well. 



A First 'real' job: a simple scratch gauge.
A side view (below) reveals that the 'scriber' is a suitably ground masonry nail.

Figure 1



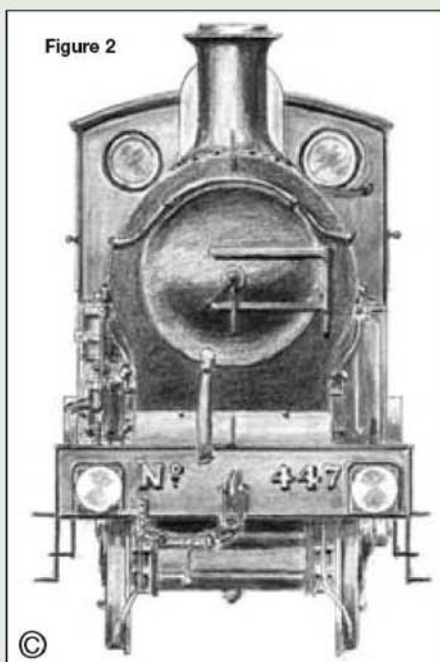
EDWARDIAN ELEGANCE

Ron Isted
describes the South Eastern
and Chatham Railway and its
'Rebuilt Stirlings': the B1 4-4-0s.
●Part III continued from page 487
(M.E. 4194, 2 May 2003)

The upward progress of the new electric lift in the BBC's recently opened prestigious building in West London slowed to a crawl and then proceeded in a series of jerks. The only other occupant of the lift, a cheerful middle-aged 'char' (nowadays known as a cleaning lady) gave me a broad grin. "Blimey" she said in an accent straight out of *East Enders*, "this is the *Slow, Easy and Comfortable* line, this is!"

The above incident took place in 1961, long before *East Enders* was thought of, but nearly 40 years after the 'Slow, Easy and Comfortable', aka the South Eastern and Chatham Railway, ceased to exist. At the time of its demise, my cockney lift companion would just about have started school, so why after all these years should she so

Figure 2

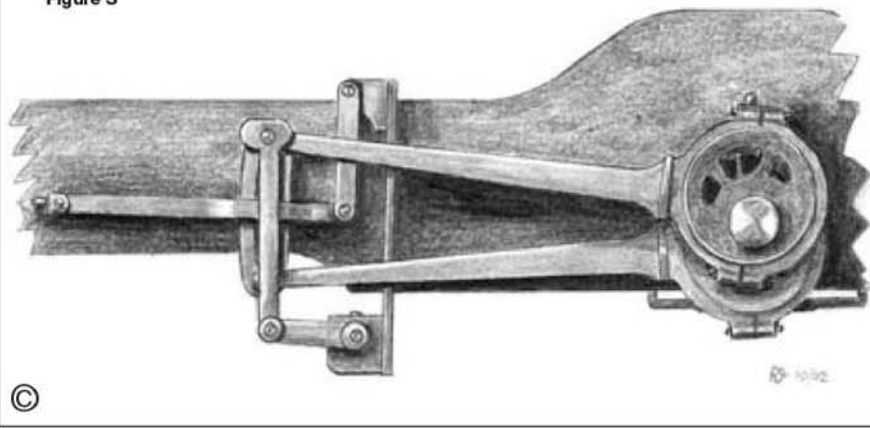


naturally refer back to something associated with her early childhood? I suspect the answer lies in one (hyphenated) word: hop-pickers.

Readers in the South of England and connoisseurs of Real Ale will know that the county of Kent is renowned for growing hops, the main ingredient used in the brewing of beer. In days gone by, the harvesting was carried out by a veritable army of seasonal casual labour and until comparatively recently, the South Eastern and Chatham and its successors the Southern Railway and British Railways ran a highly lucrative business transporting a large proportion of London's East End population to the fresh air of the Kent countryside. Here, whole families helped to gather in the hops in exchange for a holiday away from 'the Smoke' and, who knows, maybe even enjoyed a taste of the resultant brew.

The weekly 'STs' (*Special Timetable of Extra Trains: Private and not for publication*) which my railway signalman father used to bring home for me, not only showed pages of timings for hop-pickers' trains but even hop-pickers' friends' trains! To transport this mass of humanity, the railway kept a special collection of the most ancient

Figure 3



they were not thumped" — certainly inferior for example to the boilers produced at Derby to the designs of S. W. Johnson. The 4ft. 4in. diameter boilers fitted to Stirling's previous design, the otherwise similar F class, were even more shy for steam, probably because the grate area of both classes was only 16½

and decrepit rolling stock which had to be ridden in to be properly appreciated, and which spent the rest of the year decently interred in the furthest reaches of remote carriage sidings. The motive power of these museum pieces was usually an ex-SE&CR 0-6-0 'C' class goods engine dating back to 1901, or rather less

frequently, the subject of this article, a rebuilt ex-SER Stirling 4-4-0 of class F1 or B1, some of which first saw the light of day in the early 1880s.

So what, you will ask, is a Victorian locomotive doing in a series on Edwardian elegance? Two reasons: first, they were rebuilt from 1903 onwards and second, the colour scheme introduced by the South Eastern and Chatham Managing Committee is to me, along with Midland lake and Caledonian blue, one of the most attractive to adorn a railway engine. It also happened to be one of the most expensive: in 1910, the cost of painting a Chatham engine exceeded that of the neighbouring Brighton line, itself not renowned for cut-price work, by over 20%. Perhaps it is only fair to point out that the LB&SCR had given up Stroudley's famous yellow and was now using the somewhat cheaper Marsh umber brown.

The main Chatham colour was a genuine Brunswick green, which I believe was specially mixed 'in house' at Ashford, and should not be confused with the middle chrome green of the Great Western, often referred to as Brunswick. The borders were a lighter green edged by black with red and yellow lining, while the outside of the frames was deep red, also lined in red and yellow. The buffer beam was vermilion edged in black with a thin white line and the chimney, smokebox, top of the running boards and cab roof were really glossy black. Individual cast brass numerals were fitted to the cab side and polished brass was used in abundance for boiler mountings, splashers, joint ring between smokebox and boiler barrel, cab window frames, oil boxes, etc. The letters SE&CR on the tender were in gold shaded red, but perhaps the *piece de resistance* was the armorial device of the South Eastern and Chatham Managing Committee which adorned the leading splashers (fig 4).

The application of all this finery was of course a lengthy as well as an expensive process: after the initial rubbing down with pumice and 'stopping,' there followed various coats of red lead primer, each of which was allowed to dry thoroughly and then rubbed down and 'stopped'. Next came three coats of Brunswick green, and again each coat was left to become completely hard before again being rubbed down and filled, after which the lining was applied. Finally, the whole ensemble was given four coats of high quality varnish, again with drying time and much sand-papering between each coat.

Small wonder then that this was an expensive process even when labour was cheap, but I just wonder how the cost compares in real terms with the recent abortive foray by British Airways into the realms of High Art on the tail fins of its passenger aircraft?

In any case, the 'Slow, Easy and Comfortable' had a great deal of leeway to make up in terms of its public image: in the late 19th century, the South Eastern and London, Chatham and Dover were the two most reviled railway companies in the country, their reputation for exorbitant fares and bad service rivalling that of the Lancashire and Yorkshire a few years earlier. Does this too sound depressingly familiar? But I digress...

Figure 4



The subject of this article and drawings, SE&CR No. 447 was originally built as class 'B' for the South Eastern Railway in July 1898 at a cost of £3,230 by Neilson Reid of Glasgow, works No. 5332, to the design of James Stirling, the SER Locomotive Superintendent and younger brother of Patrick of GN fame. The engine carried a domeless boiler, trademark of that illustrious family, but was equipped with a more modern looking cab and tender. The mean diameter of the barrel was 4ft. 7in., an increase of 3in. over the previous 'F' class, but the pressure remained a modest 160psi and reading between the lines of contemporary railway literature, was not the most brilliant steam generator — "ran well as long as

square feet, compared to the 19sq.ft. or more of the Midland 4-4-0s. As the SE&CR, formed in 1899, inherited no fewer than 117 Stirling 4-4-0s of the two classes, many of which including No. 447, were almost new engines, something had to be done to give them a little more 'oomph'.

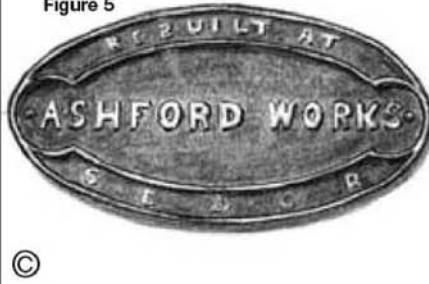
So Ashford's Chief Draftsman, Robert Surtees, an ex-London, Chatham and Dover man, produced a design for a domed boiler, the diameter of which was actually 4in. less than that of class B, and on paper increased the heating surface and grate area by just 3% and 6% respectively. In practice the rebuilding transformed those slightly wimpy small passenger engines the Southern ever possessed. The process began in 1903 and in the original version with short smokebox and the colour scheme already described, they became one of the best proportioned 4-4-0s ever to run in this country, in my opinion even more elegant than the classic D class 'Coppertops' built new for the same railway from 1901.

These too were largely the work of Robert Surtees, although officially designed by the SE&CR Locomotive, Carriage and Wagon Superintendent, Harry Wainwright, but to me they have always had a slightly 'chinless' look — very difficult to describe, but if you look at a standard three-quarter view, I think you will see what I mean. Better still, visit the National Railway Museum at York and inspect 'D' No. 737 which carries a superb re-creation of the SE&CR colour scheme, which incidentally can also be seen on the Bluebell Railway in Sussex on three ex-SE&CR locomotives.

The Stirling rebuilds did not long remain in the condition shown in fig 1: from 1914, the original colour scheme was very much simplified and later in the first World War, the SE&CR adopted what must surely be the *least* attractive scheme ever applied to a railway engine — an overall slate grey which rapidly weathered to a dirty matt black, with plain large white numerals on the tender, and this funereal garb lasted until the Southern Railway was formed in 1923. Whatever the 'Railwayacs' of the day thought, the change was not altogether unwelcome to the footplate crews, who had complained previously of their view ahead being impaired by the sun glinting off the polished brass.

The physical proportions of these elegant 4-4-0s were also changed, and not for the better, when in 1915 Ashford began to incorporate extended smoke boxes. To make matters worse, they were copiously covered in what LBSC called 'pimples,' large snaphead rivets in place of the neat countersunk variety previously used. As the earlier rebuilds went through Ashford works for overhaul,

Figure 5



all were gradually updated to the later design and by the end of 1924 not a single locomotive remained in the condition shown in my drawing.

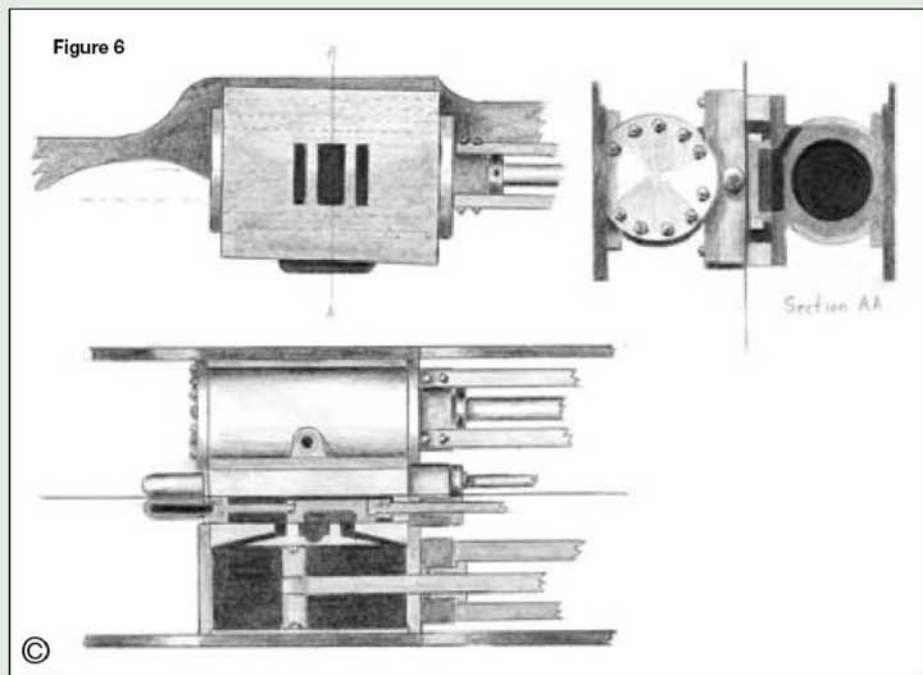
The 'rebuilt Stirlings' as they were universally known, were excellent performers and in their earlier days worked every type of passenger train, from the 'Royal' boat trains to Queenborough, for which an F1 was specially fitted with a copper capped chimney, to the hop-pickers' trains previously described. For many years they virtually monopolised the Reading-Redhill-Tonbridge services and were well liked by both drivers and firemen. Perhaps the best indication of their popularity was the way in which ex-LB&SCR men accepted them in the early 1930s as replacements for their native coal-gobbling B2x 4-4-0s, derisively known as 'grasshoppers'.

In spite of the spreading tentacles of the Southern Railway electrification schemes, many carried on to serve under their fourth owner, the nationalised British Railways and the last machine was not taken out of service until February 1951. I remember very clearly, six months earlier from my parents' home in Surrey, seeing this last survivor, B1 No. 1443, running light engine up the Brighton main line. Although in a rather shabby and run-down state, she was obviously still a game little locomotive and beneath the grime somehow managed to retain that racy, thoroughbred look which some engines have and others definitely do not.

The subject of my drawing, B1 No. 447, was rebuilt in March 1911, but was one of the first to be scrapped, as long ago as 1933. My reason for choosing this particular engine is that I have scaled many of the dimensions from a very fine photograph of her in *Locomotives Illustrated* No. 115 (see Bibliography). In view of the fact that so many 'Stirlings' survived the Second World War, it is surprising that no general arrangement diagram of either F1 or B1 still exists (at least as far as my enquiries are concerned!), so my drawing incorporates information from a variety of sources.

It has been stated many times that the F1 and B1 rebuilds were identical apart from their tenders, but like so many 'facts' that are regurgitated over and over again, this simply is not true. The cab of the B1, retained I believe from its 'domeless' days, was 6in. wider than that which replaced the typical Stirling rounded cabs on the F class and from a modelling point of view this is quite important, as in $3\frac{1}{2}$ in. gauge for example, it gives us an extra $\frac{3}{8}$ in. in which to squeeze our overscale cab fittings (fig 2). The driving and coupled wheel splashes were also 3in. wider than on the F1, again an advantage in a miniature version, while the small 'splashes' over the coupling rods, were correspondingly narrower. The tender of the B1 is also wider, with the springs mounted in the modern position below the running board, where in small size they are less vulnerable than the rather ungainly arrangement above the footplate on the F1.

The main frames were a modest 1in. thick and of course an exact scale version ($\frac{1}{16}$ in. in $3\frac{1}{2}$ in. gauge) would be hopelessly flimsy for a working model, but using the normal $\frac{1}{8}$ in. thick plate at the 'standard' spacing of $2\frac{7}{8}$ in. (to quote $3\frac{1}{2}$ in. gauge again) will lead to two major problems with this particular engine. The first is that the rather shallow front end section of the main



frame will be reduced to the equivalent of about 3in. deep because of the cut-outs for the unusually large diameter bogie wheels, 3ft. 9in. The second challenge is that on this locomotive, like so many whose original design dates back to the 19th century, the valves are between the cylinder bores and our overscale frames make an already constricted layout almost, but as I hope to show, not quite impossible.

Let us first examine the bogie wheel situation: the problem is alleviated to some extent by the unusually short wheelbase, 5ft. 4in., which will reduce the sideways displacement of the wheels by about 12% compared to the more normal 6ft. 6in. wheelbase. Even so, I fear that without a little judicious wangling there would be some unpleasant grinding noises on a 30ft. curve in $3\frac{1}{2}$ in. gauge. As mentioned above, the combination of wheels to exact scale on tread, overscale flanges and enough clearance in the cut-outs to allow for the relative roughness of our miniature tracks will leave the frames approximately $\frac{3}{16}$ in. ($3\frac{1}{2}$ in. gauge) or $\frac{17}{64}$ in. (5in. gauge) deep between the front buffer beam and cylinder block. To increase the depth of the frame upwards (if you see what I mean!) would completely ruin the appearance of the engine, so I make two suggestions:

- 1: work to scale diameter over flanges rather than treads, and
- 2: fit a horizontal stretcher where the frames are at their shallowest.

The disadvantage of (2) is that it will add even more weight to the front end, always a problem with 4-4-0s, so some fairly substantial lightening holes will be necessary. The above does not help the situation with the rear bogie wheels, but here the depth of frame above the cut-outs will be much greater, about the equivalent of $8\frac{1}{2}$ in. in full size.

While on the subject of the bogie, James Stirling's design, which was retained when the engines were rebuilt, possessed other peculiarities apart from its short wheelbase. The pivot was 1in. in front of the mid point, whereas brother Patrick on his famous Great Northern 8ft. 'Singles' placed it 3in. behind the mid point of his 6ft. 6in. bogie. James' centre pin moved in an oval slot which gave it $\frac{3}{4}$ in. movement to either side and was positioned in the 'fork' of a horizontal 'Y' frame, the jaws of which projected towards the rear.

They were, in fact, hollow sockets into which arms fitted to the main bogie frame and fitted with rubber pads, projected and provided side control. This unconventional bogie would make an interesting project in miniature and detailed drawings of the full size version are listed in the Bibliography.

Both Patrick's and James' designs gave long and honourable service — nearly 70 years in James' case — and nowhere have I found any mention of complaints about rough riding on the Stirling rebuilds. Considering the abysmal state of some of the permanent way in the South East of England right into Southern Railway days, it would appear that James' bogie design must have been more than adequate.

Of course cynics will say that speeds in that part of the world were so low anyway that design deficiencies would not be noticeable, but that is not actually true. In 1895, the fastest booking over the $26\frac{1}{2}$ miles between Tonbridge and Ashford was just $29\frac{1}{2}$ minutes, average 54.1mph, while others were only a minute slower. Even the lordly Great Western could only muster 53.2mph over Brunel's billiard table! Over more difficult stretches, the South Eastern had booked speeds of 36-40mph, which compared reasonably well with most other companies at the time. Punctuality had improved a great deal by the late 1890s and in June 1898 the average lateness for all South Eastern passenger trains was $3\frac{3}{4}$ minutes. When one considers the congestion even then in the London area, including the almost unworkable layout between London Bridge, Charing Cross and Cannon Street, not to mention the permanent feud with its neighbours the London, Chatham and Dover, and London, Brighton and South Coast (over the joint line to Redhill), this was no mean achievement.

So to the second major challenge in building a miniature live steam version of this attractive 4-4-0: the layout of cylinders and valves. It has been stated that the rebuilds were given new 18in. diameter cylinders instead of 19in., while retaining the 26in. stroke, but I think it more likely that the original castings were retained and lined up to the smaller diameter. Certainly the rather old-fashioned version of the Stephenson link motion (fig 3) with its jointed intermediate valve spindle suspended from a vertical swing

The South Eastern & Chatham Railway Rebuilt Stirling B1 No. 447

Useful Dimensions

Note: these are intended specifically for use in producing a miniature version of No. 447, so 'internal' measurements such as heating surface and diameter of boiler barrel sections are omitted.

The figures for 3¹/₂in. and 5in. gauges have been calculated to the nearest 1/64in., using 3/4in. to the foot and 1¹/₁₆in. to the foot respectively.

For gauge 1, halve the 3¹/₂in. gauge figures, for 2¹/₂in. gauge, halve the 5in. gauge figures, for 7¹/₄in. gauge, double the 3¹/₂in. gauge figures. Figures prefixed by ~ are approximate only

Description	Full Size	3 ¹ / ₂ in. scale (3 ¹ / ₂ in. gauge)	1 ¹ / ₁₆ in. scale (5in. gauge)
Overall length: engine and tender	52ft. 9 ¹ / ₄ in.	39 ⁷ / ₆₄ in.	55 ¹ / ₁₆ in.
Overall length: engine	29ft. 11 ¹ / ₂ in.	22 ¹⁵ / ₃₂ in.	31 ⁵³ / ₆₄ in.
Overall length: tender	22ft. 2in.	16 ⁵ / ₈ in.	23 ³⁵ / ₆₄ in.
Maximum width over footsteps	8ft. 5 ¹ / ₄ in.	6 ²¹ / ₆₄ in.	8 ⁷ / ₈ in.
Height to top of chimney	13ft. 2in.	9 ⁷ / ₈ in.	13 ⁶³ / ₆₄ in.
Overall length of main frame	28ft. 0 ¹ / ₄ in.	21 ¹ / ₆₄ in.	29 ²⁵ / ₃₂ in.
Overall length of bogie frame	7ft. 6 ¹ / ₂ in.	5 ²¹ / ₃₂ in.	8 ¹ / ₆₄ in.
Engine wheelbase	5ft. 4in. +	4in. +	5 ⁴³ / ₆₄ in. +
	7ft. 4 ¹ / ₄ in. +	5 ³³ / ₆₄ in. +	17 ¹³ / ₁₆ in. +
	8ft. 6in.	6 ³ / ₈ in.	9 ¹ / ₃₂ in.
Tender wheelbase	6ft. 0in. + 6ft. 0in.	4 ¹ / ₂ in. + 4 ¹ / ₂ in.	6 ³ / ₈ in. + 6 ³ / ₈ in.
Bogie wheel diameter (10 spokes)	3ft. 9in.	2 ¹³ / ₁₆ in.	3 ⁶³ / ₆₄ in.
Driving and coupled wheel diameter (20 spokes)	7ft. 0in.	5 ¹ / ₄ in.	7 ⁷ / ₁₆ in.
Tender wheel diameter	4ft. 0in.	3in.	4 ¹ / ₄ in.
Height to running board	4ft. 4in.	3 ¹ / ₄ in.	4 ³⁹ / ₆₄ in.
Height to cab roof	11ft. 11in.	8 ¹⁵ / ₁₆ in.	12 ²¹ / ₃₂ in.
Length of cab roof	4ft. 9in.	3 ⁹ / ₁₆ in.	5 ³ / ₆₄ in.
Maximum width of cab roof (B1)	7ft. 3in.	5 ⁷ / ₁₆ in.	7 ⁴⁵ / ₆₄ in.
Width of cab sides (B1)	6ft. 6 ¹ / ₂ in.	4 ²⁹ / ₃₂ in.	6 ⁶¹ / ₆₄ in.
Height of cabside: footplate to bottom of cut-out	3ft. 4in.	2 ¹ / ₂ in.	3 ³⁵ / ₆₄ in.
Width over footplate	7ft. 7in.	5 ¹¹ / ₁₆ in.	8 ¹ / ₁₆ in.
Width of tender body (B1)	6ft. 6 ¹ / ₂ in.	4 ²⁹ / ₃₂ in.	6 ⁶¹ / ₆₄ in.
Width of splashers (B1)	1ft. 3in.	1 ⁵ / ₁₆ in.	1 ²¹ / ₆₄ in.
Width of coupling rod splashers	3 ³ / ₄ in.	1 ⁵ / ₈ in.	2 ¹ / ₆₄ in.
Cylinders: bore x stroke	18in. x 26in.	1 ¹ / ₈ in. x 1 ⁵ / ₈ in.	1 ¹⁹ / ₃₂ in. x 2 ¹⁹ / ₆₄ in.
Inclination of motion	1 in 30	-	-
Length of connecting rod	5ft. 11in.	4 ⁷ / ₁₆ in.	6 ⁹ / ₃₂ in.
Length of eccentric rods	5ft. 2 ³ / ₄ in.	3 ⁵⁹ / ₆₄ in.	5 ⁹ / ₁₆ in.
Centres of eccentric rod pins	1ft. 6in.	1 ¹ / ₈ in.	1 ¹⁹ / ₃₂ in.
Boiler: Pitch above rail level	7ft. 10in.	5 ⁷ / ₈ in.	8 ⁵ / ₁₆ in.
Diameter of boiler over cladding	~ 4ft. 5 ¹ / ₂ in.	3 ¹¹ / ₃₂ in.	4 ⁴⁷ / ₆₄ in.
External length of smokebox	2ft. 9 ³ / ₄ in.	2 ⁷ / ₆₄ in.	2 ⁶³ / ₆₄ in.
Diameter of smokebox door	3ft. 10in.	2 ⁷ / ₈ in.	4 ¹ / ₁₆ in.
External diameter of chimney	1ft. 4 ³ / ₄ in.	1 ³ / ₆₄ in.	1 ³¹ / ₆₄ in.
Height of chimney	2ft. 9 ⁵ / ₁₆ in.	2 ⁵ / ₆₄ in.	2 ⁶¹ / ₆₄ in.

