

MODEL ENGINEER

Vol. 187 No. 4162

8 - 21 February 2002 £2.10

MODEL
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IN COLOUR

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GOOD BUILDING

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*A tender for a
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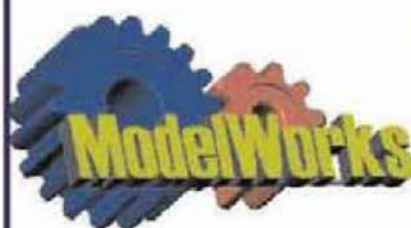
HIGH SPEED MILLING SPINDLE

For miniature cutters



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Modelworks aims to become a world leader in the design, manufacture and sale of precision scale working model kits. Our products are limited editions, manufactured in small batches and are designed for straight forward assembly on a build-as-you-buy basis. This concept enables model engineers of all abilities to experience the immense satisfaction of producing a complex working model with a minimum of tools and experience.



The ModelWorks 5700 live steam kit

This 5" gauge locomotive is a manageable size, powerful enough to pull a substantial load and yet fits into the boot of an average car. It is one of the classic designs from the GWR and looks equally attractive in original or BR livery.

The 5700 locomotive is comprised of 15 kits, purchased and delivered monthly. Limited availability only, commencing March, 2002.

Building a working model locomotive is a deeply satisfying experience and whether you are an experienced model engineer or are new to the hobby you will find the 5700 a highly rewarding project.

The ModelWorks Panther Pz.Kw.V Kit

This substantial 1/8th scale model of one of the greatest tanks of World War II is approximately 110cms (44") long and weighs 60Kgs. It was produced as a result of extensive research carried out at the Bovington Tank Museum in Dorset, where there are carefully preserved versions of the original.

The model comprises nine separate kits, delivered and paid for monthly. The limited edition kits provide every component you will need to finish your model and will begin production in March. After this, no further models will be available until at least 2003. Radio control and power options are available.



The ModelWorks Sea Clock Kit

This beautiful clock is based on the famous H1 clock, designed and built by John Harrison. Parliament in 1714 passed the Longitude Act offering a reward of up to £20,000 to "...such person who shall discover the Longitude".

One method was to devise a clock which could withstand the motion of a ship and still maintain high accuracy. Harrison, who eventually claimed the prize, incorporated several revolutionary features in his clock, notably a "Grasshopper" escapement and 2 dumb-bell pendulums.

The ModelWorks Sea Clock is supplied in two monthly kits and comes fully machined requiring only assembly and final polishing. The kit includes a mahogany base and a wood framed glass case.

The ModelWorks BR 16 ton Mineral wagon

A mainstay of B.R.'s freight fleet was the 16 ton all steel riveted mineral wagon - a classic design that has stood the test of time. This splendid detailed 5" gauge replica is complete with over 800 rivets and is produced in co-operation with Doug Hewson.

The sheet metal parts are laser cut and all the components are fully machined. The kit is in two parts and comes complete with everything needed to finish this fine model, including simple to follow instructions.



For full details of any of these and our other new products, visit our website, call, write, or email us:
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www.modelworks-int.com info@modelworks-int.com



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EDITORIAL

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Mike Chrisp
Technical Editor
Neil Read
Assistant Editor
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Club News Editor
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Technical Consultants
Martin Evans, John Haining, Stan Bray,
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H. D. Bickley BSc CEng MIEE.
Editorial Administrator
Sarah White

PRODUCTION

Design
Elizabeth Marfell
Production Manager
Ralph Stringer
Production Administrator
Sifa Symons
Printed by
Polestar (Colchester)
Origination by
Atelier Data Services

SALES & MARKETING

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Colin Taylor
Sales Manager
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ROAD STEAM:

SAVAGE'S LITTLE SAMSON

Exploring techniques for completing the
back tank platework with illustrations from
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GENERAL STEAM NAVIGATION

Having completed the locomotive, work
now turns to the tender and solutions
found for a few more problems. Part V.
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On the cover ...