Dimensions indicated thus ~ have been scaled from a drawing or photograph.

link and underhung weighshaft was retained on the rebuilt engines.

The locomotive type expansion link was suspended from the top (forward) eccentric rod pin and full travel in forward gear was 4⁵/₁₆in. while in back gear it was 3¹⁵/₁₆in. Other relevant dimensions: steam ports 1¹/₂ x 16in., exhaust 3¹/₂ x 16in., lead 3¹/₁₆in., lap 1in., angle of forward eccentric 105¹/₂deg., backward eccentric 105deg., throw of eccentrics, 6¹/₂in. Although these are obviously pre-Churchward (but post Benjamin Conner!) figures, the generous exhaust ports are worthy of note and make an interesting comparison with Stroudley's famous 'Gladstones' for example, which had ports of 1¹/₂ x 15in. and 2 x 15in. respectively.

The 18in. cylinders on the full size B1 were inclined at 1in. 30 and set at 2ft. 4¹/₂in. centres, which left just 10¹/₂in. for depth of steam chest and the steam and exhaust passages. Translating all this to 3¹/₂in. gauge, major difficulties arise: assuming the standard 2⁷/₈in. between frames and scale diameter cylinders, i.e. 2 x 1¹/₈in., we are left with just 5⁵/₈in. for

- 1: depth of steam chest,
- 2: room for steam and exhaust passages and
- 3: two cylinder wall thicknesses.

The obvious solution seems to be to forget the valves between layout altogether, put them above or below the cylinder bores and use vertical rocking shafts. But remember we have an extremely short bogie wheelbase and even assuming scale diameter over flanges, there is just 1¹/₈in. (for 3¹/₂in. gauge) between the two wheels, hardly enough to clear a big deep cylinder block with valves above or below, the length of which will be at least 2⁵/₁₆in.

In any case it would be a great pity and an admission of defeat to give up without a struggle, so here are a few thoughts and suggestions which may provoke discussion and (I hope) constructive criticism.

The first point is that any small locomotive, and indeed some full size examples of this wheel arrangement, are notoriously front heavy. By reducing the diameter of the cylinders by the equivalent of 3 or 4in., not only do we gain another 3³/₈-1¹/₂in. (3¹/₂in. gauge again) of horizontal space, but we also reduce the weight on the bogie. It is as well to accept the fact that no 4-4-0 is likely to break records at IMLEC in load haulage, but if necessary the boiler pressure could be increased above the normal 70-80psi to compensate for smaller cylinder volume, and the use of heavier

gauge boiler components would also have a beneficial effect on the weight distribution. The late C. M. Keiller for example achieved excellent results in 2¹/₂in. gauge, using a combination of 150lb. pressure and small cylinders.

Is it my imagination, or do I hear a cacophonous racket wafting down from the Celestial Regions in a mixture of snorts of derision from LBSC and loud cheers from K. N. Harris?

When it came to putting pen to paper, again in 3¹/₂in. gauge, I had what I first thought was the brainwave of the century for winning a further 1/4in. of 'horizontal' space, by cutting narrow longitudinal slots in the frames and 'stepping' the centre section of the outer side of the cylinder block to a nice snug fit in the said slot. Having had several attempts at making it work it became only too apparent that this was one of those 'paper' ideas which are totally impractical — not least because in this engine the inclination of the cylinders would have to be increased from 1in. 30 to approximately 1in. 12 in order to position the slot in the frame clear of the bogie wheel cut-outs. A more serious disadvantage is that almost the entire locomotive would have to be dismantled in order to remove the cylinder covers and finally, the outside of the frames above the footplate would probably have to be clad to conceal the join. All in all, not quite the brilliant idea I thought it was.

Back to the drawing board and fig 6 is the result of further lengthy deliberations, originally drawn full size for 3¹/₂in. gauge but reduced for publication. Please note this is a sketch intended as a subject for discussion rather than a blueprint for construction and not all details are shown. As will be immediately obvious, things are pretty tight to put it mildly and perhaps this is why I have been unable to discover any commercially available castings in this scale, but I hope all is not lost, as will be revealed.

Eagle-eyed experts will notice that the overall length of the cylinder block is rather shorter than normal: it is in fact 2⁵/₁₆in. including cylinder covers instead of the standard 2¹/₂in. Now the usual 7¹/₁₆in. thick piston, plus scale stroke of 1⁵/₈in., plus two 1/8in. cylinder covers, plus two 1/32in. 'registers,' add up to 2³/₈in., without any allowance for clearance, so how do I propose to persuade this particular quart into a pint pot?

The main reason for our long cylinder blocks is overscale piston thickness and one possible solution to this problem was put forward in *Model Engineer* as long ago as 1964 by the late Arnold Throp: the use of O-rings in place of what one writer to *Postbag* graphically described as 'bits of granny's vest' i.e. braided graphited yarn. Unfortunately, there still appears to be some confusion about the ability of O-rings to withstand high temperature steam: in his original article, Mr. Throp claimed "they will stand 1000lb. per sq. in.," presumably dry saturated steam. The steam tables in my elderly copy of Dalby only go up to 550psi, at which the temperature is approximately 248deg. C, so it is reasonable to assume that 1000psi will be around 300deg. Celsius. In *M.E.* 3845, 17 March 1989, the late Jim Ewins reported that he had achieved a maximum temperature of 387deg. C using a radiant superheater, but in *M.E.* 3955, 15 October 1993, Mr. Southworth informed us that the maximum working temperature of silicone O-rings

is 230deg. C, roughly equivalent to dry saturated steam at 400psi. Does this mean they are not suitable for use with modern radiant superheaters?

Another article in *Model Engineer* some years ago suggested the use of stainless steel piston rings in gunmetal cylinders: test results quoted seemed very promising, but nothing further seems to have been forthcoming. The firm named in the article still manufactures these rings and is very sympathetic to model engineers, but as the rings are produced by the thousand for hi-tech applications in the car and aero industries there is an understandable reluctance to deal with orders from our fraternity for one pair at a time! The chairman of this family run firm told me on the telephone that, provided they happened to have 'spares' in stock, they would be prepared to donate them — a very generous offer, as they are high-precision and therefore expensive. If anybody is really serious about experimenting along these lines, please contact me via the editor and I will do my best to co-ordinate matters.

The use of piston rings in gunmetal cylinders would enable us to supersede the frankly rather amateurish graphited yarn, and more important reduce the piston thickness to approximately scale dimensions instead of twice that figure. The usual objection is possible lubrication problems, but surely that is not insoluble.

I would be interested to know how others have solved the inside cylinder/valves between conundrum in 3 1/2in. gauge, as this layout was very common indeed in 19th century locomotives until cylinder diameters increased to the point where exactly the same difficulties arose in full size. Successful designs have been produced in 5in. gauge, including Martin Evans' *Boxhill, Metro* and *Stirling* (GNR 2-2-2!) and Don Young's LSWR '02' *Calbourne*, but it is perhaps significant that the largest cylinder bore specified is 1 3/8in., equivalent to 1 1/2in. in full size. In all the above designs, the depth of the communal steam chest is 3/4in. (8 1/2in. in full size.)

To return to fig 6, I have made the following alterations to the strict scale dimensions:

- 1: cylinder diameter reduced from 18 to 14in. (1 1/8 to 7/8in. in this scale)
- 2: cylinder centres at the equivalent of 2ft. 6in. instead of 2ft. 4in.
- 3: bogie wheelbase increased by approximately 1 1/2% from the equivalent of 5ft. 4in. to 5ft. 5in., which amounts to just 1/16in. in this scale.
- 4: bogie wheels scale size over flanges, the equivalent of 3ft. 7 1/2in. in tread instead of 3ft. 9in.

My sketch is based on Martin Evans' *Metro* castings, cut down to 3 1/2in. gauge, and I think Don Young's '02' castings could be used, but I have drawn in a more substantial outer bolting flange. The depth of the steam chest (or should that be width as it is vertical?) is 9/16in. which is equivalent to 9in. in full size, slightly more generous *pro rata* than the 5in. gauge original, but actually very shallow. The port sizes are 1/8in. by 5/8in. (steam), 9/32in. by 5/8in. (exhaust), which in full size would give areas of 20sq.in. and 45sq.in. respectively, compared to the 24sq.in. and 56sq.in. of the original engine. In my suggested layout, the cylinder bore is 7/8in. and the distance from cylinder centre to port face

is 2 1/32in.: the figures for *Metro* are 1in. and 3/4in. respectively, but if the steam chest bolting flange is reduced from Martin's specified 3/16 to 9/32in., it should be feasible. As I said, the drawing is there for you to tear to bits, but please don't tell me I am no engineering draftsman because I am already well aware of that.

Let us turn to less complicated matters, namely wheels: as mentioned earlier, I suggest making the bogie wheels the equivalent of 3ft. 7 1/2in. dia. on tread, that is 2 23/32 in 3 1/2in. gauge. The only 10 spoke wheels that may be suitable are tender wheels for Martin Evans' *S15 Greene King*, which in view of the Stirlings' association with hop-pickers' trains would be eminently appropriate! However, their specified tread diameter is 27/8in., so you may end up with slightly undernourished tyres. In 5in. gauge, 3 7/8in. diameter is what we need and Martin's *Metro* leading wheels should be ideal, with the correct 10 spokes.

The driving and coupled wheels on our B1 are 7ft. diameter with 20 spokes and a crankpin throw of 12in. (compared to the piston stroke of 26in.) Again assuming scale diameter over flanges, tread diameter in 3 1/2in. gauge works out at approximately 5 5/32in. and in 5in. gauge, 7 1/8in.: in the smaller size the driving wheels for LBSC's *Jeannie Deans Webb* compound are nominally just 3/32in. larger and have the correct crankpin throw of 3/4in., but I am not sure about the balance weights or the cross section of the spokes. In 5in. gauge, Don Young's GCR *Atlantic Jersey Lily* driving and coupled wheels would appear to be possible with the correct number of spokes, but the designed crank throw is 3/32in. more than the 1 1/16in. on our 4-4-0 Martin Evans' GER 'Super Claud' may be usable, specified tread diameter 7in., with 1 1/8in. crank throw.

Finally, the smokebox and boiler of the B1: referring back to fig 6, the milled away section of the top of the frame, visible in the frontal view, is intended to receive the smokebox wrapper. If fitted inside the full thickness of the frame, it would be immediately obvious that our frames are twice the thickness they should be. With the short smokebox as shown in fig 1, it will make sense to recess the front tube plate into the barrel to leave more room for the superheater header which of course the full size locomotive did not have, and other fittings. The boiler is generally very straightforward, diameter over lagging approximately 4ft. 5 1/2in. with a deep and level grate. As already mentioned, the grate area, even on the rebuilds, is none too generous, so there must be a temptation to extend it back over the coupled wheels and make it sloped. This must not be overdone on this engine however, as with the rather meagre cab, the out of position back head could easily become very obvious. A detail on the full size engine which was really eye catching was the polished brass reducing ring between smokebox and boiler barrel — but if anyone does have a go at building a 'Stirling,' they will be pretty skilled at working in brass by the time the engine is finished.

One final thought: James Stirling retired at the end of 1898, but continued to live at Ashford, where he was a familiar figure around the works

until shortly before his death in 1917 at the age of 81. I just wonder how he reacted to the crop of sassenach bulbous excrescences which sprouted in such profusion on the boilers of his engines?

Postscript

Since writing the preceding text, I have discovered that one detail at least of James Stirling's bogie design was not as unusual as I thought: on J. F. McIntosh's famous 'Dunalastair' 4-4-0s for the Caledonian Railway, the 'centre' pin was also 1in. in advance of the centre point, although the wheelbase was the more normal 6ft. 6in. Perhaps one of our experts could comment on what appear to be diametrically opposed opinions on the position of the pivot? With the relatively sharp curves of miniature tracks, it is probably more important than in full size, or is it in practice, academic?

I was also surprised to find that frame slots were cut to house the 20in. cylinders of the later 'Dunalastairs,' so perhaps my idea was not quite so impractical as I thought! However, the 6ft. 6in. wheelbase on the Caledonian engines gives much more freedom longitudinally than James Stirling's 5ft. 4in. design.

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- 2: *SER Locomotives*; D. L. Bradley; Pub. RCTS 1963.
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- 11: *British Locomotive Builders' Plates*; K. Buckle/D. Love; Pub: Midland Publishing.
- 12: G.A. Side Elevation original SER 'B' 4-4-0 (Neilson Reid)* NRM drawing 2/GW/10832.
- 13: G.A. Plan original SER 'B'* NRM drawing 2/GW/1831.
- 14: Weight Diagram Southern Railway B1 4-4-0; NRM drawing 2/GW/17795.

References marked thus* contain a description and/or drawings of J. Stirling bogie; Nos. 5 and 8 are the most useful.

●To be continued.

Neville Evans

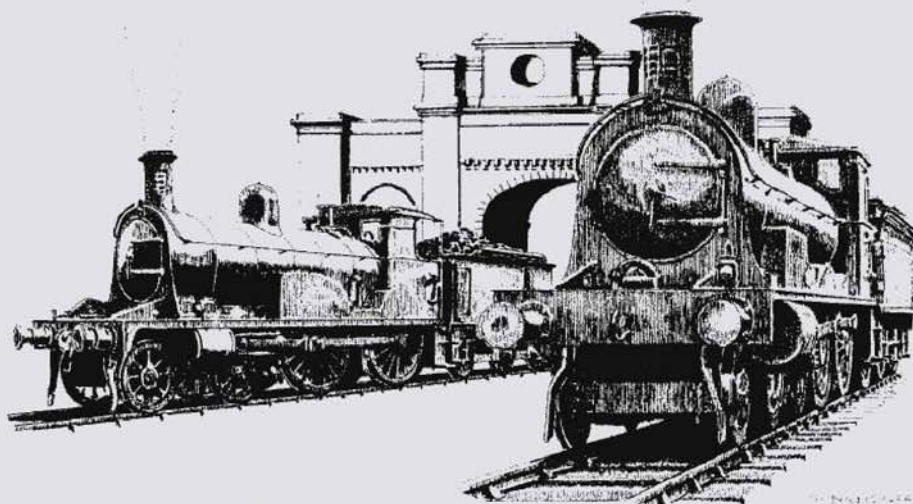
looks at some more boiler fittings, dealing this time with clack and blow-down valves, fire doors, grate and ash-pan.

●Part XXVII continued from page 616 (M.E. 4196, 13 June 2003)

I have decided to use three clack valves so as to avoid T-pieces, water diverting valves, extra lengths of copper tubing, stop cocks and all those little bits and pieces that seem to empty tenders in a trice when I'm not looking. The two main injector valves are reproductions of the Gresham and Craven No. 9 combination injector, as used on both the Highland locomotives. I have arranged for these devices to be made by Dave Noble from whom they may be obtained at reasonable prices. They are left and right handed, of superb quality, as one would expect of anything that emanates from the Noble establishment and of course were used on many of the locomotives of our era. For those of you who prefer to make everything yourselves, I shall include a drawing, together with that of the Westinghouse brake valve, at a later date. And the best of luck!

Hand pump clack valve

This is to be found on the bottom of the backhead, next to the blow-down valve. Mr. Goodall and I have been using O-ring clack valves for over 20 years, and the valve that I have measured, and show for your inspection, has been used in



THE HIGHLAND RAILWAY JONES 'BIG GOODS' & LOCH 4-4-0 LOCOMOTIVES IN 5in. GAUGE

Deryck's test boiler for at least 10 years. The O-ring has never been replaced. We tested it yesterday, and it leaked not a drop of water at 50psi. The O-ring is of silicone rubber, the last time I looked I had about 50 left, so if you can't find one, drop me a line and I'll send you some.

The important part is the valve bobbin, which is simple enough to make; just remember to file

Blow-down valve

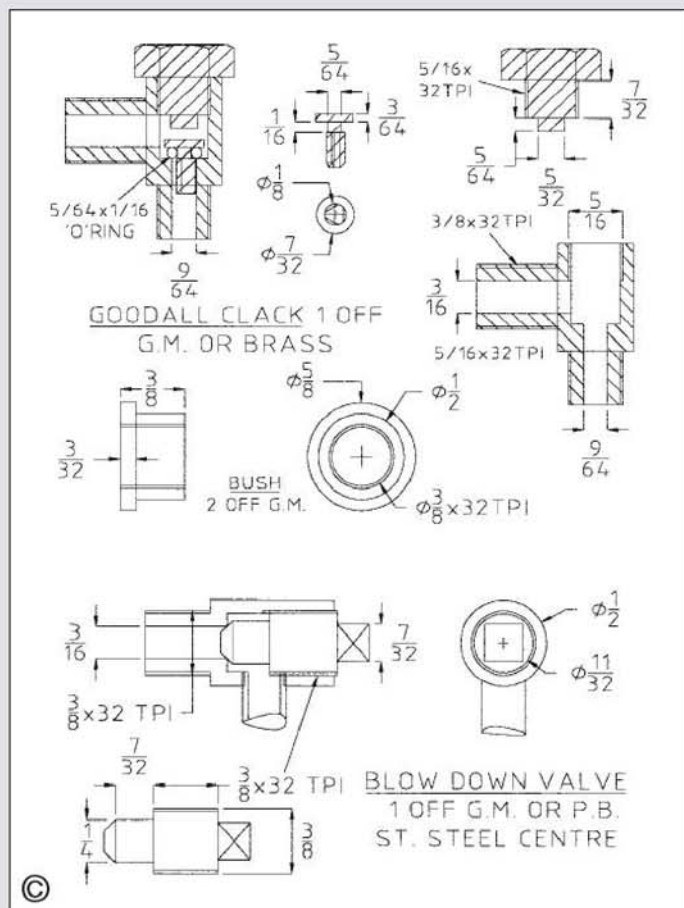
This is a simple, standard sort of valve. Make sure that you get the seats square with a D-bit and ream the $\frac{3}{16}$ in. hole. Use a good quality gunmetal or phosphor bronze with a polished stainless steel spindle, so as to avoid undue wear on the seat.

Fire doors

The Jones locomotives used a fire door that opened inwards into the fire. This quite probably came from William Stroudley who used it on most of his engines. It was common in British railway practice at the end of the nineteenth century. I see little to commend it as a 5in. gauge fitting, and consider that the single drop door that I have drawn would do a far better job. The heat deflector plate helps to hold the door shut, although the depression in the fire box will certainly do that whenever the locomotive is in steam. I would go so far as to say that the door on my *Hielan' Lassie* which worked on the same principle was quite difficult to open when the locomotive was running. The little handle may be more conveniently placed up the other way, so as to open it with a shovel from above. You can decide for yourself. The heat deflector plate is held onto the back of the door by a machined piece of bright mild steel round bar which is then riveted onto said door. Make the shield from a small piece of stainless steel.

Ash pan and grate

These are among the most critical parts of a locomotive, especially in full size. Many British locomotives were hamstrung by poor ash-pan design, especially those where the ash-pan passed over a coupled axle. The problem in Britain lay with the use of big wheels and hence high axles, coupled with low boilers due to the small loading gauge. In fairness to the average draughtsman however, it was generally thought at the time, that a low centre of gravity was to be desired, which necessitated a low slung boiler. It wasn't realised in most circles, that a higher C of G helped to





Four lubricators were fitted to the 'Big Goods' slidebars: HR No. 103 was photographed at the Glasgow Museum of Transport and Technology.



A simple cylinder displacement lubricator is fitted to the 'Big Goods' but the designs varied.

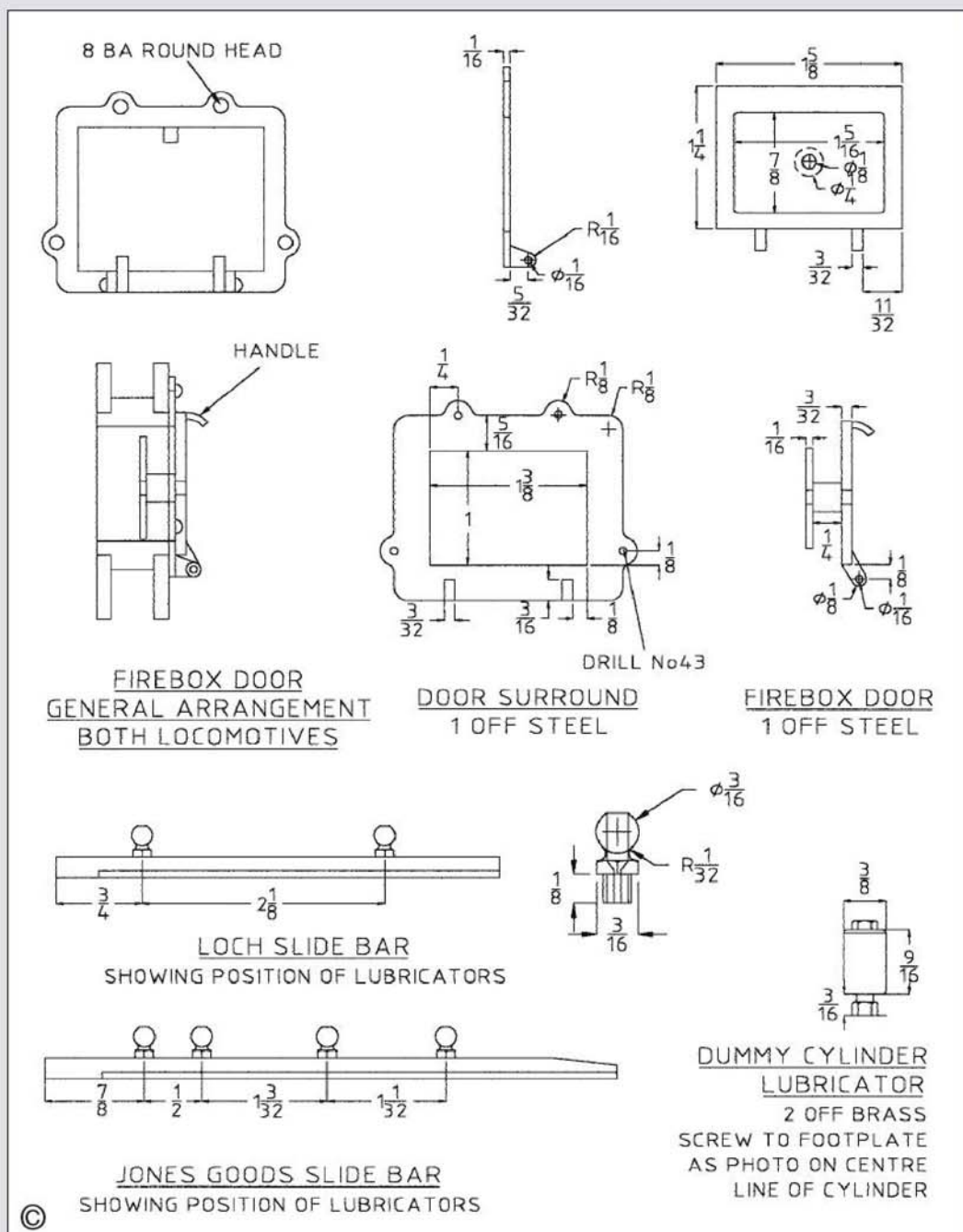
avoid spreading the track and that in conjunction with a well laid permanent way, which carried the correct amount of superelevation, a higher boiler was a most desirable feature. Churchward learned this fact before his series of 'super locomotives' were conceived, they therefore used a combination of high boiler and well designed ash pan. This, of course, demonstrated another reason for the superiority of the Churchward boiler, the firebox was set high, which allowed for a decent sized ash-pan, the downward inclination of the front of the boiler, then helped to reduce the height of the C of G to a manageable figure.