This miniature Brush Waggon
certainly caught the eye of many visitors
to the 71st Model Engineer Exhibition
at Sandown Park Exhibition Centre. Its
appeal included the range of brushes,
brooms and other impedimenta with
which it was necessarily displayed,
and the bright livery appropriate to the
type with which it had been finished.
Timothy Smith built this 1:8 scale model
to a John Thompson design and was
awarded a Bronze Medal for his efforts.

See also page 631 in this issue
for a brief appreciation of MEX 2001.

(Photograph by Mike Chrisp)

BRAY'S BENCH: RANSOMES & MAY HORIZONTAL ENGINE OF 1850

Making the water pump for this steam
plant built to a design available from
Woking Precision Models. Part XIII.
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Work on the screw reverser is completed
and followed by details of a pole reverser
for this most elegant locomotive. Part XXII.
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Recent activities and forthcoming events.
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We regret that pressure on space in this
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Part II of this series and apologise for
the inconvenience caused thereby.

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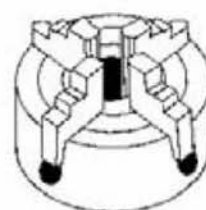
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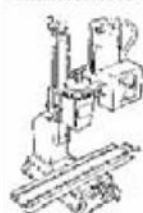
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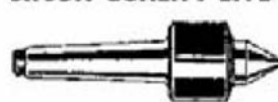
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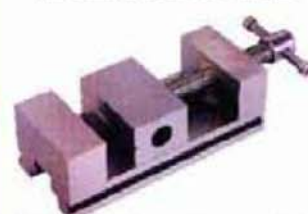
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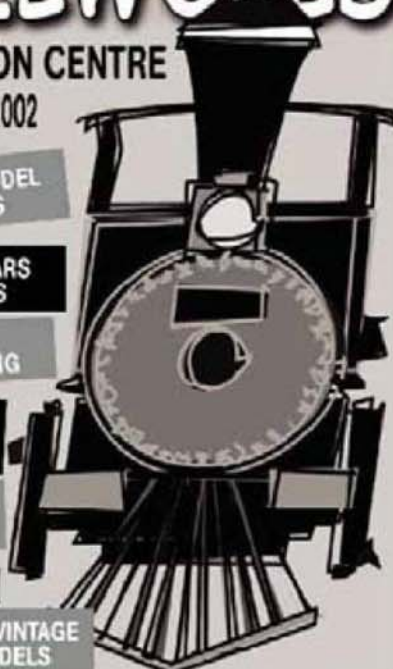
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SMOKE RINGS

With the Editors

Peter Dupen

It is with great regret that we have to record the sad news of Peter Dupen's death at home on the morning of Saturday 22 December at the age of 84 years. While acknowledging others who have written to acquaint us with the news, it is appropriate here to reproduce an Appreciation specially prepared by Gordon Bullard, who writes:

"My stepfather will be remembered by his many model engineering friends as a superb model engineer who built nine locomotives in various gauges. Many of these locomotives won Awards at the Model Engineer Exhibition over the years, starting in 1951 with his model of the industrial locomotive Lord Mayor which won the Championship Cup. At his death he was building a model of NER compound locomotive No. 731 in 7¹/₄in. gauge. The locomotive had been air tested and the boiler and fittings completed; it would undoubtedly have been another cup winner.

"Peter was a qualified mechanical engineer by trade and his specialism was in hydraulic transmission systems. His career, of which many of his model engineering friends will probably be unaware, was to begin where all good engineers invent wonderful things: yes, in the garden shed. After a fairly routine mechanical apprenticeship and with an HNC under his belt he got a job with Samuel White's shipyard on the Isle of Wight and, in association with Vosper Thornycroft,

was given the job of designing the fuel storage and supply systems for the motor torpedo boats built by these companies during the second world war. After the war he joined Chamberlains where he was again employed on design work.

During the evenings he undertook model engineering in the garden shed and it was there that he designed and perfected what was at that time a novel radial hydraulic motor of astounding efficiency. After patenting the motor, unbelievably his company saw no future in it and refused to back him. Undeterred by this short-sighted decision, he set up his own company: Hydrostatic Transmissions in Brentwood in 1951, and within fifteen years the motors and associated transmission systems were being sold all over the world. Indeed the demand was so great that they were being made in other countries under licence. They were used to power equipment as diverse as ship winchgear, lorry tail lifts, mining locomotives, cableship cable laying equipment, defence equipment and even the massive transporter which moves space rockets to the launch pad at Cape Canaveral.