Incidentally, while we're talking about the GWR I was pondering on the design of 'Super Schools', which was thought out by Messrs Holcroft and Donaldson in the late 50s. The concept was based on LBSC's *Roedean*, the 3 1/2 in. gauge Schools 4-4-0 and included a 'Lord Nelson' type firebox and a Holcroft designed conjugated valve gear. My mind then wandered toward the simple conjugating lever used on the GWR 4 cylinder locomotives. Received wisdom says that the backward kink in the lever was put there to compensate for 'angularity of the con-rod'. I don't think so. All it does is to shorten the travel of the outside valves, in their rearward position. What it is really for is simply to shorten the length of the linkage from lever to valve rod, thus saving quite a lot of reciprocating weight. Note that Coleman used a straight lever on the 'Duchesses', which had the outside cylinders set further forward than the 'Kings', from which, via the 'Princesses' they were derived. The valve rods were therefore much shorter and lighter, which meant that the problem of excess weight didn't arise.

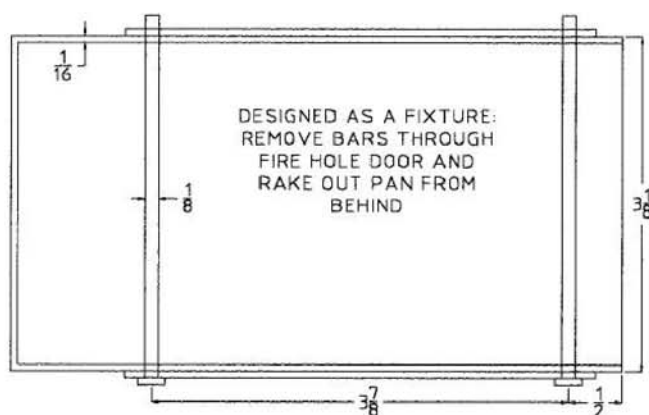
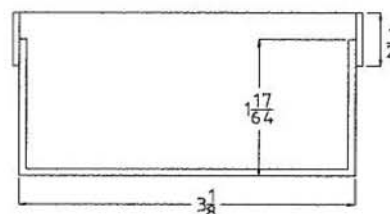
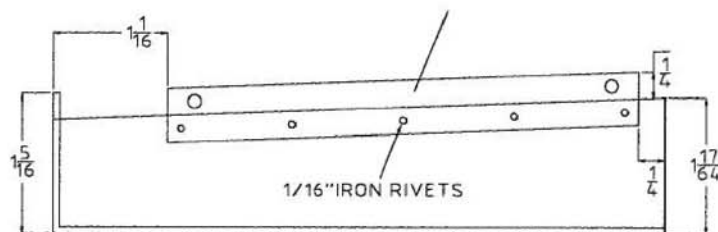
For a variety of reasons, the ash-pan I'm using on the Highland locomotives is semi-permanently fixed to the bottom of the firebox. The brake rods run directly underneath, and therefore to remove

the pan, we would have to dismantle these parts. We also have a problem due to the compensated suspension taking up a lot of room which

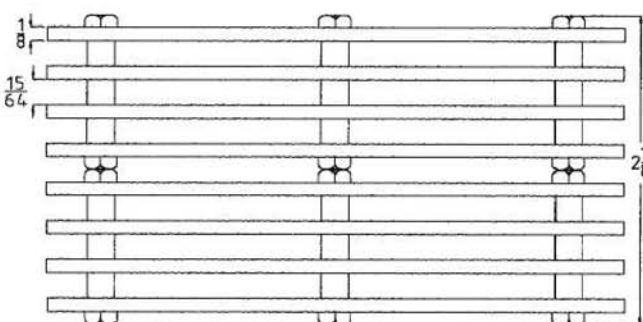
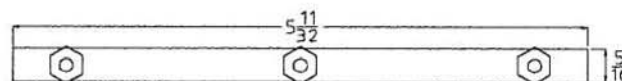
restricts the width of the assembly. I have therefore decided to use a fixed ash-pan together with a split grate which can be inveigled out of



NB - DUE TO LIMITED CLEARANCE BETWEEN ASH PAN AND COMPENSATING LEVERS, THE PAN HAS TO FIT UNDERNEATH THE FIREBOX, HENCE THE EXTRA STRIP



LOCH ASH PAN 1 OFF ST.S OR BMS



LOCH 2 PIECE FIREGRATE 1 OFF ST+ STEEL

©

the fire-hole door with the aid of a pair of bent long-nosed pliers. We only have room for the 'Loch' equipment this month, the Big Goods will follow shortly. On the 4-4-0 the pan is held on by two long $\frac{1}{8}$ in. pins, which serve the dual purpose of supporting the grate. I have given a nominal dimension for their position under the firebox, but will leave it to individual builders to put them in the optimum place for their own locomotives. The ash-pan is cleaned out through the open back end. After raking out as much as possible of the larger lumps of ash, I use an old vacuum cleaner with a thinnish nozzle, which does a splendid job in no time at all.

Lubricators various

Both engines had a variety of rather ornate lubricators scattered around the front end. They possessed a pair of cylindrical pots on the running board, just above the centre line of the cylinders as per the photograph. These devices varied a bit in shape, probably according to the whim of whoever was building or indeed servicing that particular locomotive. So my advice is to try to get a good photograph of your engine and copy that one.

The rather attractive little globular pieces were attached to the slide bars as shown and led oil to the slide bars either directly, to the top bar, or

through a pipe to the bottom. One slight snag on the 'Loch' is that clearances are a bit tight between the crosshead and the gland so that the front pipe may have to be left out.

Supplier

Readers are reminded that that drawings, castings, laser cut frames, etc., are available for the 'Loch' and 'Big Goods' locomotives from Practical Scale, 46 Pentyla, Port Talbot, West Glamorgan SA12 8AA; tel: 01639-883741.

Please send a stamped, self-addressed envelope for details.

●To be continued.



SUPERCLEAN AIRBRUSH CLEANER FROM PHOENIX PRECISION PAINTS

Now that Phoenix Precision have installed aerosol plant, model engineers and modellers have been asking for some time if they could supply an airbrush cleaner. In response to these enquiries Phoenix have introduced their own SuperClean Airbrush Cleaner. Supplied in a full 150ml aerosol instead of the more usual 125ml

capacity, this new product is being introduced at the special price of £3.25. Carriage and packing on a single can is £1.20 and for 2 cans it is £2.05. These prices include VAT. SuperClean is now available for immediate delivery.

SuperClean has been formulated to ensure that it is one of the most effective products of its type available to the modeller. It will even clean dried deposits of most kinds of paint used in modelling if the parts are allowed to soak. Its use is not just restricted to airbrush cleaning, it can be used for cleaning paint from all kinds of equipment, although care should naturally be taken with already painted items.

SuperClean is available now from Phoenix Precision Paints Ltd. PO Box 359, Cheltenham GL52 3YN; tel/fax: 01242-572326; e-mail sales@phoenix-paints.co.uk website: www.phoenix-paints.co.uk



Stan Wade

based his useful device on tooling seen in use in the aircraft industry fifty years ago.

While visiting a friend who is building a locomotive that is rather a big job and is taking some time in the building, I noticed that he was shortening bolts by sawing them in a jig and then having to round off the ends by some means or other. As there seemed to be a lot of these to do, I could see that a fair amount of time would be taken up in doing the job. I was reminded of a tool that I had seen some 50 or so years ago at the aircraft factory where I had worked during the war.

I had not used the tool myself as it was not in use in the department in which I worked, but I had seen it and how effectively it seemed to do the job for which it was made. The device fitted onto an electric pistol drill and used a specially sharpened drill to cut away the bolt end protruding from the nut after assembly. Upon reflection, it did not seem an impossible task to make something similar to ease the pain of sawing and filing that was my friend's only alternative. The original was for cutting larger bolts than were needed in this case, and so I thought that a smaller and simpler version would do all that was required.

Drawing 1 shows the idea but is not to scale. The drill on the original was sharpened by inverting the normal method of sharpening so as to finish with a slightly rounded internal V-shape as shown in Drawing 2 but, using small drills, I would think that just being sharpened at an angle as shown would be suitable. This would require a bit of experimentation to arrive at a satisfactory shape to the end of the bolt. An alternative cutting tool could be made along the lines of a D-bit if you do not wish to modify a twist drill.

The tool is used by putting the end hole of the stop on the bolt and, in effect, drilling the end of the bolt away. The sliding stop has to be set, by using the locking screw, so that the drilling stops when the bolt is left with the right length of thread protruding from the nut.

The main body could be made from practically any kind of metal. The main dimensions are the diameter of the collar behind the chuck on the electric drill and the length of the chuck.

As an example, the relevant sizes on my drill are:

Diameter of collar: 43mm

Length of collar: 15mm

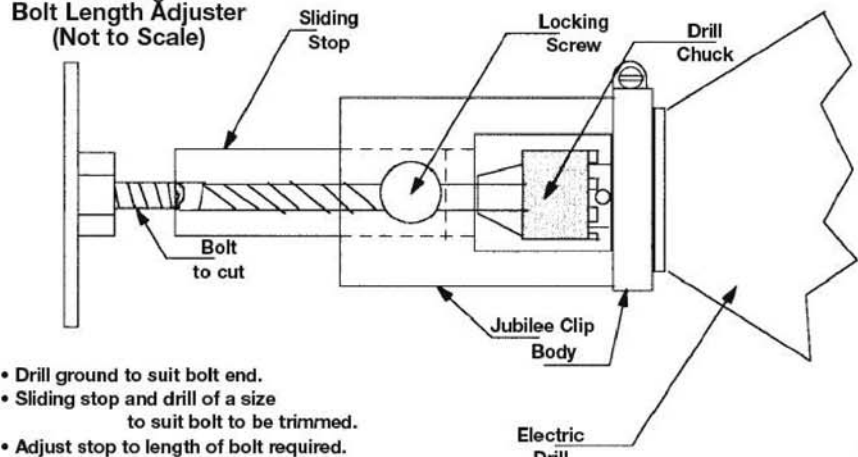
Distance from inner edge of collar to outer end of chuck jaws: 85mm

So, allowing for a thickness of 3mm to fit round the collar and 30mm for the sliding stop to fit in, a piece of round bar 50 dia. x 120mm long would be enough to make the main body.

Drawing 3 gives details and measurements but these may have to be changed depending on the electric drill used.

The sliding stops (Drawing 4) need to be made of steel and could, with advantage, be hardened if the tool is to get a lot of use. Each size of bolt needs a stop and a drill of its own. I have shown the end reduced; this is not essential, but will allow the tool to be used in a confined space.

Drawing 1
Bolt Length Adjuster
(Not to Scale)



- Drill ground to suit bolt end.
- Sliding stop and drill of a size to suit bolt to be trimmed.
- Adjust stop to length of bolt required.

BOLT END TRIMMER TOOL

It may also be an advantage to recess the end to fit over the nut in the case of small sizes, and then the finished bolt length can be measured from the plate or, if used, the washer. The overall length of the stop in all cases is dependent on the length of the drill. The locking screw can be as push as you like; I used a 2BA socket head Allen screw.

The body is fixed on the drill and is secured by means of a Jubilee clip, the slot on the body

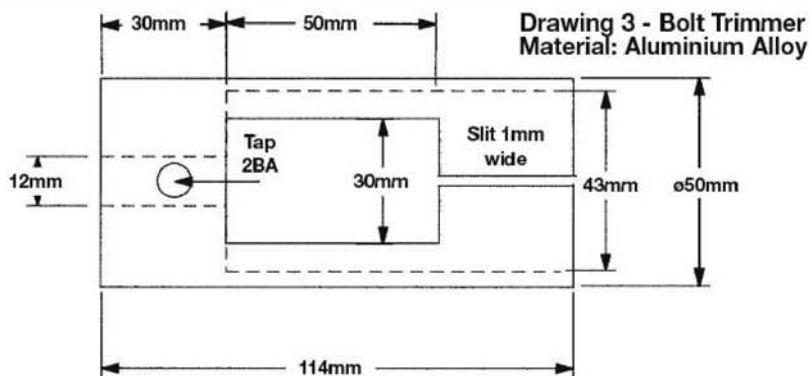
allowing it to be tightened. This size is alright for down to about 4BA but I think that for smaller, I would be inclined to use a small 12 volt drill and make a tool to fit. I have not tried it but I think that with a bit of care in using and drill sharpening it could be effective down to as small as 10BA.

I have given dimensions in millimetres but it would work just as well if you make it in inches, if that is what you prefer.

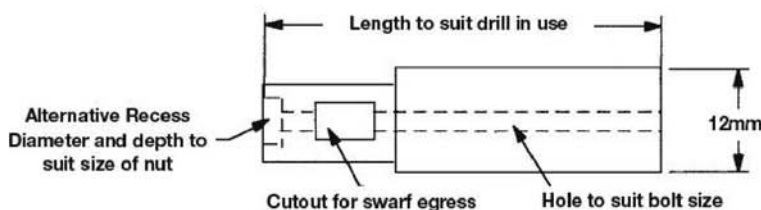


Drawing 2 - Drill Sharpening
(Not to Scale)

©



©



Drawing 4 - Drill Guide - Material: Silver Steel (Harden)

THE INTERNATIONAL MODEL LOCOMOTIVE EFFICIENCY COMPETITION FOR THE MARTIN EVANS CHALLENGE CUP

FOR STEAM LOCOMOTIVES OF 3 1/2 & 5in. GAUGES

HOSTED BY

BRISTOL SMEE

AT THEIR

ASHTON COURT MINIATURE RAILWAY 12/13 JULY 2003

Don Cordall,

IMLEC Group Leader at Bristol
SMEE, explains the arrangements
for this year's competition.

Bristol Society of Model and Experimental Engineers will be hosting this year's IMLEC on Saturday and Sunday, 12/13 July 2003. This will be the fifth time BSME has staged the event. The competition will be held on the Society's track in Ashton Court estate at the edge of Bristol. The map shows the location of the site relative to the major approach roads in the city. Some care is needed if approaching from Junction 19 on the M5, since it is no longer possible to turn right off the A369 into the estate. Full instructions are given on the Society's website www.bristolmodelengineers.co.uk.

The first of fifteen runs will start at 8.30am on Saturday followed by a further twelve on Sunday, the last starting at about 4.30pm. Entry forms are available from Kate Canner on 0117-969-0022, Don Cordall on 0117-962-4073 or by e-mail on doncordall@blueyonder.co.uk. A temporary camping site for tents and caravans will be opened for the weekend on part of the golf course adjacent to the railway site. The site will open at 6pm on Friday 11 July and although the golf course must revert to its normal use on Monday morning, a few campers can be accommodated on the railway site on Sunday night. Pre-booking

with Kate Canner on 0117-969-0022 is essential if you wish to camp on-site.

Refreshments will be available throughout the event and an exhibition of Bristol SMEE work will be on display in the marquee. A number of traders will be present to satisfy your model engineering needs. The ground level 7 1/4in. gauge track will operate as a diversion throughout the weekend. There will be a free temporary car park alongside the drive into the estate and a short walk will be necessary to reach the railway. No vehicles will be allowed on the railway site, although special arrangements will be made to allow elderly and infirm visitors to be driven directly to the venue. The price of admission will be £5 for adults including programme for one or two days. Under-18s will be free, but no unaccompanied youngsters will be admitted.

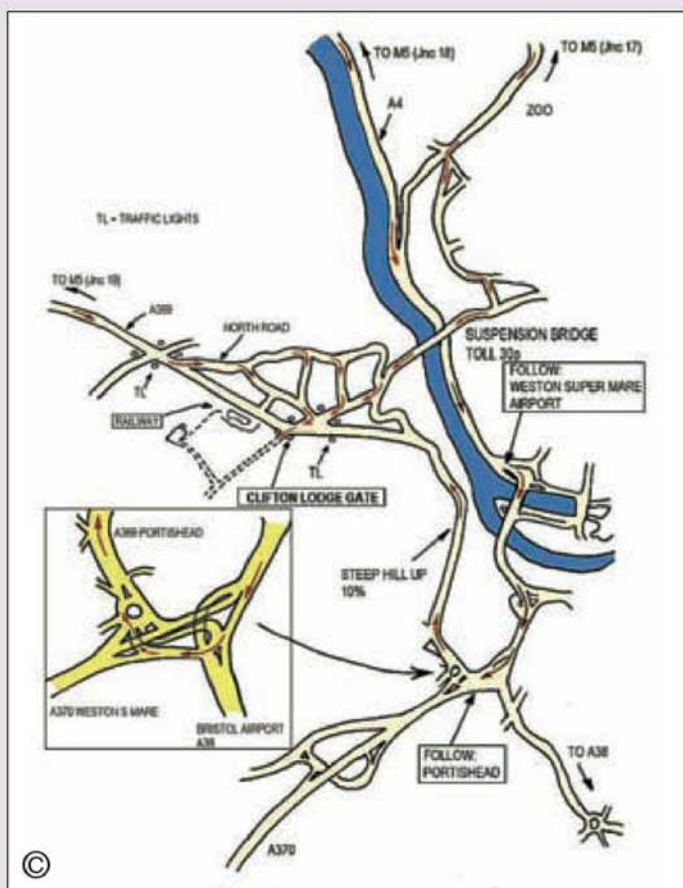
In addition, there are many attractions in Bristol and the surrounding area for those who wish to make a weekend of it. Within a quarter mile is Brunel's Clifton Suspension Bridge, which is attracting attention with the recent discovery of chambers within the brick piers supporting the bridge. There are interesting displays in the visitor centre just across the bridge in Bridge House. A little further are the Observatory, Camera

Obscura and the cave platform giving splendid views of the Avon Gorge. Further again, the leisure area of the Downs covering many acres offers the chance to stretch one's legs and a visit to Bristol Zoo is well worthwhile. Nearer to the city centre is the floating harbour that can provide a most rewarding experience. The ferry provides an excellent means of viewing the dock scene. It can be boarded at the Pump House, the Nova Scotia or the Cottage, all of which provide an excellent chance to wet one's whistle. In the docks are the *SS Great Britain* and the *Matthew*, a replica of John Cabot's boat in which he crossed the Atlantic, and many relics of Bristol's industrial past. If your interest is spending money, then a visit to Cribbs Causeway shopping centre, about four miles from the railway, could well prove satisfying and expensive. Further attractions can be found on www.visitbristol.co.uk and www.whatsonbristol.co.uk.

Finally, if you don't want to camp, much hotel and B&B accommodation is listed on www.bristol-hotelsonline.com



The station complex at Ashton Court Miniature Railway; in conversation with John Coleman, Colin MacEke is sitting on his locomotive Machrihanish.



SAVAGE'S LITTLE SAMSON in 3in, 4in. (and other) Scales

Martin Wallis

has a few words to say about maintenance before dealing with the backhead fittings.

●Part XXXVIII continued from page 621 (M.E. 4196, 30 May 2003)

Before starting work on the backhead fittings, as mentioned last time, I am including some pictures of the ashpan and grate for John Freeborne's 4in. scale engine. Photograph 1 shows John's *Little Samson* in a nose-down position to give easy access to the firebox. This is not only a handy pose for the engine to assume during construction but is also beneficial during the annual boiler cleaning and inspection when complete. My 3in. Clayton & Shuttleworth steam tractor has a different drawbar and tender arrangement to *Little Samson's* which allows it to sit tender down with fairly good stability, ideal for firebox inspection.

I wish I could find a means of doing such a thing on my half-size model Fowler. At the end of each year a good deal of time is spent lying on my back under the firebox, with all the soot and debris falling straight into my face. The worst job is attending to the fusible plug which, of course, is annually removed, inspected, and safely returned. Reaching the plug from underneath has proved problematical. It can be removed — just — but with great discomfort. Regrettably, it is not at all easy to get sufficient leverage inside the firebox to undo it after a full season. I have tried extension bars on the socket to take the drive down to ground level but have to admit that this has not proved successful either. The socket falls off the plug and is the very devil to put back on again.

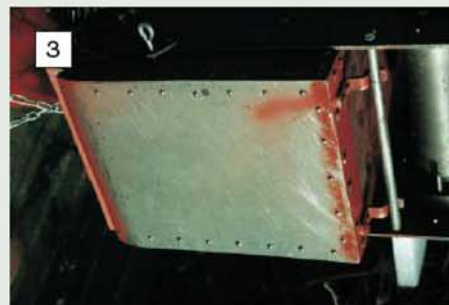
As an aside, the greatest amusement of the annual end of year firebox clean must be that afforded to passing motorists. When cleaning the



John Freeborne with his 4in. *Little Samson*. The engine's undignified position here facilitates access when fitting the grate and ashpan.



John's grate and ashpan are both fabricated, mostly from stainless steel.



The ashpan is held in place by the two tabs at the back and the single pin. (Photos 1-3: P. Kybert)

firebox the dress code is as follows. One supermarket carrier bag has its bottom cut right out and is pulled down over the neck. At the neck it is secured using masking tape to prevent soot dropping down inside the shirt/boiler suit. Another is placed over the hair like a shower cap. Two further bags are used as gloves, taped shut at

the elbow. It is easy to hold a wire brush from inside a carrier bag, and they are surprisingly durable. A very grubby pair of allegedly transparent goggles completes the appearance.

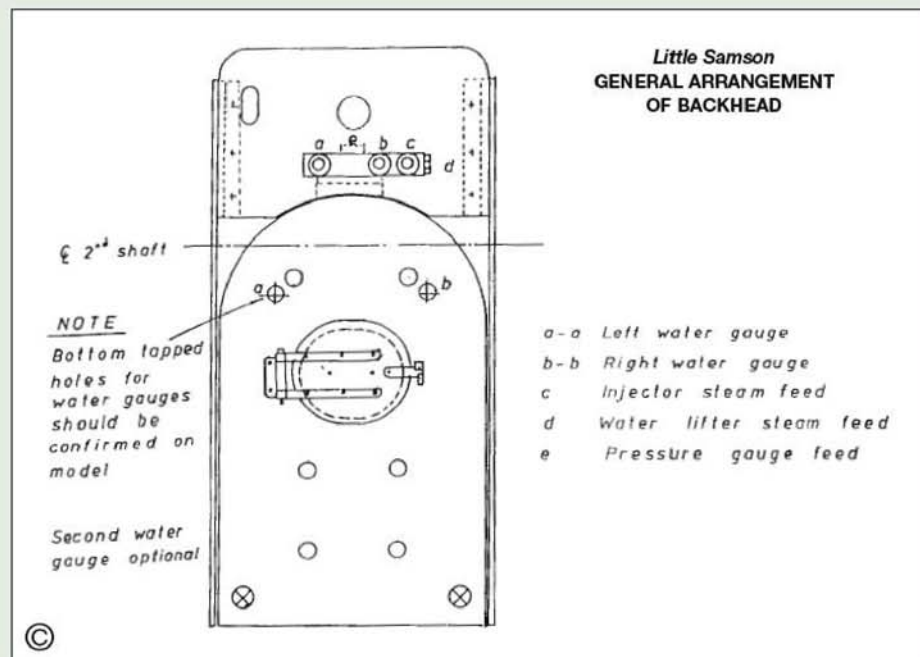
Back to John's grate and ashpan, which may be seen in photo 2 and *in situ* in photo 3. I believe it is clear that when the front pin is removed, everything drops away with the minimum of fuss. The ashpan control rod would need to be removed first of course. The point of the 'quick drop' ashpan and grate is not as much for the unlikely emergency removal of the fire (although clearly desirable) but in the day-to-day maintenance and removal of clinker. As much of the ashpan/grate assembly should be made of stainless steel as possible to assure longevity.

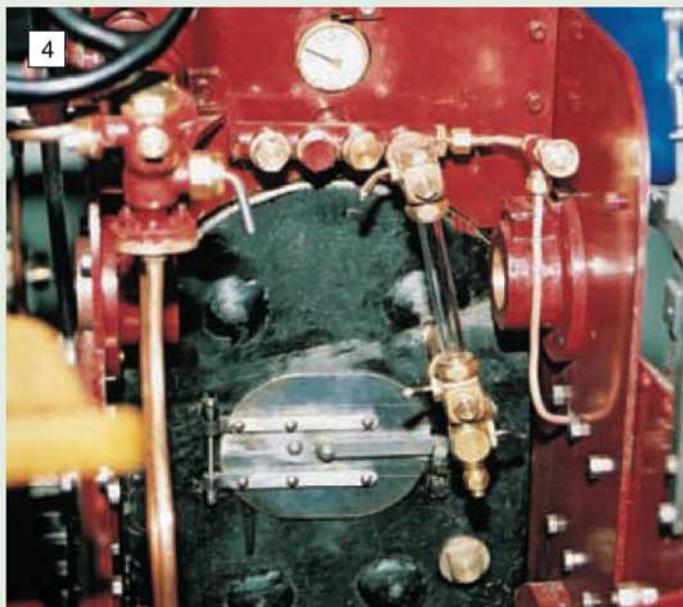
Backhead fittings

And so to the backhead fittings which comprise of one or two gauge glasses, the steam manifold and associated fittings, the pressure gauge and the fire hole door. Few folk these days make their own gauge glass(es), pressure gauge, or globe valves and those that do undoubtedly will need no comment from me to assist them. Let us assume they are to be bought-in; the shopping list might thus run as follows.

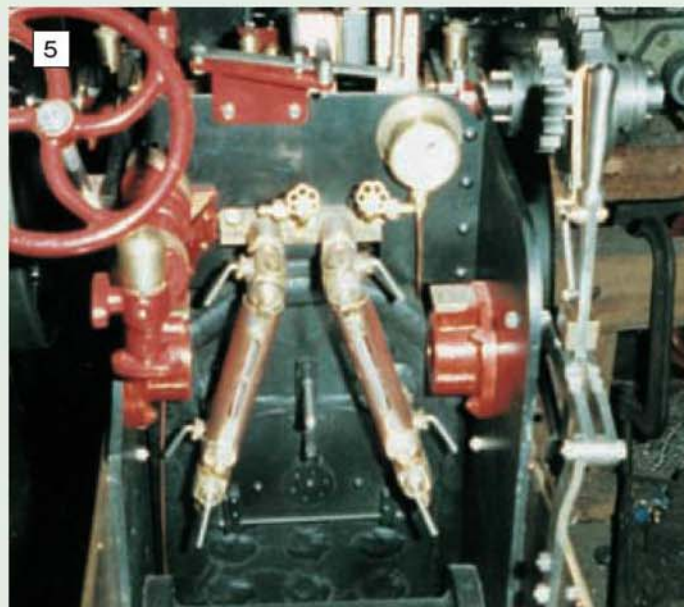
Pressure gauge

In 3in. scale, the pressure gauge is 3/4in. dia. and in 4in. scale, it is 1in. dia., or sensible metric equivalents, if available. The position detailed on the Savage drawings for the pressure gauge is





Stan's 3in. Little Samson backhead. The globe valve on the right is the steam feed for the injector. Note the position of the backhead drilling for the bottom water gauge fitting; a different water gauge may need a different placing. (Photo: Stan Nipper)



Mr. Hearle's 4in. Little Samson backhead. Note the revised horizontal regulator bracket, the alternative position of the pressure gauge, the twin gauge glasses, and the ingenious firehole door. (Photo: J. Hearle)

shown in photo 4, a tight squeeze between the manifold below and the regulator bracket above. Since most pressure gauges have the steam feed from below, a special 90deg. elbow may be required to get the steam to it. An alternative would be to reposition it as in photo 5. I can see no reason why the gauge should not be repositioned to suit the builder, I am sure Savage's fitters would have done just the same.

I do, however, prefer the gauges to be fitted from behind as they are invariably considerably over-scale in the front-to-back dimension. Recessing the gauge

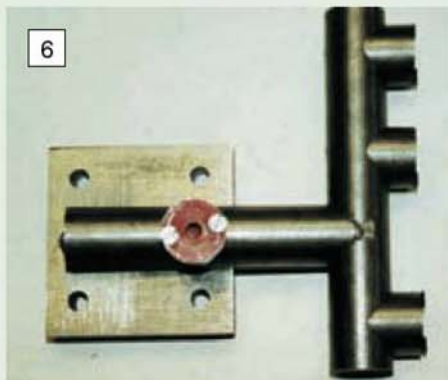
into the front plate gives the impression of scale thickness. The siphon is thus positioned in the crank pit, out of view. To accord with current requirements, before fitting, the body of the gauge and the glass will need to be dis-assembled and a red line marked at maximum working pressure, which for us is 125psi. The mechanism will not need to be touched, in any case the calibration will be checked when the boiler is inspected.

Contemporary full-size gauges are invariably 'eccentric movement' which means the axis about which the hand moves is towards the bottom of the gauge. Apart from model gauges, it seems universal these days for the mass-produced gauges to have the point of rotation of the hand in the middle of the body. I went to some lengths to get an eccentric movement gauge for my Fowler, with very little success. In the end I secured a gauge which had been one of a series of sample items still kept in his box by a retired pressure gauge salesman.

Gauge glasses

These should be of the 3-cock design, one cock to blow down the gauge to check all is clear and two further cocks to shut it off should a misadventure occur to the glass. Do make certain it is made from bronze and not from brass. If made from brass, in the fullness of time the zinc will become depleted and the strength of the fitting compromised.

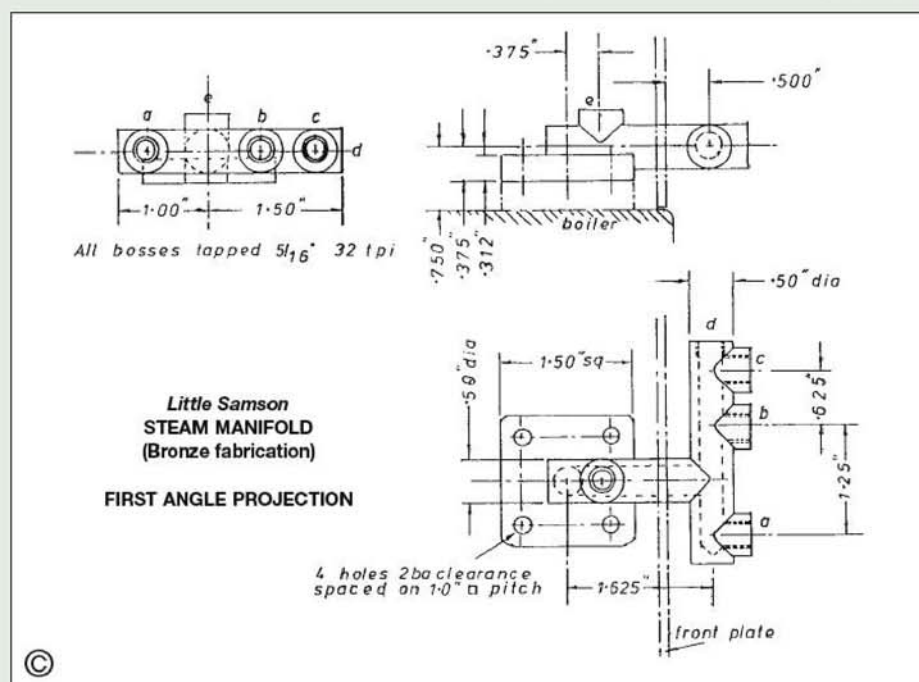
The choice of one or two water gauges is for the builder to decide. An additional gauge is, if you like, a second opinion and certainly an asset should the first fail. Full size engines sometimes have one and sometimes two; the second offered by the maker either as standard or as an extra. A second gauge glass was usual, I understand, for engines bought for military purposes. I recall reading a list of the extras supplied on a large compound Aveling & Porter road engine (later converted to a Showman's engine and called *Samson*) which included a second gauge glass, ►

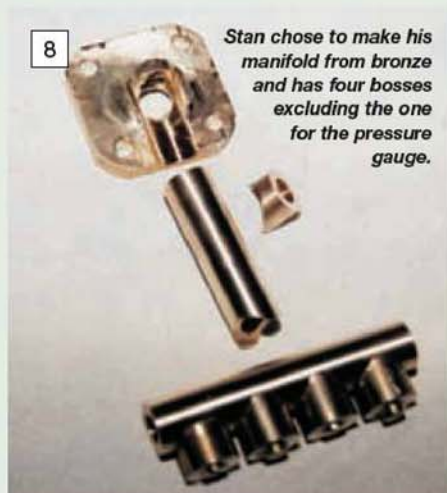


John's 4in. manifold is fabricated from steel. The individual parts are held together with small screws. (Photos 6-7 P. Kybert)

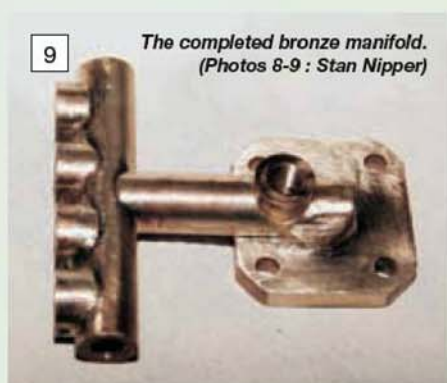


John's manifold after silver-soldering and cleaning up. Note the low profile, necessary to clear the crankshaft and motion.





8 Stan chose to make his manifold from bronze and has four bosses excluding the one for the pressure gauge.



9 The completed bronze manifold. (Photos 8-9: Stan Nipper)

screw-in gear selector pins, additional drive pins to each rear wheel, and a few other features which now elude my recollection.

It is worth remembering that the commercial 3-cock gauge glass fittings come in different sizes and with different degrees of 'chunkiness'. I suggest avoiding the overly 'chunky' ones which, if scaled up, would end up with the hexagonal nuts at each end of the glass some 3in. or more across the flats. There are some very nice ones around these days and it is worth seeking them out. Having said that I fitted a 'fine scale' 3-cock water gauge to the school's narrow gauge engine, which, while it looked great, was a real fiddle to use and keep in good order. It was duly changed for the 'chunkiest' one I could find — since when it has given every satisfaction.

Deliberate omission

A deliberate omission on the *Little Samson* boiler drawings has now to be admitted to, along with my reason. This is the dimensioned location of the bottom drilling of the gauge glass, and much will depend upon the size and proportion of the fitting, as mentioned earlier. The drilling should be arranged so that the firebox crown is still covered with a little water when the water level is just visible in the bottom nut. I suggest it is drilled as far to the right as looks sensible, to give clearance to the firehole door. Do not drill it too close to the hornplate or you will be unable to screw it in without taking the hornplate off. A study of photo 4 puts it all in perspective. I believe it is much better to determine the best position of the bottom drilling *in situ*, hence no dimension is given on the boiler drawing. End of explanation.

Globe valves

Some very nice scale globe valves are available these days. I prefer the ones with the neat scale lost wax cast handwheels, but I know others

advocate handwheels made of plastic or fibre which remain cool enough to handle when the engine is in steam. As always, the choice is yours.

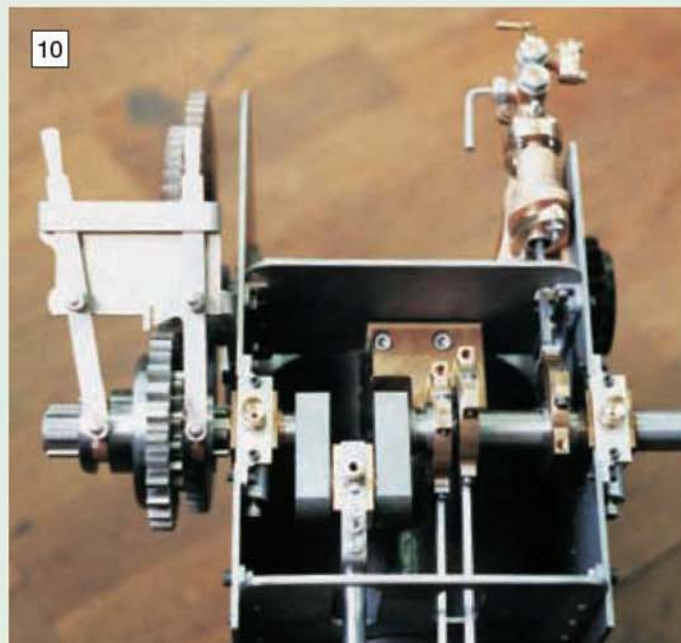
A point to make here is to consider feeding the steam valve for the injector direct to the top of the boiler and not through the manifold. The reason is that when drawing steam there will be a small drop in pressure in the manifold compared to the rest of the boiler. This will be picked up by the water gauge, which is between the boiler at bottom and the manifold at the top. When the injector is used the water will rise in the glass accordingly giving a false reading, just when a reliable reading is sought.

Three globe valves should be purchased. One is for the injector, one for the water lifter and the third for the blower, which will be mentioned in a future instalment. When purchasing the globe valve for the injector check that it is big enough to pass all the steam your injector might use.

In my experience there are four reasons why an injector may not work. First, stuck clack valves, a problem which is likely to occur at the beginning of the season; secondly, dirty cones, which tend to be associated with hard water areas; thirdly, not enough cold water, and finally, not enough steam. Through friends, I became acquainted with a chap who had bought a 7 $\frac{1}{4}$ in. gauge railway engine complete with half a dozen injectors in a tobacco tin 'that did not work'. He had bought yet another injector which worked hardly at all. I ended up with the engine in my workshop where I fitted a much bigger globe valve and changed the $\frac{3}{16}$ in. O/D pipework to the injector for some of $\frac{5}{16}$ in. diameter. The engine left with a fully functioning injector and half a dozen fully working spares.

Injector and drain cocks

While not backhead fittings, the injector and cylinder drain cocks are likely to be on a builder's shopping list so may reasonably be mentioned here. Injectors may be made but most folk do not even think about it! I made my own scale Penburthy style injector by carefully copying a small full size one (i.e.



10 An alternative 'block' manifold devised by David Hall; note the cut out to clear the crank. (Photo: B. Camps)

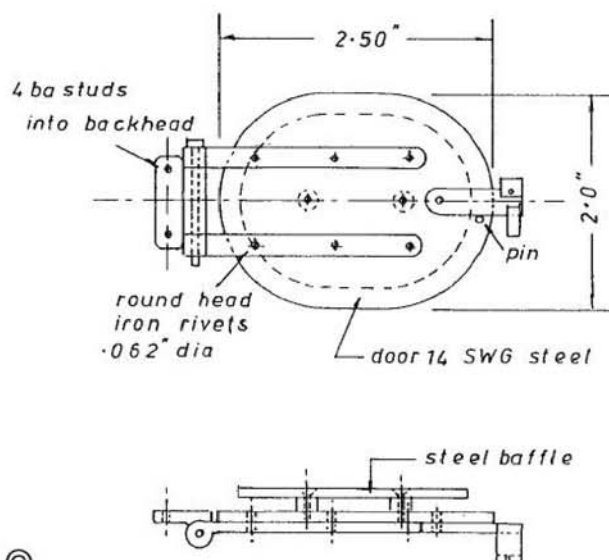
working 1:1). The time and fiddle involved is not to be underestimated and I do not plan to do it again. If it had not worked after all those hours of careful toil I would not have been a happy chappy.

The cylinder drain cocks need to be the sort which may be connected up to an operating rod. The rod is of light section and runs back to the cab for the convenience of the driver. I have no drawings of the rod but the works pictures show a round rod running outside the motion plate, level with the cylinder drains.

Manifold

The manifold is detailed with three steam feeds facing the driver and one facing to the right, which may be blanked off or used as desired. A further steam connection is mounted on the top to feed the pressure gauge syphon. I suggest the distance between the steam feeds is determined after the purchase of the fittings. Since the fittings will be of the screw-in type, thought needs to be given to

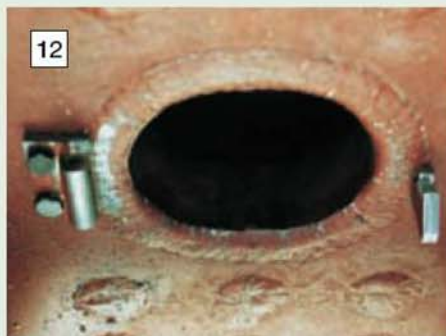
Little Samson - FIREHOLE DOOR (Mild steel)
FIRST ANGLE PROJECTION



©



The firehole door should be profiled to fit the opening; in this case John's 4in. model. (Photos 11-12: P. Kybert)



Door furniture may safely be screwed directly into a steel boiler. The right-hand hole was blind but the two left-hand holes went into the water space and were sealed with white PTFE tape.



David has fitted a butterfly valve to provide top air over the fire which is claimed to improve combustion. (Photo: B. Camps)

their assembly. Screwing in the first one is straightforward, but subsequent fittings may foul on previously fitted valves and may be impossible to turn. The water gauge may need to be on a short extension piece to clear the glass away from the second shaft (photo 4).

A steam feed is needed for the water gauge(s), one for the water lifter and one for the injector. As previously mentioned, the steam feed for the injector may usefully be located directly on the boiler top rather than from the manifold.

Builders are welcome to interpret the manifold drawings according to their own whims and fancies, and in the case of *Little Samson* this has certainly been the case. The closest to the drawings is the 4in. manifold by John Freeborn illustrated in photos 6 and 7. A symmetrical arrangement with four backward facing feeds was built in 3in. by Stan Nipper, photos 8 and 9.

A complete departure was that of David Hall on his 3in. engine where a substantial rectangular block was bolted to the pad on the top of the boiler and a similar rectangular window cut in the front plate to give access to it. The block approach is much quicker to build and there is no silver-soldering to do. In due course, once

all the soot and grime has accumulated, the block will be easily missed. The last arrangement is Mr. Hearle's, who fixed a bronze manifold to the front plate and fed it with a copper steam pipe from the boiler pad. This may be seen on photo 5, two 90deg. steam valves may be seen and one further one at the extreme left blanked off for the moment.

Firehole door

The firehole door is of my own devising, there being no drawings to hand. Stan's firehole door, shown in photo 4, and John's in photo 11, are pretty close to the drawings. An obvious practical consideration is that it must open, the competition for space being with the gauge glass. A refinement would be to fit a little chain to the latch so a gentle tug on the chain opens the door, more convenient than groping for the latch right alongside the very hot bottom gauge glass fitting.

David Hall made a nice little addition to the door of his 3in. scale engine involving a 'top air' facility (photo 12). David has departed from the drawings in several points of detail, including for example the quite extensive use of German silver for many of the bright parts. The result is an

individual engine with a character all of its own. I very much hope to have seen the engine in steam by the time these words appear in print.

There is potentially conflicting advice with regard to top air, my surmise being that it is fine in moderation. One school of thought is that the additional air passed over the fire may supply the extra oxygen required to complete combustion, the density of the smoke being reduced in proportion as more carbon is burnt off. Against this, it is said that top air is a bad idea as the cold air may hit the tubes causing severe thermal stresses which may start the tubes leaking.

The last firehole door is that fitted to Mr Hearle's engine (photo 5). With two gauge glasses, the normal hinge arrangement will not work, so ingeniously the door is hinged at the bottom.

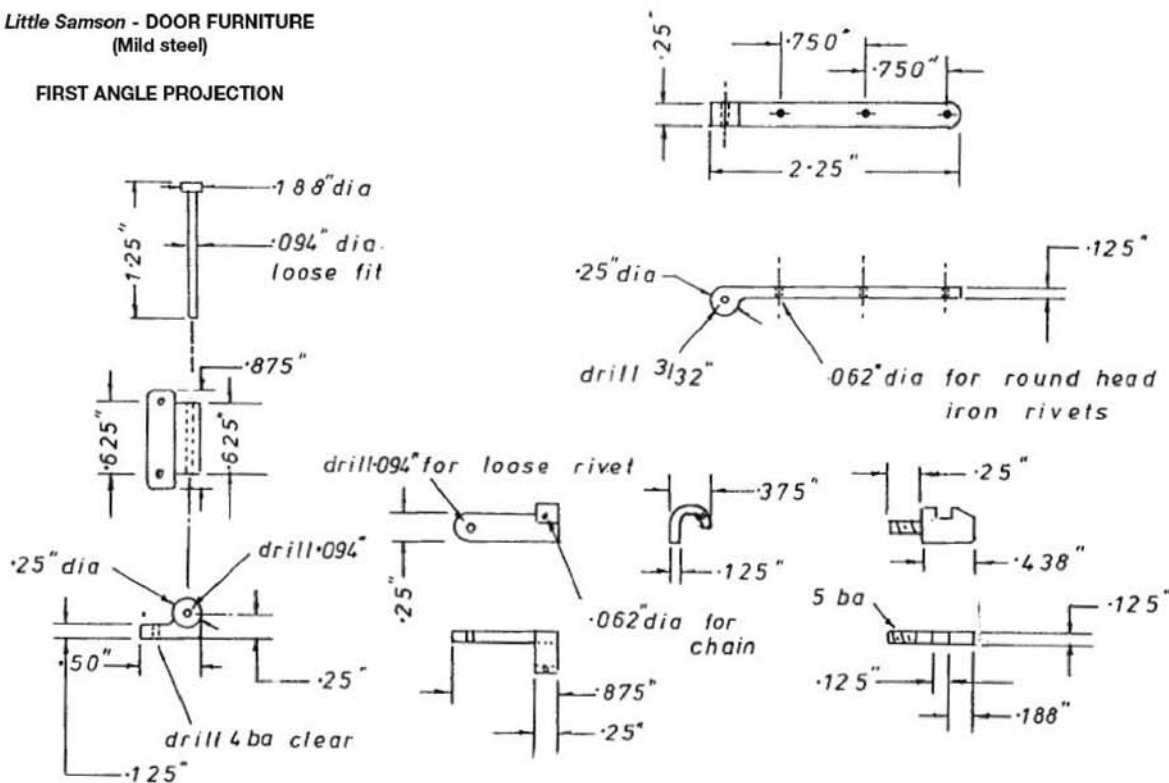
Supplier

A *Little Samson* catalogue listing drawings, copies of Works Drawings, materials and castings in 3in. and 4in. scales is available for £2.50 post paid (UK) from *Little Samson Models*, 38 Wheatsheaf Way, Linton, Cambridge CB1 6XD. Visit <http://homepages.tesco.net/~little.samson>

●To be continued.

Little Samson - DOOR FURNITURE (Mild steel)

FIRST ANGLE PROJECTION





REPLICA 18th CENTURY HOODED WALL CLOCK

Ian Beilby

deals with depthing the wheel work and describes how to lay out and cut the pallets.

●Part IV continued from page 603
(M.E. 4196, 30 May 2003)

The data for the wheels and pinions for the clock have been given previously, and assuming these are all now to hand, the next stage is to carry out the depthing of the wheel train. I am assuming once more that the constructor has experience of clockmaking and possesses and is conversant with either the traditional depthing tool, or has made a 'John Wilding depthing tool'. The only difference being that with the traditional depthing tool the wheels and pinions are fixed to their arbors before depthing the train, whereas with the John Wilding tool, the wheels and pinions are fixed after depthing the train.

The layout dimensions of the great arbor, escape wheel and pallet arbor are given in fig 14. These can be marked out and carefully centre punched on the front plate. The position of the second wheel can be ascertained by meshing the great wheel with an 8-leaf pinion and scribing an arc from the position of the great wheel to the left of the centre line, and then by meshing an 8-leaf pinion with the second wheel and scribing an intersecting arc struck from the position of the escape wheel.

At the same time, the two 39-tooth motion wheels can be meshed, and without altering the setting of the depthing tool the hour wheel and the 6-leaf pinion should mesh at the same distance. When depthing motion work, the depthing is better done loose rather than tight. This depth can then be marked at 90deg. to the position of the great arbor, on the right-hand side of the front plate. This marks the position of the reverse minute wheel stud.

If you have been using the John Wilding depthing tool, the wheels can now be fitted to their respective collets and the wheels and pinions fixed in place on their arbors with Loctite. The minute wheel can be secured to its pipe and the reverse minute wheel to its pinion in the same way, as seen in photo 25.

The two plates can then be registered together and clamped

with a pair of toolmaker's clamps before being taken to the drilling machine to drill the wheel pivot holes. At this stage *do not* drill the holes for the pallet arbor. The pivot holes should be drilled undersize for their respective pivots and then opened from the inside of the plates with the tapered cutting broach. The plates should be screwed up tightly, and each wheel should be tried in turn, they should spin freely, coasting to a gradual halt. There should be no sudden stoppage, and the wheels should spin irrespective of the position of the plates whether face up, or face down.