"On retirement he spent most of his time again in the workshop; the wheel had turned full circle, but this time model engineering was the beneficiary and he produced the sort of model about which average model engineers like myself can only dream. As a judge of locomotive models for



Peter Dupen in 2001 with his 7¹/₄in. gauge NER compound locomotive under construction.

the Model Engineer Exhibition he had a critical eye for detail and an in-depth knowledge of the subject. Re-reading some of his articles in Model Engineer magazine provides an insight into his constant quest for perfection while also revealing his ability to genuinely give advice freely to anybody who requested it. But beware the fool, who he did not suffer gladly.

"Peter will be missed by all his friends but without doubt I and many others around the world will remember him as the sort of engineer that Britain can be proud of, and which the country still desperately needs."

MEX 2001 - Thank you all!

I wish to begin the New Year with a heartfelt vote of thanks to all who contributed to the success of the Model Engineer Exhibition held recently at Sandown Park Exhibition Centre. While admitting that several matters remain to be resolved, the four-day event seemed generally to be well received by most visitors, the majority of whom were glad they attended, despite the poor weather conditions and other difficulties associated with the traditional timing of the exhibition which has been presented immediately after Christmas for the last thirty-three years.

The first of those deserving of our special thanks are all who entered models for the 2001 Model Engineer Exhibition, whether in Competition or as a Loan exhibit, or on one of the Club Stands. Without such support, the Model Engineer Exhibition could not survive, let alone flourish. Since we can only ever be custodians of this event with its international prestige which, over the years since the exhibition was first held in 1907, has attracted some of the finest trophies, we owe it to those who follow to ensure the continuity of this display of the very best in the world of model engineering. That said, most visitors delight in an opportunity to examine the craftsmanship involved in the construction of all the models exhibited; may I therefore respectfully request everyone reading this to give serious consideration to allowing us the privilege of showing your work in the Loan section if not in actual Competition at the 72nd Model Engineer Exhibition?

All major exhibitions of this nature require a sponsor and personnel to ensure that all the necessary arrangements have been made and run smoothly. In this respect we appreciate the support

given by Highbury Nexus management and in particular the work put in by members of the Exhibitions, Sales and Marketing teams whose efforts have been much appreciated. John Cundell and Bill Burkinshaw both made sure that all who brought their work for display were welcomed and suitably entered into an exhibition database. Such was the effectiveness of this last that by the 'close of business' on Judging Day, Bill had processed all the entries, recorded and published all the awards, and printed all the certificates ready for distribution.

Under the capable direction of Norman Phelps, our team of Stewards were again on hand to unpack and set out the models before the exhibition, to be around to keep a watchful eye on them and available to answer questions from interested visitors throughout the event, and to repack the models as appropriate after the exhibition closed, while maintaining a careful watch on the departure of the Competition and Loan models. We do very much appreciate the time and effort unstintingly given by this important group of enthusiastic supporters, and I hope they too enjoyed the exhibition.

We are always pleased to welcome our friends in the Trade. The timing of the exhibition has prevented some of our erstwhile regulars from attending in recent years, and who can blame them for wishing to spend the Christmas period with their families after an inevitably busy run up to the festivities? It was pleasing to see an increasing number of what some choose to call 'proper' model engineering suppliers, but it would be even better to see more. Others with a traditional association with the exhibition were also present and it is evident by the enthusiasm with which they do so, model engineers love to

turn over piles of new and second-hand tools on other trade stands in search of bargains!

I must admit to much personal satisfaction with the introduction of the Club Room on the first floor in one of the Cobham halls. By bringing most of the clubs and societies together in the one place, an atmosphere of camaraderie was engendered reminiscent of the first floor concourse at the Wembley Conference Centre many years ago. The feeling of enthusiasm was almost tangible in the Club Room and I was even more pleased when my request for seating in this hall resulted in action. The club stands featured a fine selection and variety of work, were excellently presented and well stewarded, and I noticed that the stewards seemed to be kept very busy for much of their time dealing with questions from interested visitors.