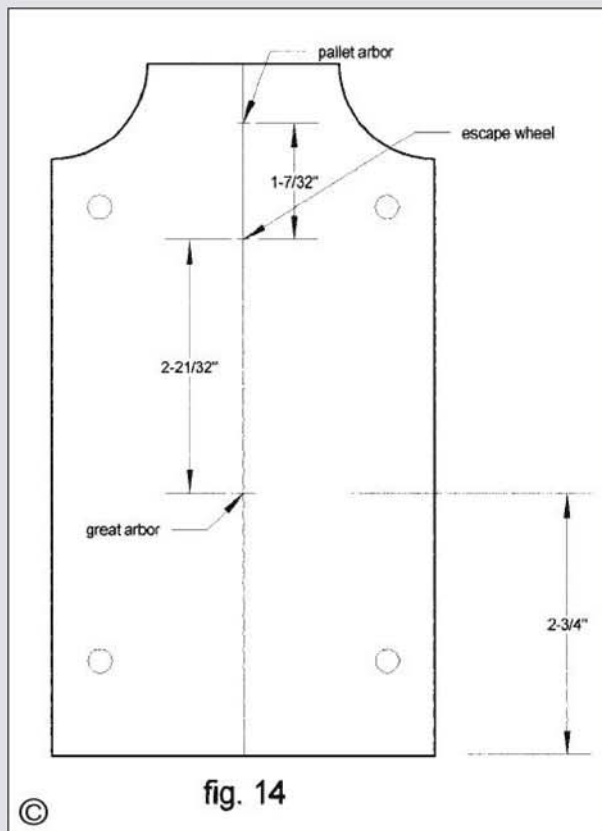
The wheels should then be tried in pairs, and again, the wheels should spin quite freely to a gradual halt, there should also be a noticeable amount of endshake between the arbors and the plates. If it rattles, it'll run!

With depthing complete, the hole for the reverse minute wheel stud on the frontplate can be drilled and tapped 5BA. The sun/moon disc should be placed on its running bush and a 10BA tapping drill sighted through the two previously drilled holes in the disc; the holes in the bush can then be tapped 10BA and the two holes in the disc opened up to 10BA clearance.

Photograph 26 shows the two fixing screws located in the front of the bush. The entire wheel and motion work can then be assembled and tested. Photographs 27 and 28 show the complete wheelwork after depthing.

Escapement

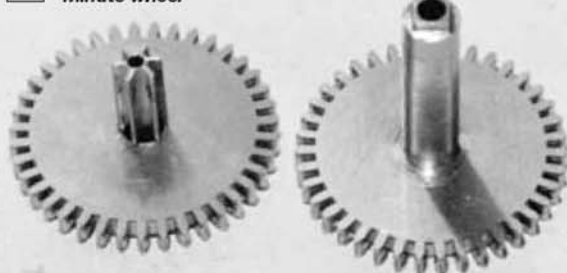
There are many ways of laying out the Standard English Recoil Escapement which I have used in this clock. The method described by W. J. Gazeley in his books on clockmaking and escapements is a very good practical method, whereby the actual escape wheel is placed on a suitable steel blank



and used to mark out the shape and angles of the pallet faces on the actual blank. However, in John Wilding's book *How to make a Castle Clock* he describes an alternative method of laying out the recoil escapement, one which I have used many times, and found to be very successful.

The pallet shape is marked out on paper or thin card, carefully cut out, and then glued onto a suitable piece of gauge plate, or a commercially available pallet blank. The blank is then carefully cut and filed to shape. This is the method I have adopted and intend to describe.

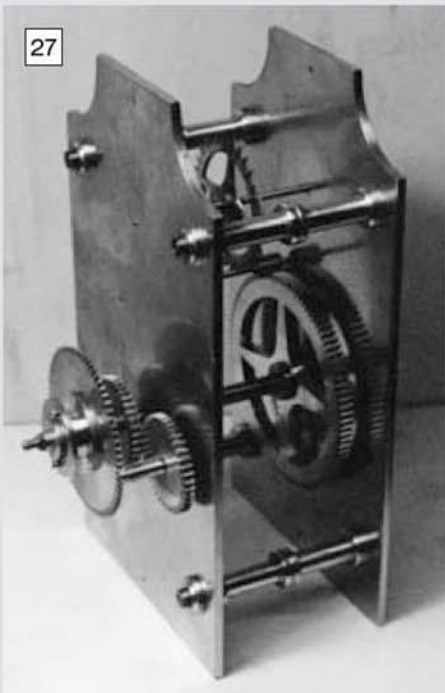
25 Minute wheel and reverse minute wheel



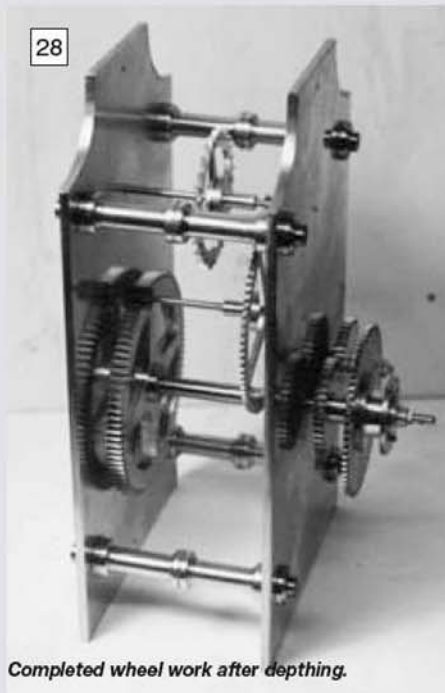
26 The two 10BA fixing screws on the sun/moon bush.



27



28



Completed wheel work after depthing.

I do not wish to go into the complex theory or geometry of escapements in this article. Anyone desiring to do so can find any amount of books on this subject alone. I intend to give sufficient information to make a practical working example for use in our clock. The following use of dimensions

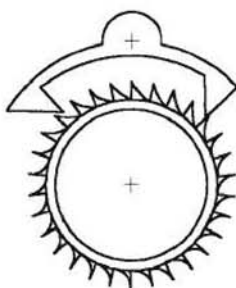
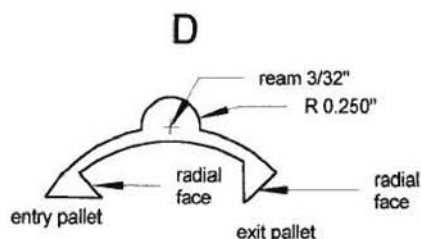
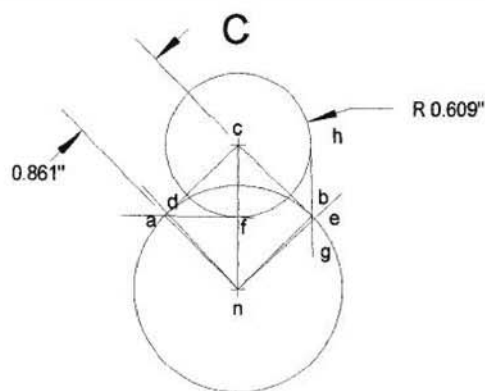
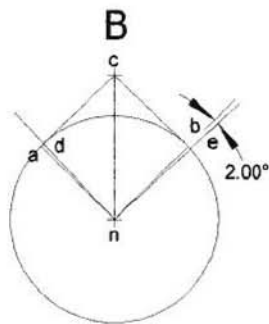
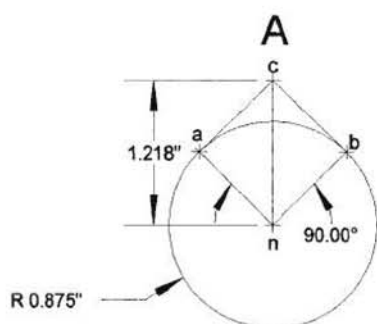
in thousandths for drawing purposes may frighten some, but these dimensions can be taken from a Vernier caliper gauge and transferred to a pair of accurate drawing compasses.

The drawings are still at best only an accurate guide; when the actual pallets have been cut out

and filed to shape, they must be tried for fit in the John Wilding depthing tool for final adjustment. Describing the construction of an escapement is not easy, and so I would like to express my grateful thanks to Mr. Wilding for checking my dimensions and description prior to publication.

In our clock, the escape wheel has 30 teeth, and it is usual for the pallets to embrace a quarter of the wheel i.e. $7\frac{1}{2}$ teeth, at an included angle of 90° ; this type of escapement is sometimes known as a square escapement. In order to achieve this we must draw the escapement as follows: as at **diagram A** (fig 15), first draw a circle 0.875in. radius, the radius of the escape wheel, then draw the vertical line *n-c* for 1.218in. which represents the distance between the centres of the escape wheel and the pallet arbors.

Two lines *n-a* and *n-b* are drawn at 45° to this vertical line (90° included) terminating at the radius of the escape wheel. At **diagram B** two further lines *n-d* and *n-e* are drawn at 2° to these lines. In **diagram C** we need to draw the radius of the impulse circle. This is found by multiplying the length of the pallet arm tangent *a-c* (0.861in.) by the sine of 45° , which is 0.707in., giving us a radius of 0.609in., which is drawn as a radius at *c*.



REPLICA HOODED WALL CLOCK

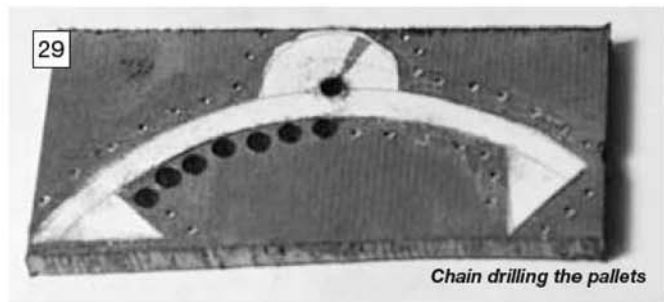
Figure 15
Constructing the pallet profile

$$\begin{aligned} \sin 45^\circ &= 0.707 \\ 0.861 \times 0.707 &= 0.60872 \end{aligned}$$

Escape wheel cut with a No. 7 Recoil cutter

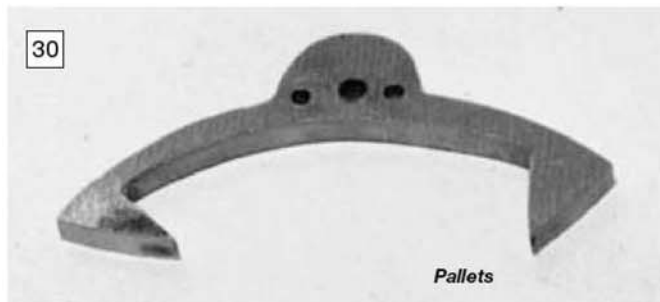
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29

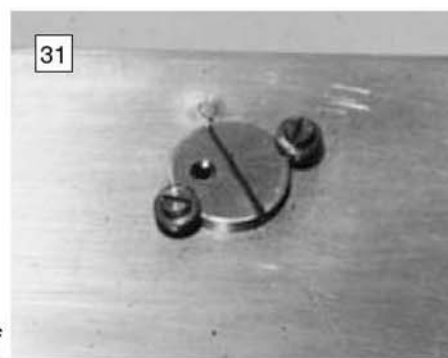
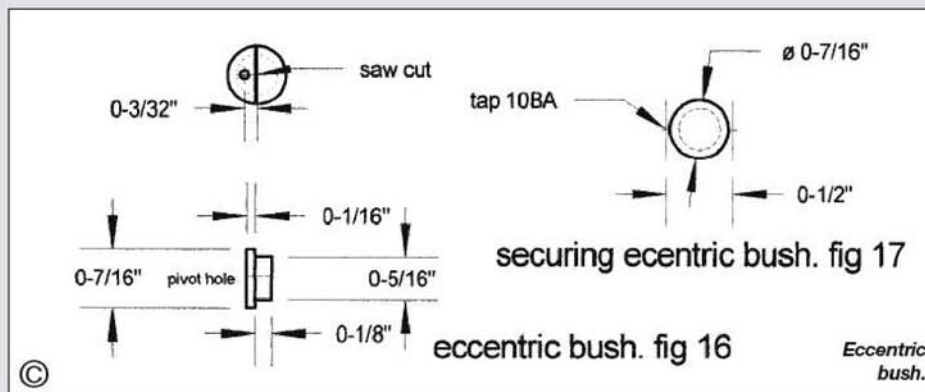


Chain drilling the pallets

30



Pallets



The impulse plane of the entry pallet is then drawn through a-f, and the impulse plane of the exit pallet drawn as g-b-h. The backs or radial faces of the pallets are drawn as n-d, and n-e.

The arms of the pallets are drawn as a radius of $1\frac{7}{32}$ in. from n for the upper curve, and the same radius struck $\frac{1}{8}$ in. lower for the lower curve. The centre of the pallets is made as part of a circle with a radius of $\frac{1}{4}$ inch.

The drawing as at D is then carefully cut out, and stuck onto a piece of $\frac{1}{8}$ in. gauge plate, or a pallet blank forging. The $\frac{3}{32}$ in. hole for the pallet arbor is then drilled and reamed.

If you are constructing the pallets from a piece of gauge plate there is quite a lot of metal to be removed. The best method that I have found is to chain drill around the outline of the pallets (photo 29), followed by the use of an Abrafile saw. Finally, files are used to bring the pallets to the outline shape. I have a 1 in. Linisher which comes in very handy for this work; the outline shape of the pallets (photo 30) can be achieved very accurately and quickly with the aid of this tool.

When forming the shape of the entry pallet, the action of the escapement on recoil will be greatly improved if this face is made convex. The exit pallet face can be left flat, as the action of the escapement here is different. The impulse planes of the pallets should then be brought to a high polish. The pallets must then be tried for fit with the escape wheel in the John Wilding depthing tool. The runners of the depthing tool are set to $1\frac{7}{32}$ in., and the procedure is to remove metal

from the radial faces of the pallets until they will just pass the teeth.

The action of the escapement should produce minimum drop, that is the movement of the escape wheel between the release of one tooth and the arrest of another. A 10BA tapping drill should be used to drill two equidistant holes in the pallets boss to enable the pallets to be fixed to the pallet collet previously made. The pallets can then be fitted onto the arbor and used as a jig for drilling the collet, after which the collet can be tapped 10BA and the holes in the pallet then drilled 10BA clearance.

The pallets will require hardening; I usually do not harden the whole of the pallets, but just the nibs. This I do by holding the body of the pallets in a pair of pliers and placing just the pallet nibs in a gas flame. When they reach red heat, I plunge them into water and leave them dead hard; they do not require tempering. The pallets are then brought to a high degree of polish, especially on their acting faces. The pallets can then be placed in the depthing tool and the action checked. As the centre of the pallets has not been hardened, it should be possible to make any necessary adjustments.

Eccentric bush

Although this item would not have been fitted to the original clock, I have included one in this replica. An eccentric bush allows a certain amount of simple but desirable adjustment to the entry pallet of the escapement. Machined from $\frac{7}{16}$ in. brass bar, this component is detailed in

fig 16. The $\frac{5}{16}$ in. dimension is carefully machined and reduced to a length of no more than $\frac{1}{8}$ inch. The bush is then parted off leaving a $\frac{1}{16}$ in. flange.

A point for the pallet arbor has been marked on the frontplate, and a point $\frac{3}{32}$ in. to the right of this should now be scribed and centre punched. As the bush is held in place with the heads of two 10BA screws, the holes for these screws should be drilled as close as possible to the $\frac{7}{16}$ in. rim of the bush (fig 17). I usually make two special steel screws, which can be seen in photo 31. These have specially wide heads in order to secure the rim of the bush to the plate. A $\frac{1}{2}$ in circle should be scribed from the second point just made, to mark the radius position of these two screws.

The two plates should be registered together, and held with toolmaker's clamps. A No. 55 drill is then put through the first original point. The plates are then separated, and the second point on the frontplate drilled $\frac{5}{16}$ in. to accommodate the eccentric bush. The two holes for the retaining screws should be drilled and tapped 10BA. The bush is fitted into the frontplate and held in place by means of the two 10BA screws. The plates are then again placed together and held with the toolmaker's clamps.

A No. 55 drill is put through the bush from the previously drilled hole in the back plate, the plates are separated, and a slot is filed in the front of the bush with a screwhead-slotting file to facilitate adjustment of the bush.

●To be continued.

EUROPEAN CANALS, SHIPLIFTS AND LOCKS

John Olsen
visits St. Louis-Arzwiller.

●Part VI continued from page 612
(M.E. 4196, 12 June 2003)

The Rhine valley is a continental rift valley, of the same type as the well-known great African rift valley. At some time in the past, tectonic forces have pulled the European land mass apart, creating a wide valley with steep escarpments. The forces are no longer so active, but the escarpments remain either side of the valley. The roads and railways and canals that link Strasbourg to Paris must necessarily climb this escarpment to reach the high Alsation plain.

The pretty town of Saverne sits at the mouth of the valley of La Zorn, one of the streams that dissects the edge of the escarpment, and the path that this valley provides has been an important route for many years. Evidence for this is seen in the castles that crown the surrounding hills, showing that in medieval times this was an important route. In due time this valley came to provide a route for the Rhine-Marne canal, and since has also provided the route for the Paris-Strasbourg railway.

The initial construction of the canal followed up the narrow valley beside the stream, providing a lock every kilometre or so as required to gain height. In the upper end of the valley where the main climb to the summit level took place,

seventeen locks followed each other in close succession, culminating in a tunnel 2600 metres long. The original canal had a total of 52 locks between Strasbourg at Rhine level and the summit of the canal. The locks each had 2.6 metres lift. Standardising the lift of each lock means that the appropriate amount of water should always be available in each level as the boats pass through. Each lock when emptied will provide enough extra water in the level below for the filling of the next lock down.

The 17 locks at the top end of the valley were replaced in the 1960s by a shiplift. This reduces the time taken to make the final climb from hours down to minutes. This shiplift is unique. Like the shiplift at Ronquieres, it is an inclined plane.



The trough descends towards the lower gate structure.

However, the incline is much steeper, and the trough is lifted up sideways rather than end on. The lift was built between 1964 and 1968 and entered service in January 1969.

Approaching the lift from below, the canal passes under the railway, then passes the opening of the old canal. The old canal leaves on the right to go up the right-hand side of the side valley. The newer section proceeds up the main valley a little further past the mouth of the side valley. There is a mooring area, in which the canal makes a U turn to face back down the valley and enter the trough of the lift. The lift takes the boat up the side of the main valley. On leaving the trough at the top, the new section of canal turns left into the side valley and proceeds along the left side, high above the old canal and the railway.

At the head of the valley the old and new sections meet at the mouth of the tunnel. The railway also comes up the same valley, and enters its own tunnel lower in level than the canal tunnel. The two tunnels are parallel, but the railway tunnel is on a grade, so at the far end emerges at the same level as the canal tunnel.

The area is composed of sandstone, and considerable work has been done to stabilise the cliffs above the new section of canal. An

emergency gate is provided near the tunnel to stop the flow of water should any accident happen to this section of canal or to the shiplift itself.

The Rhine-Marne canal provides for barges up to 300 tonnes, so it will be seen that this lift is not as big as some of the others. The difference in height is 44.5 metres, and the length of the inclines is 129 metres, with a gradient of 41%. One unusual feature is that provision has been made for a second trough to be added parallel to the first. This would double the capacity. Provision is also made for adding a second set of counterbalance weights. Since both troughs would work as a unit, it would not provide for any redundancy. Traffic on this canal has not increased sufficiently to justify this, and it appears unlikely that it will. The bulk of the traffic to be seen is pleasure craft. The trough is counterbalanced by two counterweights running either side of a central support.

The trough is 43 metres long, with a useful length of 41m inside. The width inside is 5.2m and the depth is 3.2m, with a total weight of around 900 tonnes. There are 32 wheels on eight bogies. The drive plant is a pair of 120hp Ward-Leonard sets. On one of our visits, some problem occurred while we were waiting to descend and three

pleasure boats spent about 20 minutes waiting partway up. It must have only been a minor problem since the lift was soon back in action.

The physical arrangements are such that to see the shiplift well you must either pay to enter or else take a boat through. The latter is also likely to involve some cost! You can get a distant view from the road in the valley below, but to get close you must park in the visitor car park and take the tour provided. This can include a boat trip along the summit level, and I believe may also optionally include a trip down and up the lift at some times. Included in the tour is a canal boat museum on the *Sophie-Marie*, an ex-canal boat now permanently on dry land beside the canal.

Getting there

From the E25-A4 take the Saverne exit and head towards Saverne. I do not have an exit number, but this exit is just after the steep descent from the high Alsace plain. Proceed into the town and turn right when you reach a T intersection. Cross the canal and bear left into the valley of La Zorn. You will see the canal and cross it before reaching Saverne and again in the town. Drive up the valley of La Zorn, crossing the canal again near a rail bridge. About 3 or 4 kilometres past



Looking up the lift towards the machinery room and upper gate structure. The two counterweights are descending. There is room for two more either side.



Looking down the lift showing the lower gate. The provision for an extra gate can be seen.



Approaching the upper gate. The lift moves quietly and smoothly.

the village of Lutzelbourg you will see the shiplift on your right. Just past the mooring area, turn right up the hill to the parking area.

The old canal may be readily visited by taking the turn up the side valley before reaching the

shiplift. It is possible to walk down the towpath beside all 17 of the old locks. At the time of my visit, most of this canal was empty of water, but there was evidence that it is planned to refill it. This would make it more attractive. Each lock is provided with a lock keeper's house in a typical French style. Some of these are unused and shabby, but some are obviously inhabited and look very pretty with their colourful paint and attractive gardens below the beetling sandstone cliffs. At one time, narrow gauge locomotives were used to provide haulage through the locks and tunnel and some track still remains. This appears to be about 600mm gauge.

Despite my penchant for picking up pamphlets at such places, I do not have detailed contact information for the visit to the shiplift. The open season is from March to October. The tourist office in Saverne may be contacted on France 0387253019.

Saverne is in the northern Vosges, a very scenic area. The town possesses a rose garden, used for the annual assessment of new rose varieties, and so is likely to appeal to the distaff side of the family. Apparently there are 1300 varieties on display. The centre of town and the canal boat mooring area is dominated by the Chateau du Rohan. One of the castles on the hills above the town is Haut Barre, also known as



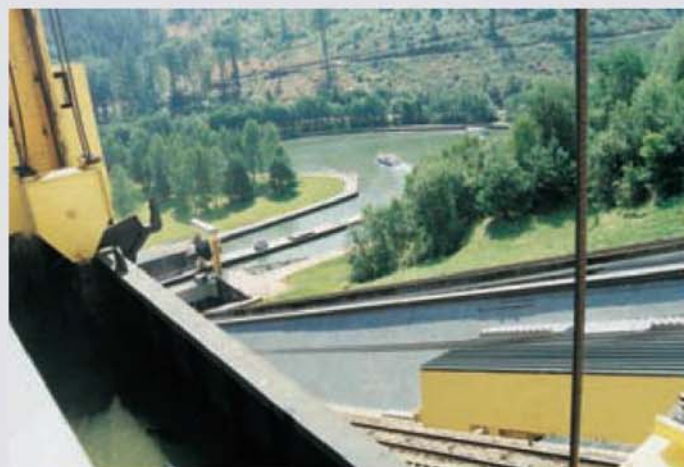
A lock keeper's cottage beside one of the seventeen locks replaced by the lift. The timber gives some hope that it may be intended to rewater this section of the canal, which would look better even if not navigable.

L'Oeil de l'Alsace, the eye of Alsace. A good camping ground is available near the town.

●*To be continued.*



The upper gate open ready for departure. The boat on the right is moored in the entrance for the possible future second gate.



Looking down the lift from the upper gate with the mooring area beyond.



The trough with its supporting structure and bogies. These boats spent some time stuck here while a minor technical problem was sorted out.



The tunnel mouth with a short section of the old narrow gauge haulage railway used to pull the barges.

Keith Wilson

discusses tender frame variations.

●Part XL continued from page 628
(M.E. 4196, 30 May 2003)

Frames of any locomotive part are always tricky to shew, for they are invariably full of holes tied together with metal and are somewhat large to boot. Since they have to be reduced in size to fit on our pages, the scale of the dimensions must therefore be large enough to still be readable when reduced. The drawing must be large in order to get the lot on, so we have two vital parameters which are mutually incompatible. Ever heard of the irresistible force meeting an immovable object? The only real answer to that is 'an indescribable catastrophe!' Fortunately for us there is a way round, and I hope to have made best use of it.

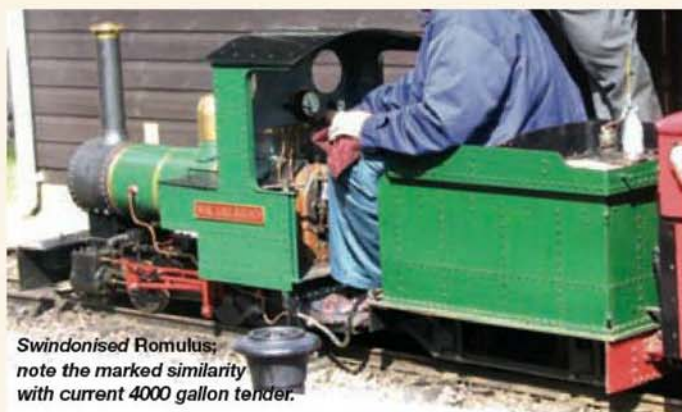
GWR tender frames have an advantage for us, in that all have regularly spaced axles, and the leading and trailing portions are identical in spacing. Thus the 3000, 3500, and 4000 gallon tenders all have 7ft. 6in. axle spacing, with leading portion 4ft. and trailing portion 3ft. 6 inches. Smaller tenders have the same fore-and-aft bits, but axle spacings 5ft. 6in. for 2000 gallons and 6ft. 6in. for 2,500 gallons. Makes life easier, doesn't it?

So while a small-scale reproduction of a full size drawing has to be shewn, it is quite simple to prepare full-size drawings of sections that do not require such reduction. More detail is easy to shew, and the scale of the dimensions is smaller so the drawing is easier and clearer to follow.

By far the best way of dealing with frames is to purchase them laser-cut or plasma-cut. It saves

many hours of time and guarantees an accuracy that we cannot hope to match. If properly done, not only is much of the hard work done, but generally every hole smaller in diameter than frame thickness is marked out with deadly accuracy and all that is needed is a reasonably good eye and a sharp centre-punch. Incidentally, I ordered a couple of nail-punches recently, and received them, nearly 8in. long each with long thin lower parts. Sharpening the $\frac{1}{8}$ in. dia. one to an acute angle produces a fine (in two senses) centre-punch, not to be hammered too strongly, but nevertheless easy to sight and use. You can then either use the dent to locate a shorter and fatter punch with a heavier blow to produce bigger and better dents, or use a fairly small drill for starters.

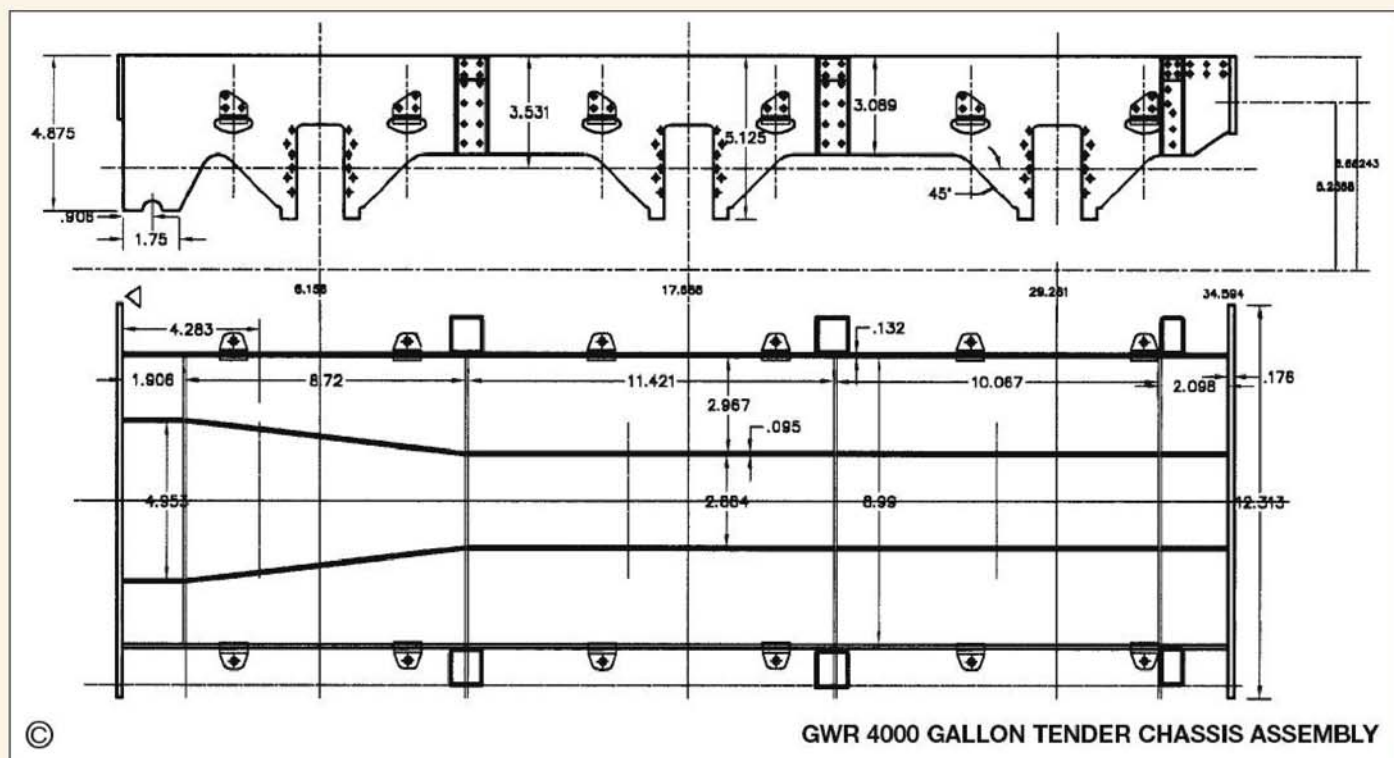
If the horns are cast with small raised bosses around the riveting holes (full size practice) use them rather than locating the holes from the frames; it is easier. It is best to use a couple of bolts and nuts as jacking pieces to clamp the horns against their frame slots, for sure as hens have teeth they



Swindonised Romulus; note the marked similarity with current 4000 gallon tender.

will do their utmost to move away. Use the two bolts between the horn faces, and two toolmaker's clamps each to hold them flat to the frames. I recommend that you drill one rivet hole in each at first, push in a rivet, and then drill the rest.

There are two inner frames plus some cross-braces to be dealt with. I must point out that they are not to be omitted, for they carry the vacuum brake cylinder which would otherwise be most difficult to mount, and the cross-braces carry the vacuum reservoir. In full-size they are held together with pieces of steel angle, but in our size it would be the deuce of a job to drill and rivet them up unless you are small enough to get inside the

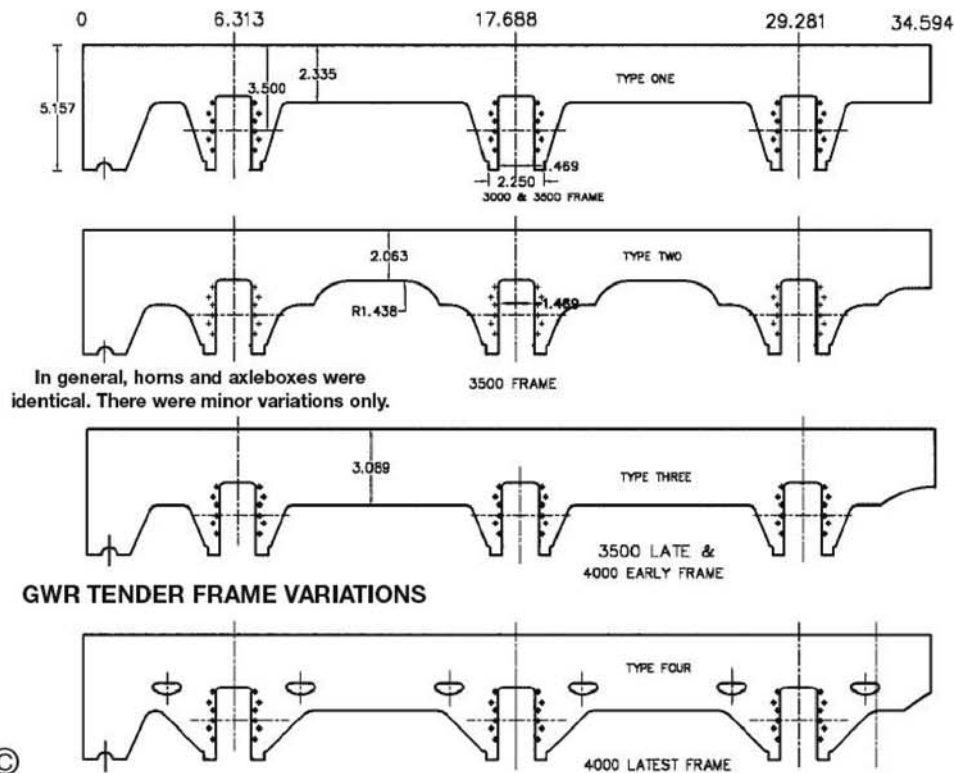


frames and take some power-tools with you. So I have shewn slotted inner frames and cross-braces that mesh together like some wall-mounted ornaments, and are then welded. It is by far the best way that I have so far discovered; I have used it several times.

In the same way, it is easier to weld the inner assembly to the outer frames than it is to rivet them. Unless you look underneath, this is quite invisible from the outside and the result is of course much stronger. Admittedly our locomotives are far stronger than 'scale' even if made with dead-scale materials, for old 'square-cube' says so. But a bit of extra beef does no-one any harm, and of course our tenders are more heavily loaded relative to their size due to non-scale drivers and firemen.

While mentioning strength, I had an e-mail recently from a good old friend querying the use of hollow axles on strength grounds. The strength of a round shaft to bending stress varies as the cube of the diameter, and the deflection under load as the fourth power. So a shaft 1.25in. dia. and $\frac{3}{4}$ in. bore has a (reference) strength factor of $(1.25 \text{ cubed} - 0.75 \text{ cubed})$ which works out to $(1.953 - 0.422) = 1.531$, the equivalent solid size being 1.153. Sufficient. For deflection under load the figures are 2.125 and 1.224, so a 1.25×0.75 in. hollow shaft has the same deflection as a 1.224in. solid shaft. Strength and stiffness enough! I have used this system since 1981 (a total of 86 axles) without troubles from lack of strength.

I shew a drawing of all the larger frames (as far as I know) and I believe there is sufficient information to enable any reasonable draughtsman to prepare the complete basic drawings for any set of tender frames.



Wilson's Words of Wisdom:
The worst danger of saying a thing cannot be done is that you may be interrupted by someone doing it.

The holes for hornchecks and hornstays are identical, and any holes required for brackets are located from the brackets; holes for fixing buffer plates are hidden anyway. There are differences in the brackets for spring bolts, and different lengths and types of spring.

The 67.5deg. tender frames have the spring brackets at the bottom of the frames, whereas the stouter 45deg. frames have the brackets mounted

by the semi-oval shaped holes shewn. In every case, as will be seen, the brackets clip under the lower edge of the frames (or into the aforementioned holes) as well as being riveted thereto; it all adds to the strength.

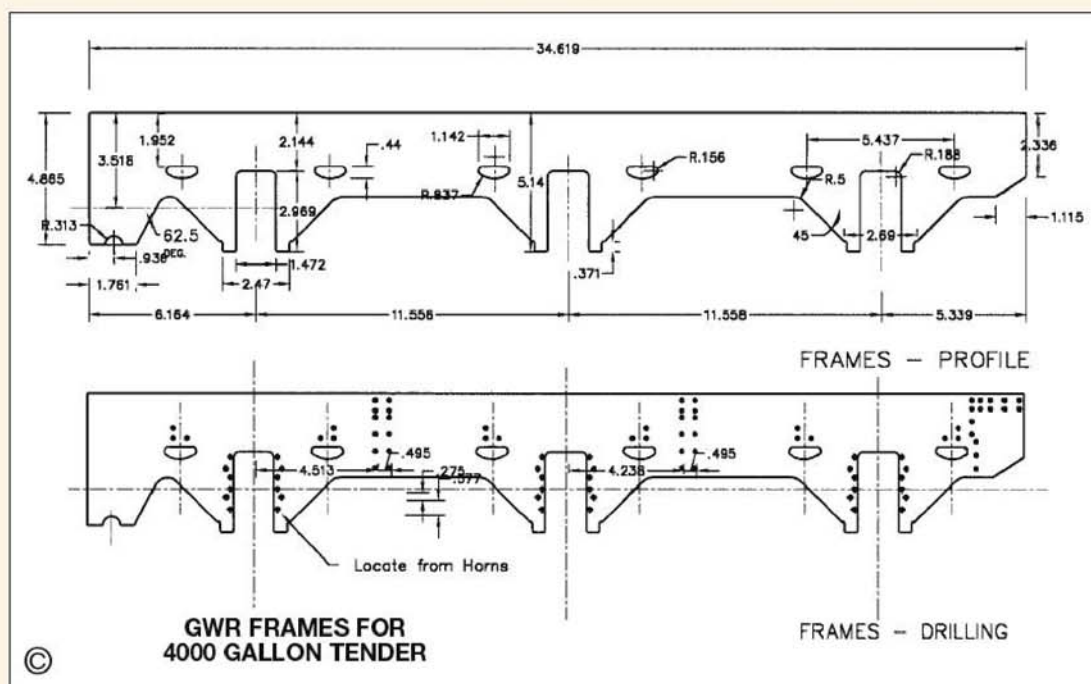
Not all frames are the same

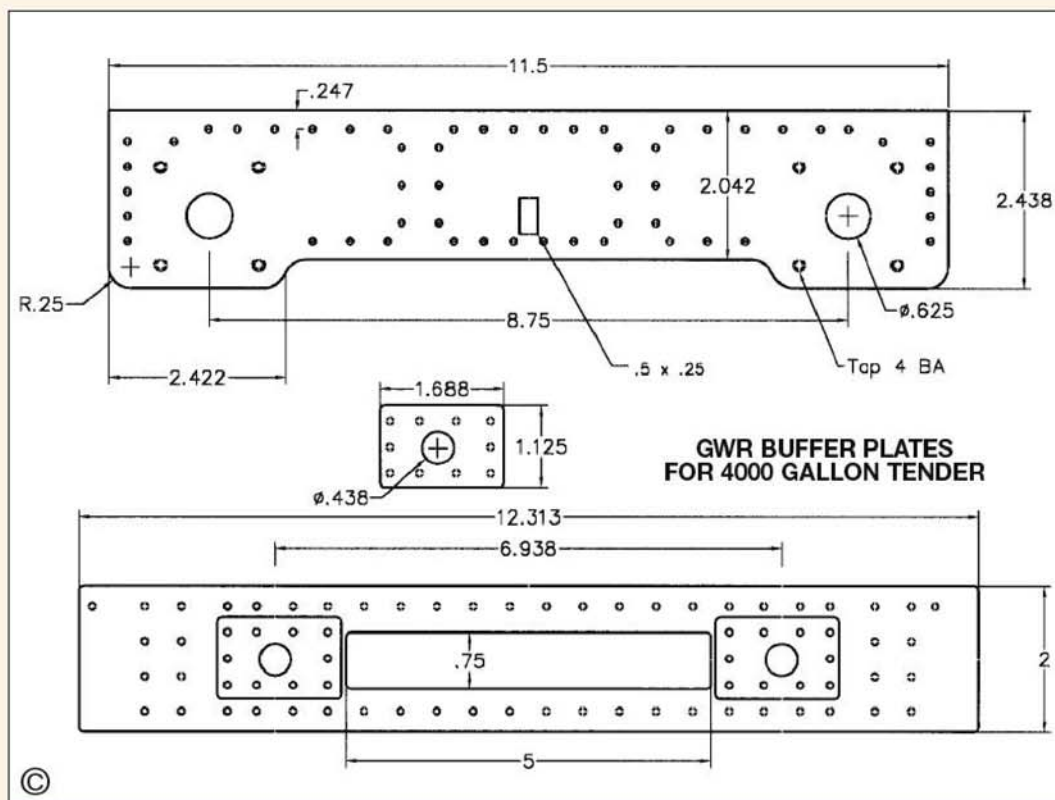
Type one generally applies to 3000 and 3500 gallon tenders, type two to some 3500 gallon tenders, especially where pieces of channel were used instead of angle for the hanging plates. I believe this was a Collett variation. There is at least one of these on the Severn Valley Line.

Types three and four are for the 4000 gallon tenders, the 45deg. frames type four was the later version; I think it was introduced for the second batch of Kings: Nos. 6020-29.

I have not bothered with the high-sided Hawkesworth tender, for it does not apply to any locomotives that I have built (except possibly post-war Castles), and I understand that it was a nightmare to fire from anyway.

Speaking of Kings, some good folk have wondered why my son's King is *King Charles III*. Anticipatory no doubt, but as is generally known, 6000 *King George V* is the 'flagship' and the rest were all named in reverse chronological order, back to 6029 *King Stephen*. When George V died, 6029 was re-named *King Edward VIII*, which in one sense was wrong, for he was never crowned (or coronated if you prefer). He abdicated, and 6028 was re-named *King George VI*, I think it was originally *Richard I*. In course of time and GWR tradition (for me there is no other





reason), 6027 *Richard II* would come to be 6027 *King Charles III*, so that is the reason. The last King I made would have been 6026 *King William V* (from 6026 *King John*) for exactly the same reason; but the future owner wanted KGV like most others. There is no other motive. The grape vine suggests that there are many *Kings Charles III*s 'waiting in the wings', perchance in 'table-top' gauges. It may come as a surprise to some readers, but of railway modellers (as distinct from 'our' sizes) some 40% or more model railways are Great Western in origin.

All these frames are from 3mm (0.116in.) mild steel, 1/8in. (0.125in.) is of course quite as good, but may be harder to 'procure'. While recommending laser-cut frames, I include buffer plates. They are of course less difficult to make than frames, but it all takes time. Of buffers themselves there is little point in re-describing, for I covered the matter pretty thoroughly in *M.E.* 4125, 28 July 2000, page 82 *et seq.* For the 4000 gallon tender, the big 'Collett' buffer is appropriate. Some earlier versions of this tender had the long-tapered 'Churchward' type, but as far as I know 4073 *Caerphilly Castle* is the only existing locomotive carrying this buffer. And I have searched!

Examination of the Swindon drawings of 3500 and 4000 gallon tenders does not seem to shew any difference in the buffer plates, so that is a bit of work saved. Two cover-plates are shown on the front buffer plate; these are for the snubbers. Snubbers? The correct name for 'buffers' 'twixt engine and tender. I have yet to make them, it



Axlebox, horns and springs on a Hawkesworth high-sided 4000-gallon capacity tender.

really is hardly worth the bother.

Coupling hooks and chains were dealt with in the issue but one following the 'buffers' article. I find that the long hook for the tender fits neatly back to the rearmost cross-brace, which will spring slightly under load.

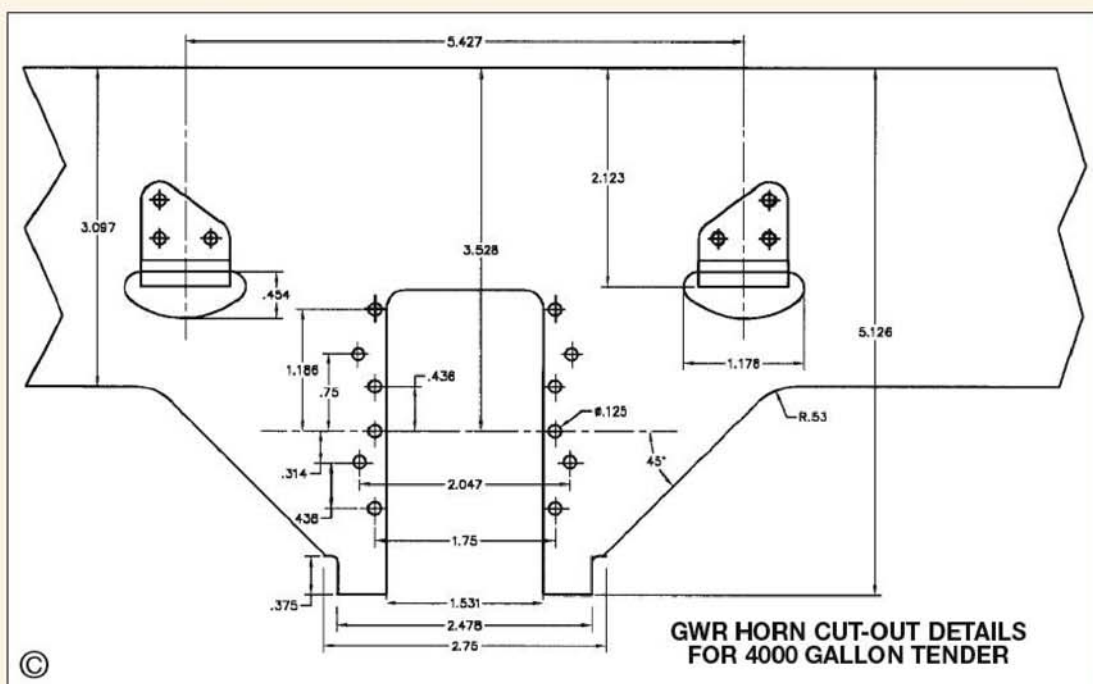
Incidentally, most of the inner frames appear to be stiffened with angle riveted along the top; unnecessary in our sizes, quite invisible from outside, and tricky to fix. Forget 'em. Said inner frames will appear next time.

I have mentioned before that GWR (at least) locomotive coupling hooks were not spring-loaded. Rolling stock yes, in special ways, but locomotives were fitted with shock absorbers similar (possibly, nay probably, identical) with those fitted to main springs.

Wagons were fitted with a long drawbar which ran right through from hook to hook with a spring 'yoke' in the centre, thus coupling and traction stresses were not part of the strain on the frame of each vehicle. On some, if not all of the freight stock, this bar passed through, or was firmly attached to the buckles of two big leaf springs, the outer ends of these pressing on the back rods of the buffers. Now, buffers are at 5ft. 8in. centres, so at 3ft. 4 1/2in., these springs were much longer than main springs; they were possibly the longest springs in use, but as always, I stand to be corrected.

I can clearly recall giving my first railway lecture — on simple signal interlocking principles — at the age of just under 13, but I have yet to reach infallibility! (Stand up, that twit who yelled "Hear, hear!")

●To be continued.



CLUB CHAT

With Stan Bray

UK News

Members of **Beamish ME Group** spent much of last winter completing their rack railway which was officially opened towards the end of last year. The work included fitting 224 stanchions to the viaduct and laying an extra track into the station. At the earliest opportunity, it is the intention to fit the carriages used on the rack railway with an independent braking system. Since these vehicles are always uphill of the locomotives, which have three braking systems, the present arrangement is perfectly safe. In the event of a locomotive derailment, it would be virtually impossible for the engine to leave the track far enough for the carriages and their passengers to pass it, so in any such incident the locomotive is almost certain to act as a buffer stop to prevent the carriages from moving. Nevertheless, an additional system is planned, involving a compressed air bottle, and is expected to be in use this summer. Publicity generated by reports of the opening of the rack railway has brought numerous requests from various clubs and organised groups to visit the society. Since these are usually combined with visits to the museum, there has been discussion with the museum authorities to devise a satisfactory and convenient manner to organise such visits. The society is also to become involved with restoration work being carried out on an LNER Class J21 locomotive which is being brought up to main line standard.