Finally, our thanks to all who braved the immediate post-Christmas weather and transport difficulties to visit the 71st Model Engineer Exhibition. Without your attendance, the event would not have been financially viable and I can admit to noticing smiles beginning to appear on certain faces as the exhibition continued. In view of this, there is very likely to be a 72nd Model Engineer Exhibition and, together with my repeated thanks to all who visited, exhibited, traded or participated in any other way in the recent event, I would also say that we look forward to seeing you all again next time, and in our turn we will undertake to do what we can to implement the improvements already suggested to us.

Most of the material for the content of this issue was prepared before Christmas; our Exhibition Reports will therefore have to wait for forthcoming issues, beginning in our next with an illustrated listing of the Results and Awards.

POST BAG

Bulleid's pacifics

SIRS, - The many recent references in your pages to Oliver Bulleid's marvellous pacifics has prompted me to declare my great affection for these innovative and idiosyncratic locomotives. A model engineer for some thirty years, I have always had a high regard for them, whether in original or rebuilt form.

I have copies of drawings prepared in 1974 by Ernest Steel for the Bassett-Lowke company showing an unrebuilt West Country class locomotive in 7 1/4 in. gauge. At the time I obtained these drawings I recall that the company had completed a chassis which ran successfully on air on a rolling road. I understood it to be a special commission with full complement of three cylinders and chain driven valve gear, and I believe that problems were experienced with the model just as they were with the prototype. My drawings are of a simplified version with two cylinders and conventional valve gear.

If any reader has a use for these drawings and would like access to the wheel patterns which I had made at the time, I would be pleased to pass them on. I can be contacted by way of the Editor.

Although active in my workshop, and currently engaged on the construction of a 3 1/2 in. gauge *Britannia*, I do not consider that I have the expertise or, I suspect, sufficient time left to build a miniature Bulleid pacific. I have therefore been searching for some time for a model in 3 1/2 or 5 in. gauge which I could purchase and have the pleasure of running. If anyone has or knows of such a model for sale and could let me know about it, I would be extremely grateful.

Clive Repik, Devon.

In praise of shaping machines

SIRS, - Having finally taken the plunge and started to build a small steam locomotive as a change from machinery, I have made the acquaintance of a material about which I had often read in these hallowed pages but otherwise knew not. In all innocence I put the first 'gunmetal' horn block casting for *Sweet William* on the vertical mill and started work. After a few seconds a nasty suspicion began to creep up on me and I stopped the mill, brushed away the cuttings and looked at the awful finish. I then examined the end mill, cut myself on it, and said some pretty

words. I took a look at the heap of pristine un-machined 'gunmetal' castings and my heart sank — getting a nice finish on that lot started to look pretty remote. I retired to an easy chair and selected one or two MAP/Argus/Nexus, etc., etc., publications and they all more or less advised that gunmetal was not a particularly nice material to machine. Some authors referred to the use of files for finishing, but hell, this is a machine shop!

On return to the workshop, while contemplating the pending disaster, my eye settled on a recent acquisition. This is a large (I mean large) Invicta shaper bought cheaply from a gent in Timaru a few months ago. I actually wanted something to produce flat areas of about 6 x 4 in. on certain bits of plate for farm machinery, but this size was not available or was too expensive. What I got will flatten an area of about 19 x 28 inches. It took but a few minutes to bolt a large milling vice to the table, true it and put the work into it; I dug out some very large HSS tooling that I was given many years ago and set it up. Oh! What a difference; that vast 1 ton or more of Invicta taught that horrible material manners in short order. A lovely silky finish began to appear on the work.

A phone call to Jock Millar who led me to the 'Invicta' and is no stranger to these pages got me the advice that there is a particular type of finishing tool used for these machines. There was one of these among the large tooling and this produced such a fine finish that I could hardly believe it. The fine finish looks like fine surface grinding and is quite literally shiny.

I now have a serious question: why, oh why, have these machines gone out of favour? Unlike milling, there is no need to dress the surface after machining to clean it up, the finish is smooth and for simple plane surfaces, much superior to that from an end mill.