Committee members of **St Albans DMES** were all returned unopposed at the recent well attended AGM. Having established a schedule of dates for track meetings, the club is now sorting out a similar arrangement for the boating enthusiasts who meet at Verulamium lake in St. Albans. Those interested in both activities will now find that they have plenty of opportunity to enjoy themselves, without one aspect of their hobby clashing with the other.

Work on the **Romney Marsh MES** clubhouse extension is now close to completion, thanks to the dedicated band of Wednesday Workers. Although a grand toilet block has been included, there has been no news so far about the proposed connection to the main sewer so, for the present at least, the facilities will have to remain unused. A proposed adjacent housing

development which would have brought dwellings right up to the edge of the club site

has been refused by the authorities for a variety of reasons, one of which concerns the tendency of the club to flooding, a problem which would have been aggravated had approval for the development been granted.

Having completed his allotted 2-year stint as Chairman of **Nottingham SMEE**, Roy Whiting stood down in favour of Steve Harris who was elected at the recent AGM. Members are now able to enjoy workshop sessions on two evenings a week when, not only can they make use of the available machinery, but they can also obtain advice on all aspects of engineering techniques from fellow members.

Maidstone MES plans for a new carriage store, complete with the associated sidings and point work, have been approved by the local authority, so members now have plenty of work to keep them going during the summer. The old store was repainted not long ago, but was attacked in no time at all by vandals and graffiti 'artists'. It is hoped that a similar fate does not befall the new set up. Although at the time of writing 2003 is not even half way through, the club is already making plans for a special Luncheon in early 2004 as part of celebrations to mark the 75th anniversary of the society's founding.

Bedford MES has acquired a mechanical digger at what has been described as a 'reasonable' cost. Not only will this save a great deal of work with shovels, but it will also mean that there will be no need to hire one for work planned for the future. Unfortunately, it was acquired a little too late for some recent construction work for which a JCB and driver had already been hired. The club has a busy summer programme with several special events planned, some of which are purely for members' enjoyment. A pop-pop boat competition has been mooted as a new venture to augment the existing schedule.

The last social event of the closed season for **Cardiff MES** was a skittles competition held at the Three Arches Hotel when the President's Team fought a hard contest against the Chairman's Team, ultimately winning by a good margin. As well as social events, members have been engaged in improving the club facilities, including, among other things, a new tram shed and redecoration of the clubhouse. There have also been

discussions with the local Parks Department about a proposed extension to the ground level track, which involved both parties walking the proposed new route. There appear to be no objections from the Parks Department and the matter has now been passed to the Ward Councillors and National Playing Field Association for their views.

Much thought is given these days to boiler safety and general track safety, but we hear of few societies with special regulations relating to the operation of non-steam models. One that does is **Crawley MES** which has drawn up a set of special rules concerning the refuelling of petrol-driven locomotives. The regulations are quite stringent, which is as it should be, as the danger from accidental ignition of a can of petrol could be far greater than the risks associated with a steam boiler. A point of particular interest is that during the refuelling of a petrol locomotive, no steam locomotive is permitted to move from the station or steaming bays until the operation is complete, a real source of danger that has obviously been spotted.

The **Erewash Valley MES** annual dinner in late March was attended by 50 people and proved to be a very enjoyable evening. We are not told whether or not any members left with thick heads, but do know that a number had to be up very early the next morning in order to set up a stand at the Ilkeston Lions' annual Hobbies Exhibition, a display that apparently proved very popular with the general public.

For a number of years a Class 08 locomotive belonging to **Fylde SME** has handled a great deal of the club's passenger traffic. Powered by a 32cc JAP petrol engine, the model was made by late member John Lawson and purchased by the society when he died. The engine has been giving trouble recently and, despite efforts to coax it back to its former reliable condition, steadily deteriorated. A decision was therefore made to convert it to electric power. Although this may sound a simple task, it ultimately involved renewing virtually all the working parts, as well as altering the bodywork to accommodate the necessary batteries. With work now completed, the locomotive will once again be the mainstay of operations, although it is generally agreed that the electric motor does not deliver as much power as the JAP engine when in good order.

A rally will be held by **Leeds SME** during the weekend of 9/10

August when all visitors are assured of a warm welcome. Camping and caravanning space is available by prior arrangement and anyone wishing to take advantage of this should contact Arthur Bellamy on 01757-702863. The club is situated at Eggborough Power Station, which is on the east side of the A19 about 1½ miles north of junction 34 on the M62 Motorway. More information about the event and the society can be obtained from the club's website at <http://homepage.nflworld.co.uk/colin.abrey/LEEDS.htm>

The pupils who run **Ashcombe Miniature Railway** spent much of last winter carrying out work in the workshops, but still managed to make steady progress on the never-ending task of maintaining and upgrading the railway. Posts have been made to raise the signal wires higher from the ground to prevent them becoming entangled with the undergrowth, as has happened in the past. Lights have also now been fitted to the semaphore signals which will allow evening running to take place in the autumn.

Marine enthusiasts in the **North London SME** will be holding an open day on 27 July when all visitors will be welcome. The society's boat will be available for anyone that would like to try their hand at operating a radio control vessel. During the winter months the garden railway has been redesigned and additional sidings are now in place for storage purposes. A special circuit has also been installed to enable youngsters to run their Mamod models. In the larger gauges a loop of the ground level track around the boating pond is expected to be completed later this summer.

The idea of a celebration dinner to mark the 21st anniversary of the founding of **Stamford MES** did not prove as popular as anticipated. A special anniversary running session with a barbecue is therefore to be organised for August. The event will be for members, families and friends and sounds as though it will be a splendid party. Following the ravages of winter, time has been spent cleaning the track which, because it runs through a wooded area, gets into a bit of a state. Necessary repairs to a passing loop were completed by staff and pupils from the school where the track is situated.

Last autumn, the area around the **Leicester SME** track was adopted by children from Abbey Primary School who came along to plant bulbs. They returned in the spring to see the effects of their efforts

In Memoriam

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

Eric Lisle Rolly Ouellette Bill Prouse Roger Wigley	St Albans DSME Ottawa Valley Live Steamers Ottawa Valley Live Steamers Bedford MES
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and, to show their appreciation, society members provided trains for them to ride on. Members have been busy during the winter, working to improve wheelchair access to the club site facilities. The entrance has been completed and now efforts are concentrating on the exit, work which is having a dual effect since it will also improve general safety during public running. Passengers will no longer use the same entrance and exit for access to and egress from the trains; boarding and leaving will be separated into two distinctly separated areas.

We would like to join members of **Melton Mowbray MES** in offering our congratulations to their President, Lady Gretton, who has been appointed Lord Lieutenant of Leicestershire. The family having owned a 10 1/4in. gauge railway for many years, Lady Gretton, wife of the late Lord Gretton, is a very competent locomotive driver and takes a great interest in all the club's activities.

The **South Downs Light Railway Society** is involved with both 7 1/4 and 10 1/4in. gauges and so a major rerouting of the track which took place recently involved a great deal of heavy constructional work

Some 3 1/2 tonnes of rail and 30 tonnes of scalplings and track ballast have so far been used, plus a very large quantity of hardcore. The work has involved cutting down several large trees and building a retaining wall using old railway sleepers to support a section of the track that had to be raised. The work is not yet finished and for this running season parts of the original layout will remain in use. Apart from wishing to extend the track, the reason behind all this effort is an attempt to increase the radii of some curves which locomotives had been finding difficult to negotiate. It is anticipated that the new layouts will be taken into use in the spring of 2004.

Although generally aimed at small gauge railway interests, the **Historical Model Railway Society** is in fact also popular among modellers in the larger gauges. This popularity lies in the fact that members of the society carry out a great deal of research into our railways and can provide information and interest no matter in which gauge modellers happen to

be working. The latest issue of *The Journal*, their very high quality magazine which we are always pleased to receive, contains among other things, detailed articles on signal boxes of the Cheshire Lines, wagons built by the Bristol Carriage & Wagon Works and the locomotives built by Beyer Peacock Ltd. In addition to this the numerous sections of the society hold meeting of interest to model makers, at which interested visitors are generally made welcome. Anyone requiring further information about the society may contact the secretary by e-mail at secretary@hmsr.org.uk

World News

New Zealand

An auction held by **Hutt Valley MES** attracted a larger attendance than usual and there was some spirited bidding for some of the items, although there were still plenty of things which sold at knock-down prices. At Easter the club decided to run on one day only rather than attempting to rustle up sufficient volunteers for four

separate events. The decision was justified when members of the public turned out for rides in considerable numbers. To ease track congestion, a new storage road is planned and the track work, including the point, has been constructed. To be installed at the end of the club building, the land has to be built up before work can get under way. At the time of writing, a promise by the local authority to provide the material for this has unfortunately not yet materialised, so delaying the start of the project.

Good progress on building a 7 1/4in. gauge battery/electric locomotive is reported by **Maidstone MES** and it is expected to be running before winter sets in. A chain link fence has been built at the end of the station to allow better passenger control. It is hoped that the fence can be extended at a later date to prevent people straying onto the track. With all activities concentrated at ground level, the raised track has been somewhat neglected recently, but all this is about to change. The intention is to upgrade it for use by 2 1/2, 3 1/2 and 5in. gauge models, and when the work has been completed a rally for small locomotives will be held.

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.

JUNE

- 27-29 **Guild of Model Wheelwrights** at 8th Annual Chilterns Wood Fair, Open Air Museum, Chalfont St. Giles, Bucks. Contact Biddy Hepper: 01492-623274.
- 28 **Reading SME. Open Day.** Contact Graham Bustin: 01189-615450.
- 28 **Tallyllyn Railway. Victorian Train.** Enquiries: 01654-710472.
- 28 **Wigan DMES. Visit by Butterfly MRS.** Contact John Chamberlain: 01744-882255.
- 28/29 **Cheltenham SME. 65th Anniversary Weekend Celebrations & Running.** (No visiting locomotives please!) Contact Robert Lindsey: 01242-511436.
- 28/29 **Ribble Valley Live Steamers. Open Weekend.** Contact Mrs K. Avon: 01254-385170.
- 29 **Ascot LS. Members' Steam-Up.** Contact Ivan Hurst: 01276-28803.
- 29 **Cardiff MES. Open Day.** Contact Trevor Jenkins: 029-2075-5568.
- 29 **Chichester DSME. Steam on Sunday.** Contact Brian Bird: 01243-542266.
- 29 **High Wycombe MEC. Running.** Contact David Savage: 01494-527402.
- 29 **Kent MES. 70th Anniversary Model Engineering Exhibition.** Contact Brian Greenstreet: 0208-777-1704.
- 29 **Leighton Buzzard NG Rly. Vintage Vehicle Rally.** Enquiries: 01525-373888.
- 29 **MELSA. Sunday in the Park.** Contact Graham Chadbone: 07-4121-4341.
- 29 **Nottingham SMEE. Running.** Contact Gerry Chester: 0115-9259096.
- 29 **Ottawa Valley Live Steamers. Steaming Day.** Contact John Bryant: 761-1109.
- 29 **Oxford (City of) SME. Running.** Contact Chris Kelland: 01235-770836.
- 30 **Canterbury DMES. Meeting.** Contact Granville Askham: 01227-463295.
- 30 **Historical MRS (Essex Area). Excursion to Mid Hants Railway.** Contact Jem Harrison, 27 Colne Place, Basildon, Essex SS16 5UZ.

JULY

- 1 **Romney Marsh MES. Track Meeting.** Contact John Wimple: 01797-362295.
- 1 **Stamford MES. Presentations.** Contact David Ash: 01780-751211.
- 1 **Taunton ME. Barbecue.** Contact Don Martin: 01460-63162.
- 2 **Bradford MES. Charles Friel: Railways in Northern Ireland.** Contact John Mills: 01943-467844.
- 2 **Bristol SMEE. Meeting at Oldown Railway.** Contact Trevor Chambers: 01454-415085.
- 2 **Tyneside SMEE. Jim Reef: The Building of the Steam Elephant.** Contact Ian Spencer, 39 Briardene Crescent, Kenton, Newcastle upon Tyne NE3 4RX.
- 2 **West Wiltshire SME. Steam-Up.** Contact R. Nev. Boulton: 01380-828101.
- 2 **Wigan DMES. Charnobyl Children visit.** Contact John Chamberlain: 01744-882255.
- 3 **South Lakeland MES. Meeting.** Contact Adrian Dixon: 01229-869915.
- 3 **Sutton MEC. Bits & Pieces.** Contact Mike Dean: 0208-657-5401.
- 4 **Vale of Aylesbury MES. Track Night.** Contact Clive Ellam: 01296-623433.

- 4 **Maidstone MES. Evening Run & Hot Dogs.** Contact Martin Parham: 01622-630298.
- 4 **North Norfolk MEC. Mike Hayns: Lusitania.** Contact Gordon Ford: 01263-512350.
- 4 **Portsmouth MES. Fish & Chip Evening.** Contact John Warren: 023-9259-5354.
- 4 **Rochdale SMEE. Models Running Night at Springfield Park.** Contact Mike Foster: 01706-360849.
- 4 **Romford MEC. Competition Night.** Contact Colin Hunt: 01708-709302.
- 4-6 **British Columbia SME. 75th Anniversary Meet.** Contact Sean Laurence: (604) 931-1547.
- 5 **Cardiff MES. Steam-Up & Family Day.** Contact Trevor Jenkins: 029-2075-5568.
- 5 **Historical MRS (Bristol Area). Visit to Avon Miniature Railway.** Contact Gerry Nichols: 0117-973-1862.
- 5 **Isle of Wight MES. Track & Pond.** Contact Ken Stratton: 01983-531384.
- 5 **Leyland SME. Just a Chat.** Contact Mark Entwistle: 01772-422411.
- 5 **Maxitak Owners Club. Track Day.** Contact Eric Penn 0208-979-4335.
- 5 **SM&EE. Derek Brown: Injectors.** Contact David Boote: 01202-745862.
- 5 **The Society of Ornamental Turners. Meeting.** Contact N. S. Edwards: 01234-359392.
- 5 **Tallyllyn Railway. Victorian Train.** Enquiries: 01654-710472.
- 5 **York City & DSME. Summer Barbecue & Steaming.** Contact Ken Bateman: 01904-421445.
- 5/6 **Ammerfield Miniature Railway. Steam Open Day.** Contact David Jerome: 0118-9700274.
- 5/6 **Ascot LS. GL5MLA Rally.** Contact Ivan Hurst: 01276-28803.
- 5/6 **Chiltern Traction Engine Club. Chiltern Steam Rally at Prestwood, Nr. Great Missenden, Bucks. Admission £4, Seniors £2.50, Children £1.** Contact John Turner: 01494-526807.
- 5/6 **Dockland & E. London MES. Track Run.** Contact P. M. Jonas: 01708-228510.
- 5/6 **Lancaster and Morecambe MES. Open Weekend.** Contact Stan Jackson: 01539-560278. Contact Harry Carr: 01524-411956.
- 5/6 **Moors Valley Railway. American Weekend.** Contact Jim Haylock: 01425-471415.
- 5/6 **Stockholes Farm MR. Rally Weekend.** Contact Ivan Smith: 01427-872723.
- 5/6 **Guild of Model Wheelwrights at Fire Rail 2003, St. Peters Collegiate School, Compton Campus, Wolverhampton.** Contact Biddy Hepper: 01492-623274.
- 6 **Andover DMES. Members' Running Day.** Contact R.W. Hanman: 01980-846815.
- 6 **Basingstoke DMES. Running.** Contact Ian Shanks: 01420-561741.
- 6 **Birmingham SME. Charity Day.** Contact John Walker: 01789-266065.
- 6 **Bristol SMEE. Passenger Day.** Contact Trevor Chambers: 01454-415085.
- 6 **Centurion SME. Visit to RSME.** Contact Rudy Du Preez: 012-9986780.

And finally...

Well, I'm afraid that's all from me, at least as far as *Club Chat* is concerned, although I still hope to continue to complete the work on *The Junior* and to supply some constructional articles.

How did it all start?

Well, once upon a time, a very long time ago now, a new magazine with the title *Engineering in Miniature* was just about to be appear, and I joined Chris Deith in launching it in April 1979. At about the same time changes were taking place at Model and Allied Publications (MAP), which published *Model Engineer* at the time. Editor, Les Porter, was leaving and Laurie Lawrence agreed to take the job on, but only with suitable assistance.

He telephoned me, asked if I would like to join him, and quoted a salary which made it impossible for me to refuse. We had worked together before in a different way, partly at the formation of the Southern Federation of Model Engineering Societies, and also with the SMEE track at the Model Engineer Exhibition. Here, for a few years at least, it became something of a tradition that I would be the first driver on the track, mainly because I worked in London and was able to slip away at a time when it was difficult for others to get there.

The late Bill Carter, who was always there, preferred to spend the first hour or two on organisational matters rather than running a locomotive. So, after the first few issues of *EIM*, I made the change and joined Laurie as Associate Editor on *Model Engineer*.

Sales had fallen alarmingly and it was up to Laurie and me to pull the magazine back on track, which we did very successfully, doubling the circulation in a short period of time. We were greatly assisted by regular meetings with our team of consultants over lavish lunches funded by the then management. Those attending the meetings included such greats as Martin Evans, John Haining, Malcolm Wild, George Thomas and Professor Chaddock, and a great deal of good sound advice was the result.

It was generally agreed that I should take over *Club Chat*, which at that time was rather disorganised, and apart from wanting to involve the societies more, there was another good reason why it should change. Many new societies had been formed in the then recent years, and they were beginning to hold their own rallies. Prior to this, there had been no more than about half a dozen rallies throughout the UK to which the same people went year after year and needed no

guidance as to where and when the events would be held.

Club Diary had to be current and, as a result, we began to get numerous telephone calls asking about where and when events were to be held. Answering these was very time-consuming, so it was agreed to build up a *Club Chat*, column giving as much advance notice of events as possible and also advising readers of any improvements made by societies, as well as any other news of interest.

The column basically still follows the same format today with the addition that many societies which now hold events can provide camping and caravanning facilities for which early booking is essential; *Club Chat* provides the necessary early notice for those bookings.

Working at Hemel Hempstead involved me in a round trip of over 100 miles a day and, while it was fine during the summer, it was not too much fun in the winter. Following some particularly bad weather, I decided that I could no longer continue. Discussions with Laurie led to me being asked to take on the role of Club News Editor and to write a regular constructional column, work which I could easily do from home with just the occasional saunter into the office once or twice a month.

This arrangement suited me fine since it also gave me the opportunity to build up a little sideline I had of coaching squash. Yes, surprising as it may seem, at one time I was a professional squash player and am a qualified coach.

So that was the way things were; more part time editing jobs came along, in particular the launch of *Model Engineers' Workshop* and *World of Model Engineering*. The latter was published as a special issue every year or so and proved extremely popular, in fact many readers used to telephone for the date of the next issue. *Model Engineers' Workshop* was something that it took me some while to persuade the management to accept and, when they did, it was on an agreement to publish two issues only as it was firmly believed that nobody would buy it. In fact, of course, it has proved very popular.

Well, that's about it. Writing *Club Chat* has been great fun, and I have made many friends throughout the world as a result of doing so. I hope to retain those friendships. I must thank all the readers who have contacted me over the years and, of course, the societies which kept the newsletters coming, from which I was able to glean the necessary information.

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|---|---|
| <p>6 Guildford MES. Disability Challengers Day. Contact Dave Longhurst: 01428-605424.</p> <p>6 Leighton Buzzard NG Rly. Model Railway Mania. Enquiries: 01525-373888.</p> <p>6 Leyland SME. Ground Level Running. Contact Mark Entwistle: 01772-422411.</p> <p>6 Lincoln DMES. Running. Contact Paul Thompson: 01522-888228.</p> <p>6 Nottingham SMEE. Running. Contact Gerry Chester: 0115-9259096.</p> <p>6 Oxford (City of) SME. Running. Contact Chris Kelland: 01235-770836.</p> <p>6 Rugby MES. Running. Contact David Eadon: 01788-576956.</p> <p>6 Taunton ME. Running. Contact Don Martin: 01460-63162.</p> <p>7 Lancaster and Morecambe MES. Informal Night. Contact Harry Carr: 01524-411956.</p> <p>8 Basingstoke DMES. Meeting. Contact Ian Shanks: 01420-561741.</p> <p>8 Dockland & E. London MES. Meeting. Contact P. M. Jonas: 01708-228510.</p> <p>8 Romney Marsh MES. Track Meeting. Contact John Wimble: 01797-362295.</p> <p>8 Sutton Coldfield MES. Vintage Motorcycle Club Visit & Barbecue. Contact Roger Timings: 0121-308-5875.</p> <p>10 High Wycombe MEC. Track Evening. Contact David Savage: 01494-527402.</p> <p>10 N. W. Leicester SME. Ploughman's Supper. Contact John Elliott: 01455-847040.</p> <p>10 Sutton MEC. New Drivers' Run. Contact Mike Dean: 0208-657-5401.</p> <p>12 Cardiff MES. Lord Mayor's Charity Day. Contact Trevor Jenkins: 029-2075-5568.</p> <p>12 Maidstone MES. Invitation to Birchley. Biddenden. Contact Martin Parham: 01622-630298.</p> <p>12 Reading SME. Club Running. Contact Graham Bustin: 01189-615450.</p> <p>12 Romney Marsh MES. Track Meeting. Contact John Wimble: 01797-362295.</p> <p>12 Talylyn Railway. Victorian Train. Enquiries: 01654-710472.</p> <p>12/13 Bristol SMEE. IMLEC 2003. Contact Don Cordall: 0117-962-4073.</p> <p>12/13 Chesterfield MES. Steaming at Papplewick. Contact Mike Rhodes: 01623-648676.</p> <p>12/13 Dockland & E. London MES. Track Run at Weald Country Park. Contact P. M. Jonas: 01708-228510.</p> <p>12/13 Kew Bridge Steam Museum. Festival of Model Tramways. Information: 020-8568-4757.</p> <p>13 Canterbury DMES. Running. Contact Granville Askham: 01227-463295.</p> <p>13 Cardiff MES. Chernobyl Children's Visit. Contact Trevor Jenkins: 029-2075-5568.</p> <p>13 Harlington LS. Open Day. Contact Peter Tarrant: 01895-851168.</p> <p>13 Leeds SMEE. Running Day. Contact Colin Abrey: 01132-649630.</p> <p>13 Leighton Buzzard NG Rly. Anoraks Day. Enquiries: 01525-373888.</p> <p>13 Nottingham SMEE. ModelWorks Rally. Contact Gerry Chester: 0115-9259096.</p> <p>13 Ottawa Valley Live Steamers. Steaming Day. Contact John Bryant: 761-1109.</p> <p>13 Romney, Hythe & Dymchurch Railway. Romney Express Day. Information: 01797-362353.</p> <p>13 Surrey SME. Running. Contact John Cook: 020-8397-3932.</p> <p>13 Sutton MEC. Barbecue & Family Day. Contact Mike Dean: 0208-657-5401.</p> <p>14 Bedford MES. Meeting. Contact Ted Jolliffe: 01234-327791.</p> <p>14 Erewash Valley MES. Steaming Evening & Barbecue. Contact Jim Matthews: 01332-705259.</p> | <p>14 Saffron Walden DSME. Club Night. Contact Jack Setterfield: 01843-596822.</p> <p>15 Chesterfield MES. David Carnell: Bearings. Contact Mike Rhodes: 01623-648676.</p> <p>15 Nottingham SMEE. Visit to Plessey Pit. Contact Graham Davenport: 0115-8496703.</p> <p>15 Romney Marsh MES. Track Meeting. Contact John Wimble: 01797-362295.</p> <p>15 Taunton ME. Martin Wright: Get On Your Trike. Contact Don Martin: 01460-63162.</p> <p>16 Bournemouth DSME. AGM & Richard Harvey: Sinsheim. Contact Mike Baker: 01202-383653.</p> <p>16 Bristol SMEE. Monty Ellis: Letters to a Grandson. Contact Trevor Chambers: 01454-415085.</p> <p>16 Historical MRS (North West Area). Gavin Liddiard: An Introduction to DCC. Contact David Goodwin: 01224-880018.</p> <p>16 Maidstone MES. Members' Afternoon Playtime Run. Contact Martin Parham: 01622-630298.</p> <p>16 West Wiltshire SME. Steam-Up. Contact R. Nev. Boulton: 01380-828101.</p> <p>17 Isle of Wight MES. Bits & Pieces. Contact Ken Stratton: 01983-531384.</p> <p>17 Leyland SME. What is it? Night. Contact Mark Entwistle: 01772-422411.</p> <p>18 Rochdale SMEE. Visit to East Lancashire Railway. Contact Mike Foster: 01706-360849.</p> <p>18-21 Talylyn Railway. Have-a-Go Gala. Enquiries: 01654-710472.</p> <p>19 Chesterfield MES. Running Day. Contact Mike Rhodes: 01623-648676.</p> <p>19 Erewash Valley MES. Steaming Day. Contact Jim Matthews: 01332-705259.</p> <p>19 Hull DSME. Members' Problems Solved. Contact Brian Rylance: 01482-647032.</p> <p>19 Maidstone MES. Visit to Beech Hurst. Contact Martin Parham: 01622-630298.</p> <p>19 Romford MEC. Track Afternoon. Contact Colin Hunt: 01708-709302.</p> <p>19/20 Guildford MES. Rally/Exhibition. Contact Dave Longhurst: 01428-605424.</p> <p>19/20 Kinver & West Midlands SME. 24 Hour Charity Run. Contact John Campbell: 01384-891244.</p> <p>19/20 Moors Valley Railway. Hornby Railways Weekend. Contact Jim Haylock: 01425-471415.</p> <p>19/20 Romney, Hythe & Dymchurch Railway. A Day Out With Thomas. Information: 01797-362353.</p> <p>19/20 Guild of Model Wheelwrights at Holkham Country Fair, Holkham Hall, Norfolk. Contact Biddy Hepper: 01492-623274.</p> <p>19/20 Guild of Model Wheelwrights at Much Marcle Steam Rally, Herefordshire. Contact Biddy Hepper: 01492-623274.</p> <p>20 Andover DMES. Rob Roy Day. Contact R.W. Hanman: 01980-846815.</p> <p>20 Bedford MES. Running. Contact Ted Jolliffe: 01234-327791.</p> <p>20 Leyland SME. Scale Running Open Day. Contact Mark Entwistle: 01772-422411.</p> <p>20 Lincoln DMES. Running. Contact Paul Thompson: 01522-888228.</p> <p>20 N. W. Leicester SME. Running Sunday. Contact John Elliott: 01455-847040.</p> <p>20 Nottingham SMEE. Running. Contact Gerry Chester: 0115-9259096.</p> <p>20 Oxford (City of) SME. Running. Contact Chris Kelland: 01235-770836.</p> <p>20 Saffron Walden DSME. Running Day. 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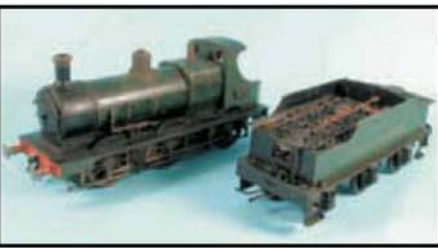
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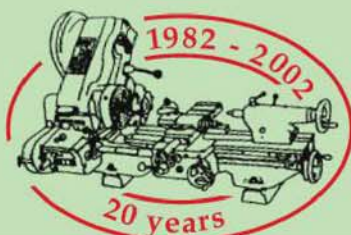
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HARRISON M250, 5" x 20", gearbox, power feeds, 3 & 4 chucks, Ex-services	nice condition £2,950
HARRISON M250, 5" x 30", long bed, gearbox, power feeds, chucks, Acutite III DRO on cross-slide, dual dials	In very nice condition £3,250
HARRISON M300 6" x 24", geared head, gearbox, power feeds, 3 jaw chuck, Dickson toolpost	As is £1,850
HARRISON M300 6" x 40", geared head, gearbox, power feeds, gap bed, 3 jaw & 4 jaw chucks, fixed steady	In very nice condition £3,450
HOBBYMAT MD200 20mm centre height x 200mm between centres, a small precision lathe	£345
HOBBYMAT MD65 2 1/2" x 12" Screwcutting Lathe with change wheels and some tooling	£425
MYFORD ML10 3 1/2" x 15", change wheels, 3 jaw chuck, stand, tray and blocks, mods on the machine & 1/1 clutch	£725
MYFORD ML7 3 1/2" x 19" lathe, 3 jaw chuck have a large selection of this popular model	£750
MYFORD ML7T 3 1/2" x 19", Tri-lever, change wheels, 3 jaw chuck, lever tailstock, cabinet stand	very clean £1,500
MYFORD ML7B 3 1/2" x 19", gearbox, 3 jaw chuck and tooling	£1,250
MYFORD SUPER 7 3 1/2" x 19", change wheels, 3 jaw chuck and tooling	Choice £950 - £1,150
MYFORD SUPER 7, 3 1/2" x 19", 3 jaw chuck, power cross-feed	Late model Choice
MYFORD SUPER 7 3 1/2" x 31", change wheels, 3 jaw chuck and tooling	Choice £1,400
MYFORD SUPER 7, 3 1/2" x 31", (long bed) power cross-feed, induction hardened bed, industrial stand and doors, green machine	£2,950
MYFORD SUPER 7B 3 1/2" x 19", gearbox, 3 jaw chuck and tooling	£1,250
MYFORD SUPER 7B, 3 1/2" x 19", gearbox, Power Cross Feed, cabinet stand, tooling	£2,750
MYFORD SUPER 7B, 3 1/2" x 19", gearbox, Power Cross Feed, 3 jaw chuck and tooling on stand	excellent condition from new and NOT re-conditioned
RAGLAN CAPSTAN 10" x 24" 6 Station Turret, out of side, collet chuck (lever) & collets, bar feed, variable speed, coolant	£950
SMART AND BROWN 1024 Tool-room lathe, full screwcutting gearbox and power feeds	£2,950
complete with 3 & 4 jaw chucks, collet set, steadies and equipment	In very good condition £1,495
VICEROY TDS 1 GBL 5" x 24", gearbox, power slides, 3 MT tailstock complete with fixed steady	£1,250

TOO MANY LATHES TO LIST!!

MILLING MACHINES

V - VERTICAL, H - HORIZONTAL

ADCOCK AND SHIPLEY HES Horizontal/Vertical Head, 30" x 8" powered table and feed gears, coolant	£1,625
ADCOCK AND SHIPLEY 2ES horizontal milling machines	a silly price of each £145
BOXFORD VM30 vertical variable speed / 30 INT head, table 21 1/2" x 6" & Abwood vice and chuck	£1,500
BRIDGEPORT vertical belt head 2 speed (short motor) head, R8 powered head, gearbox table, 42" x 9" table	Very nice £2,250
CENTEC 2B Horizontal, 1" arbor, table powered, 3 ph motor, single phase main motor	£725
CENTEC 2B Vertical/Horizontal, quill feed 2MT head, 25" x 5" table, pedestal model	£1,400
ELLIOT '00' OMMILL VH3 Morse taper quill universal head, 28" x 7 1/2" powered table	Just In £1,850
ELLIOT Turret mill R8-10 speed 70-3000 rpm, table 45" x 10" (powered)	£1,500
HARRISON horizontal, 31" x 8" powered table	still good value £625
HARRISON H/V 30 INT swivel head & clutch, 30" x 8" table/powered	£1,950
HARRISON Vertical 30 INT swivel head & clutch, 30" x 8" table/powered	£1,950
MARLOW Vertical Turret Type Mill, 3 Morse Taper	A favorite mill for its height under the head £750
RAGLAN vertical mill 2 Morse taper, 2 speed motor, variable selector 175-2220 rpm, stand	give away £750
RIKTON vertical bench milling machine, 2 MT head quill type, speeds: 175-2220 rpm, 24" x 6" table/powered	£3,250
SIP RF30, vertical milling/drilling machine complete with accessories	Still only and New £799
TOM SENIOR MODEL E vertical mill complete with cabinet stand	single phase and rare £2,650
TOM SENIOR MODEL E vertical mill complete with cabinet stand single phase and rare in excellent condition + 70m	
Senior swivel vice and geared conversion gear, one meticulous owner from new - must see good home	£3,450
TOM SENIOR JUNIOR horizontal mill with a vertical head (sleeve to be made), table, 20" x 4 1/2", powered	£1,200
TOM SENIOR M1 horizontal, 25" x 6" powered table, 1" arbor	£575
TOM SENIOR M1 V/H, 25" x 6", 2 motor taper, 1" arbor	Selection £1,200 - £1,450
TOM SENIOR M1 V/H, 25" x 6", 2 motor taper, 1" arbor	Very late 240 volt machine £1,950
TOM SENIOR ELT MAJOR, 2 motor taper quill feed head, powered 37" x 8 1/2" table	£3,200
VICEROY AEW vertical mill, 30 INT swivel head, powered table 34" x 8"	Very clean £1,625

DRILLS

ARBORA ER 25 / 25" Radial Drill speeds (8) 100-2900 RPM	clean table £1,425
ASQUITH 14-54 001 Mk2 (Smt) Radial Drill	£3,950
POBCO 1/2" Bench, tilting table	£325
POBCO 1/2" Pedestal drill tilting table	£345
MEDDINGS MB10 high speed drilling machine with 240 volts	£375
MEDDINGS 1/2" pedestal drill	£245
MEDDINGS 2 Morse taper pedestal drills (new type lighter drill)	Choice £275
MEDDINGS 2 Morse taper quality bench drills	Choice only (each) £325
POLLARD CORONA Pedestal 1/2" / 1" Morse	From £100
SIP HDP 600B 5/8" / 2MT Bench Drill, table operated by rack, speeds: (16) 162 - 3000 rpm	New £175
STARTRITE Mercury 1/2" 4 speed bench drill	£225
STARTRITE EF1 3 Morse taper, power up / down, 12 speeds, 80 - 2800 rpm	In excellent condition £950

GRINDING / BUFFING

BRIELEY drill point grinder complete with cabinet stand and parts	£375
CLARKSON MK1 Tool and cutter grinder complete with universal head and centres	£550
MILFORD 12" Pedestal Grinder	£325
VICEROY Grinder, pedestal model	£145
VICEROY Buffers, pedestal models	Each £250

MISCELLANEOUS / FABRICATION MACHINERY

New FROM New Zealand: Machine vice, 55mm. Jaws precision miniature type ideal for vertical slides and smaller milling machines such as BCA now with the swivel base	£134
Vice on own	£85
Swivel base on own	£49

CROMPTON PARKINSON 1/2 HP, resilient mount, Boxford / Myford Super 7 Type motor	New £140
MYFORD RODNEY HEAD MILLING HEAD for the Myford ML7 Lathe	£575
MYFORD TRI - LEVER for the Myford ML7	£245
MYFORD DIVIDING HEAD in a ver nice condition	£395
MYFORD CAPSTAN ATTACHMENT New and Never bored for the lathe so unused	£750
HOFFMAN DIVIDING HEAD complete with tailstock	£425
LPA 2S, 40 INT Boring Head	£375
ARCHER Tapping Heads	FROM £70
HARE MODEL 51T complete with hydraulic indexable table	JUST £425
EMI-MEC SPRINT Spindles and Collets BSA No. 46 Direct spares	Just In
SWEENEY AND BLOCKAGE NO.2 Flypress complete with Ball	Very Clean £225
MARCO Notch Broaching fixture + Notch Broach	£425
HARCOS Universal Head for tool and cutter grinder	£245
MYFORD Vertical Slides just in	£95 / £155
MYFORD VM-D Milling attachment for ML7 and super 7 lathes	As New £675
BCA 12" horizontal/vertical rotary table	Very Nice £425
QUANTITY OF slips, height gauges, squares, straight edges, micrometers, cubes, angle plates and miscellaneous measuring tools	Just In
COPE AND DRAGS	WOOD £20 / METAL £30
TONGS (a varied selection)	EACH £5
FLAMEFAST DS 130 Ceramic Chip Forge	£345
FLAMEFAST DS 100 Hearth	£140
MARCO Broaching Press	£425
JONES AND SHIPMAN 4" x 24" bench centres	very nice example £245
TOM SENIOR slotting head	£450
STARTRITE 18-5 Woodworking / non ferrous bandsaw (5 speed bandsaw)	£950
DIAMOND fret saw, variable speed	£345
RJH BT 12S Fretsaw, variable speed	£345
SMART AND BROWN / CLARKSON H3-H5 toggle presses	Each £195 / £275
VERDICT CLOCKS, Long/Short Metric and Imperial models	New £40
FLAMEFAST LD300 soldering Iron stove	£75
GRANITE 18" x 12" Surface Plate	£140
VIBRO-SHEAR Nibbler	Just in £425
TRIUMPH BURNER 4 Jaw Chuck	£245
TRIUMPH FACE PLATE D14	£70
JONES AND SHIPMAN Broaching Press + Stand	£375
ABB Inverter & 1/2 hp motor, wired up	£250
SIP 7" bandsaw, horizontal & coolant	New £750
DUPLEX D29 toolpost grinder	£345
BOXFORD (imperial only) thread dial indicator	£65
VANCO, 1" finisher / vertical + extractor	£495
BURNER, D14 lever collet chuck + collets	£400
BURNER, LO lever collet chuck + collets	£400
VERTEX Dividing head	New £245
VERTEX 6" - 8" - 10" rotary tables	good value equipment New From £135
MYFORD ML7 / Super 7 rear tool post	£40
MYFORD 254S rear tool post	New £40
MYFORD Vertical slide / fixed type (copy) 1/2	£99
LOCKWOOD QUAD HEADED 2mt Die Holder	quality equipment New £40
LOCKWOOD QUAD HEADED 3mt Die Holder	quality equipment New £40
LOCKWOOD Test Bar / 2mt Boxed	quality equipment New £39
MAGNETIC chuck - 18" x 6" fine pole	Never used £325
UNION tool and cutter grinder stand	£135
50 INT Tooling: Selection	Just In
STARTRITE 352 woodworking band saw	£975
ALCOA GF 080/1 Rapid Melting Furnace	£775
MYFORD Burner Gripturn 3 Jaw Chucks	£300
COLCHESTER D13 Burner 4 Jaw 8" light body independent chuck	Boxed £225
RJH 4" Linisher / Vertical complete with built in extraction	one off £225
MICROMETERS and associated measuring tools	Still packaged as new £825
POTTERY WHEELS, kilns and associated equipment	Just In Cheap
SPECAC Powder type press	£225
HARRISON L6 metric gearbox	As is £250
HARRISON L6 tailstock	£245
SIP 1 TON MOBILE CRANE Manufactured 2000 (used just once)	As new £375
MITUTOYO grade A set of slips	£245
F.J. EDWARDS 24" hole outter	£525
Large bench vice	£70
LINK15 ton vehicle crane + top hat	£625
MITUTOYO 103-913 metric set micrometers	£275
NORTON / EDWARDS arbor presses	£75 / £145
AJAX 6" hacksaw	£425
SURFACE plates from 12" x 12" to 36" x 36"	Very nice from £320
WEBER 1 1/2 ton mobile garage crane, late blue colour	£495
ELLIOTT 1250 STURDIMILL vertical head	One off (rare) £525
RJH finisher 4" wide belt, pedestal	£345
STEEL STOCK different stock rolling in almost daily	to callers only
ELLIOT U1 / U2 Slotting Head	£475
SWAGE BLOCKS	£125 / £145
J & S Universal grinding vices	Choice £275 / £325
BOX TABLES: Grade A and B, many sizes	£40 - £150
SLIPS / GAUGES Metric / Imperial, New Sets: 87 / 81 piece	£215 / £145
HORIZONTAL METAL BANDSAW 6" x 4 1/2" capacity	New £170
COLCHESTER STUDENT / MASTER Round head, face-plates, small / large	£50 / £80
QUALTERS AND SMITH 6" Hacksaw	£345
BORING HEADS 2 / 3 Morse, R8 Taper, Max. Capacity 41/2" round bar	New, each £90
ODON Machine Bed Clamps (pair)	Special £24.50
HEIGHT GAUGES by Chesterman, Shardlow, Moore and Wright	From £95
ELLIOTT 10M Shaper, 10" stroke	£325
DIE BOXES	From £45
TRANSWAVE 5HP Converter	New £295
TRANSWAVE 5.5HP Converter	New £385
TRANSWAVE MT & RT rotary converters	From £485
CROMPTON PARKINSON 1/2 HP, resilient mount, Boxford / Myford Super 7 Type motor	New £140



WE ARE CONSTANTLY CHANGING OUR STOCK FASTER
THAN THE ADVERTS CAN KEEP UP WITH US!!
PLEASE PHONE 020 8300 9070 TO CHECK AVAILABILITY OR TO OBTAIN OUR LIST
DISTANCE NO PROBLEM!! DEFINITELY WORTH A VISIT ALL PRICES EXCLUSIVE OF V.A.T.

SPRING CLEARANCE:
LOT'S OF MISCELLANEOUS
MACHINES AND ANCHORS
TOOLS STARTING FROM
JUST £20

- 2-Axis DRO from **£615** inc vat
- Made in the UK
- 5 year No-Fault Warranty
- 10 micron Accuracy

Conquest Lathe

NOW INCLUDES TEST CERTIFICATE



£395

VARIABLE SPEED
STANDARD ACCESSORIES
• 80MM 3-JAW CHUCK • Q.C.T.P. WITH 3 TOOL HOLDERS
Price Includes VAT & Delivery*



Chester
Open Days
24th-26th July

920 Lathe Deluxe

- SWING OVER BED: 229MM
 - SWING OVER CROSS SLIDE: 133MM
 - DISTANCE BETWEEN CENTERS: 500MM
 - SPINDLE BORE: 19MM
 - TAPE IN SPINDLE NOSE: MT3
 - MOTOR: 1/4HP
 - 6 SPEED: 100-1800RPM
 - NET WEIGHT: 100KG
- STANDARD EQUIPMENT:
- 4" 3-JAW CHUCK WITH 2 SETS OF JAWS
 - 7" 4-JAW CHUCK WITH REVERSIBLE JAWS
 - STEADY REST • FOLLOW REST
 - MT2 DEAD CENTRE
 - MT3 DEAD CENTRE
 - 4-WAY TOOL POST
 - FACE PLATE
 - TOOL BOX & TOOL KIT
 - TRAY & SPLASH GUARD



£699

Price Includes VAT & Delivery*

Model B-Super

- SWING OVER BED: 420MM
 - DISTANCE BETWEEN CENTERS: 500MM
 - MILL DRILL SPINDLE TAPER: 19MM
 - TAILSTOCK BARREL TRAVEL: 80MM
 - 7 SPEEDS 160-1360RPM
 - SWING OVER CROSS SLIDE: 160MM
 - SPINDLE TAPER: MT3
 - DRAW BAR: M12
 - CROSS SLIDE TRAVEL: 180MM
 - MOTOR: 1/4HP
 - NET WEIGHT: 155KG
- STANDARD EQUIPMENT:
- 4" 3-JAW CHUCK
 - 2 DEAD CENTERS
 - 1/2 DRILL CHUCK
 - CHANGE GEARS
 - MT3 CHUCK ARBOR



£699

Price Includes VAT & Delivery*

Centurion

- SWING OVER BED: 420MM
 - DISTANCE BETWEEN CENTERS: 520MM
 - MILL DRILL SPINDLE TAPER: MT3
 - TAILSTOCK BARREL TRAVEL: 80MM
 - 7 SPEEDS 160-1360RPM
 - SWING OVER SADDLE: 160MM
 - SPINDLE TAPER: MT3
 - DRAW BAR: M12
 - CROSS SLIDE TRAVEL: 200MM
 - MOTOR: 2 x 1/4HP
 - NET WEIGHT: 230KG
- STANDARD EQUIPMENT:
- 4" 3-JAW CHUCK
 - 2 DEAD CENTERS
 - 1/2 DRILL CHUCK
 - CHANGE GEARS
 - MT3 CHUCK ARBOR



£1100

Price Includes VAT & Delivery*

Champion Mill

- DRILLING CAPACITY: 20mm
- END MILL CAPACITY: 25mm
- FACE MILL CAPACITY: 63mm
- TABLE SIZE: 150x630mm
- NUMBER OF SPEEDS: 4
- SPEED RANGE: 400-1640RPM
- SPINDLE TAPER: MT3
- TILTING HEAD: 90° Left & Right
- MOTOR: 1/4HP

From

£585

Price Includes VAT & Delivery*



STANDARD ACCESSORIES

- 1-13MM DRILL CHUCK & ARBOR

Eagle 25 Mill/Drill

- MILL/DRILL CAPACITY: 25MM
- TABLE SIZE 190 x 585MM
- FINE FEED
- NUMBER OF SPEEDS: 12
- SPEED RANGE: 100-2150RPM
- SPINDLE TAPER: MT3
- SPINDLE TRAVEL: 100MM
- MOTOR: 1HP

Price

£699

Price Includes VAT & Delivery*



STANDARD ACCESSORIES

- 1-13MM DRILL CHUCK & MT3 DRILL CHUCK ARBOR
- EAGLE FACE MILL CUTTER
- T3 TILTING VICE
- M12 DRAWBAR
- NVR SWITCH GEAR
- INTERLOCKED CHUCK GUARD
- MANUAL AND PARTS LIST

Eagle 30 Mill/Drill

- MILL/DRILL CAPACITY: 32MM
- TABLE SIZE 210 x 740MM
- FINE FEED
- NUMBER OF SPEEDS: 10
- SPEED RANGE: 80-2300RPM
- SPINDLE TAPER: MT3
- SPINDLE TRAVEL: 130MM
- TILTING HEAD
- MOTOR: 1HP
- HIGH/LOW GEARBOX

Price

£899

Price Includes VAT & Delivery*



STANDARD ACCESSORIES

- 1-13MM DRILL CHUCK & MT3 DRILL CHUCK ARBOR
- EAGLE FACE MILL CUTTER
- V100 MACHINE VICE
- M12 DRAWBAR
- NVR SWITCH GEAR
- INTERLOCKED CHUCK GUARD
- MANUAL AND PARTS LIST

626 Turret Mill

- MILLING CAPACITY: 25MM
- DRILLING CAPACITY: 32MM
- TABLE SIZE 152 x 740MM
- FINE FEED
- NUMBER OF SPEEDS: 9
- SPEED RANGE: 190-2100RPM
- SPINDLE TAPER: MT3 OR R8
- TILTING HEAD
- MOTOR: 1/4HP

Price

£1340

Price Includes VAT & Delivery*

STANDARD ACCESSORIES

- ONE SHOT LUBRICATION
- HALOGEN WORK LIGHT
- MACHINE STAND
- DRAWBAR
- MANUAL AND PARTS LIST



Craftsman Gap Bed Lathe

- SWING OVER BED: 300MM
- SWING OVER SADDLE: 170MM
- SPINDLE BORE: 36MM
- SPINDLE NOSE TAPER: MT5
- CROSS SLIDE TRAVEL: 150MM
- COMPOUND TRAVEL: 89MM
- TAILSTOCK BARREL TAPER: MT3
- TAILSTOCK BARREL TRAVEL: 92MM
- RANGE OF SPEEDS: 50-1250RPM
- MOTOR: 11/2 HP
- NETWEIGHT 398KG

STANDARD EQUIPMENT:

- 6" 3-JAW CHUCK WITH 2 SETS OF JAWS
- 8" 4-JAW CHUCK
- STEADY REST
- FOLLOW REST
- STAND
- FACE PLATE
- SPLASH GUARD
- THREADING DIAL
- 4-WAY TURRET TOOL POST
- 3MT DEAD CENTERS
- T-SLOTTED CROSS SLIDE
- HALOGEN WORK LIGHT

£1550

Price Includes VAT & Delivery*



Super LUX Mill

- MILLING CAPACITY: 25MM
- DRILLING CAPACITY: 32MM
- TABLE SIZE 240 x 800MM
- FINE FEED
- NUMBER OF SPEEDS: 6
- SPEED RANGE: 95-1600RPM
- SPINDLE TAPER: MT3
- TILTING HEAD
- MOTOR: 1/4HP

Price

£1500

Price Includes VAT & Delivery*

STANDARD FEATURES

- POWERED HEAD ELEVATION
- CAST IRON STAND
- ANGLE TILTING HEAD
- MANUAL AND PARTS LIST