Peter King, New Zealand.

Locomotive clock

SIRS, - In the Christmas Special edition (*M.E.* 4158, 7 December 2001), although there was little of any modern model engineering relevance, my eye was led towards the reprint of Walter's article on a locomotive desk clock. In 1933 my godparents were married (although my head was not yet as big as a gooseberry!) Godfather, being a railway enthusiast, led his bride to a honeymoon in Scotland, starting with a trip on the *Flying Scotsman*.

In Edinburgh she bought him a desk clock, a replica of the front of No. 4472, which sits on a short length of 2 1/2 in. gauge rail, ballasted and mounted on a wooden plinth.

After my godfather's death his widow gave it to me and it sits on my desk to this day, as a delightful reminder both of the family and of a more leisurely way of life. Looking at it now, it seems in need of a good dust!

D. A. G. Brown, Rutland.

Polished performance

SIRS, - Please find herewith a photograph of my version of the little oscillating steam engine which was described by Stan Bray in these pages a year or two back.

It is a fascinating engine and runs very well on our cappuccino machine.

Keep up the good work!

Ed Bush, New Mexico, USA.

(Stan Bray's called his engine Ossie and the short construction series ran in *M.E.* 4075, 28 August 1998, *M.E.* 4077 25 September 1998 and *M.E.* 4079, 23 October 1998 — Ed.)

Padget and Keats

SIRS, - I refer to your review of the book *Steam Raising on the LMS*. I found the book interesting but bewildering with so many boiler types, not all of which concerned the LMS. An interesting item on page 67 refers to Top Brass at Derby as being sure no large boilers were made, while by contrast, having seen one some Rank and File Personnel had recollections of the existence such a boiler.

Having seen it on a works visit one Sunday (5 May 1957), I can confirm its existence. Our guide stopped us at the side of a building and pointed to a large boiler blanked off at certain places and declared: "Now, this is an interesting exhibit. It's a boiler of an engine



Ed Bush's engine.

with eight cylinders. Has anyone heard of it?" "Yes!" I replied "It was Sir Cecil Padget's engine and was fitted with two firehole doors." "Correct" he said, and explained a little more before we moved on.

The reason I happened to know of it was that about a year previous I had purchased a booklet (about as big as the *Radio Times*) detailing the life of Cecil Padget, who came from a wealthy family and, as a Captain in the army, was knighted for bravery during the 1914-18 war. He was subsequently offered a post in the drawing office at Derby Works.

In due course he designed his own engine which did not meet with the Board's approval owing to the expense this would incur. However, he offered some £5000 of his own money for the project which was then accepted and the engine was completed and put on trial. It kept failing in service and had to be dragged back to Derby for repairs, but each time out it failed again and after several repeats it was scrapped.

The book mentioned contained a photo of Sir Cecil, his boiler and an overhead view of the eight cylinders between the frames. It was issued by the Locomotive Publishing Co. which I still have somewhere about the place but haven't seen for years!

It's hard to believe that an engine

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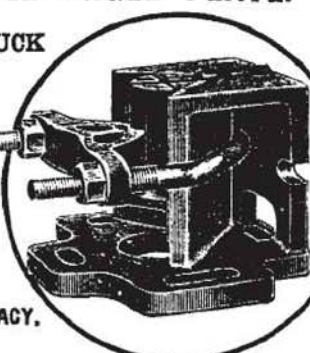
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Giles Favell's 10¹/₄in. gauge locomotive Alice at Pulborough.

of this size and importance should go unrecorded at Derby works.

On a totally different note, I've often wondered about the name of Keats, thinking that it may be French until I recently got hold of a copy of *M.E.* for May 1926 with the Keats advert inside (reproduced herewith). I was surprised to learn that the firm was based at Portsmouth, even more so to learn from the advert that five sizes of the 'Vee Angle Plate' were available. Does anyone know when the Company ceased production, and what was the most popular size?

Tubal Cain shows an exploded view of one in his book *Workholding in the Lathe*, though in a letter to me a previous Editor of *M.E.* gave it the thumbs down saying "They were more bother than they were worth and it was quicker to use a normal angle plate on the faceplate."

At one time Reeves used to advertise 'Keats type' angle plates, no doubt to overcome patent difficulties, but the current Reeves don't sell them at all, more's the pity.

K. Birkby, West Yorkshire.

Website

SIRS, - Readers of *Model Engineer* may be interested to visit the following website, home of the original Locomotion No. 1 at Darlington: www.darlington.gov.uk/railway.htm Dave Birkett, by e-mail.

Tilt hammers

SIRS, - David Jones (*Postbag, M.E.* 4159, 14 December 2001) is correct in stating that some spring action was needed to speed the 'rate' of blows, but at Abbeydale Works a separate 'spring' was provided, the tail of the helve being pushed upward by its action.

According to a 1950s metallurgy lecturer (a Mr. Manterfield) at Sheffield 'Tech', the spring was built as a vertical masonry lined 'shaft' (in the tail block position) filled with springy heather plants! A 'piston' riding on the heather

'column' provided the connection.

Heather was collected from nearby moorlands for periodic renewal. R. Pridmore, South Yorkshire.

Alice at Pulborough

SIRS, - From previous correspondence in this column, you may recall that I have been building a 10¹/₄in. gauge Bagnall locomotive which, as my photograph (above) shows, I have now finished, some five years later.

Alice now resides at the South Downs Light Railway in Pulborough where she has proved herself to be a capable and popular little engine. Giles Favell, London.

Compressed air

SIRS, - Peter Spenlove-Spenlove has given us much valuable advice on using compressed air (*M.E.* 4153, 24 August 2001, *et seq.*) I would like to emphasise a few points.

All air-driven tools and equipment including engines under air-test, not just spray-guns, require dry air at a steady pressure. The compressor pressure-switch is there not to control the outlet pressure, but to maintain the receiver pressure above that required for the applications. I would expect the pressure-switch (and safety valve) on a compressor and receiver sold as a complete unit, to be set and even locked by the manufacturer.

The delivery pressure is controlled by the outlet regulator, which relies on its inlet being kept at a higher pressure than that required. A combined regulator and water-trap unit is normally fitted permanently to the compressor outlet. On long and branching air-main systems, a further regulator/water-trap is fitted at each hose connector. All these regulators are adjustable by the user, not just the dealer, to suit the application in hand.

Oil-mist lubricators are placed in the air-tool inlet or at the head of the flexible hose, but always downstream of the local regulator/water-trap.

Blowing wood waste away from

machines may create clouds of fine dust and give rise to a possible fire risk. Some woods and wood derivatives are allergenic or even toxic, although our exposures to them will probably be very low. Blowing metal swarf from machines can create a mist of cutting-fluid, which like sawdust, is not fussy where it settles. Blowing waste from machines can force particles into nooks and crannies around leadscrews and slides. I use a heavy-duty vacuum cleaner and old paintbrushes for machine cleaning.

Compressed-air can be used to remove fumes, dust or vapour from the vicinity of the operator, by induction. Dusts may thus be blown into a receiver fitted with a cyclone and air-outlet filter. The air-mover is a simple ejector, like a locomotive chimney and blower-ring, which uses a compressed air jet in a venturi nozzle to draw a large volume of surrounding air through the device. Air-movers can be purchased or made, and ducted to an external chimney or waste receiver.

We may link this discussion to the article on steam-raising by Messrs. Chrisp, Todd & Turner in the same issue. Rather than pumping air into a boiler, I would follow the example set by former fellow club-member Fred Scard who built a freelance traction-engine of about 3in. scale. He fitted a branch to the blower steam-pipe in the smokebox; perhaps the backhead blower fitting could be used on a locomotive. The branch terminates in a discreetly-located, small-diameter air-line connection for a compressor. Once sufficient steam has been raised for the blower this connection is closed by a plug-cock or a screwed blanking-cap. Alternatively, an ejector may be made as described above, to sit in the top of the model's chimney. Either way, there are no moving parts in the heat and muck. The little compressors sold in motor-accessory shops may be suitable for this duty.

Some owners of large model traction-engines use extension chimneys and natural-draught steam-raising, as in full-size practice, which is better for the boiler than forced draught as it promotes more even heat distribution and hence reduces expansion strains.

The same steam-raising ejector, with suitable inlet and outlet adaptors and hoses, might be used during engine disposal, to draw ash from the smokebox and deposit it in a suitable receiver.

One other use for compressed-air deserves a mention: grit-blasting. A grit-blaster employs an ejector to

draw the grit into the gun, via armoured plastic or rubber hose, whence it is blown at high pressure onto the work. Ron Jarvis once demonstrated to his fellow club members the small grit-blaster he made for treating intricate mild-steel fabrications on his award-winning, finely-detailed, small-scale models of historically-significant steam plant. The process removed remnants of brazing flux from the components and gave them their appropriate cast appearance.

Two very important points regarding grit-blasters are:

1: The case must be grit-tight. Exhaust air flows out through a filter, and used grit simply falls to a hopper in the base.

2: The gauntlets, adapted from heavy-duty rubber gloves, must be scrapped if they become punctured. Clean compressed-air is hazardous enough. A high-velocity stream of compressed-air and grit striking your skin is the last thing you want.

In conclusion, I would like to thank Peter Spenlove-Spenlove for his valuable and interesting articles. Nigel Graham, Dorset.

Cow-gowns

SIRS, - Reading Mr. Welch's story of his cousin's mill (*M.E.* 4159, 14 December 2001) sent me on a trip down Memory Lane. It was his description of the figure at the mill which particularly interested me.

An old friend with whom I have since lost touch had been demobbed from the Royal Air Force and, in speaking of experiences with civilian fitters engaged on maintenance of Rolls Royce *Merlin* engines in the middle east, always described them as being dressed in cow-gowns.

Mr Welch's use of the term is the first time I have read or heard it used since 1955. Does anyone know of its derivation?

John Williamson, Kent.

Detail

SIRS, - I have now all but completed the machining of parts for the Stuart *Victoria* mill type engine, but the final touches and assembly remain.

I would be pleased to communicate with any reader(s) who, perhaps having built one for himself, could advise me on improvements to the basic model. Flywheels, for example, were not, I imagine, secured with grub screws, and the pistons probably had rings.

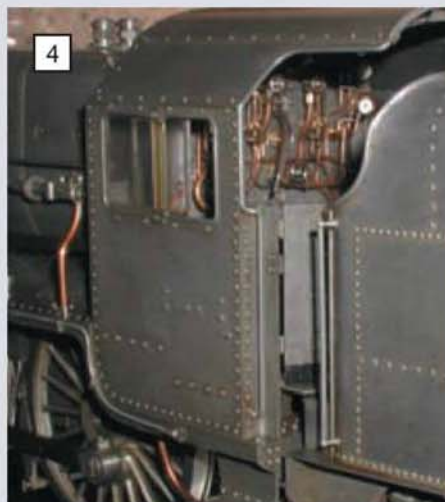
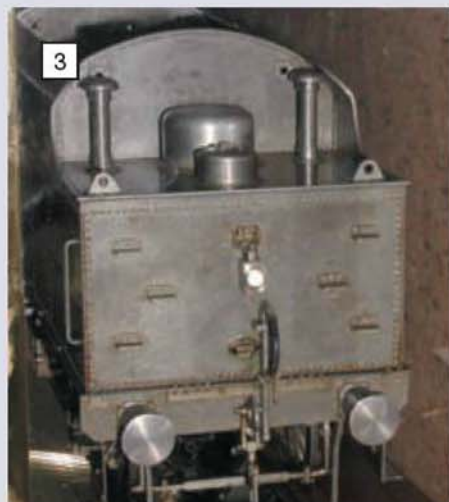
Advice on this type of detail, together with painting techniques for the final finishing would be most welcome.

Malcolm Stevens, Co. Down.

A HIGH SPEED MILLING HEAD



Leander, Mac Gower's superb 2 1/2in. gauge LMS 4-6-0 Jubilee Class locomotive was awarded a Gold Medal and the Bill Deane Memorial Cup at the 69th Model Engineer Exhibition. A sprightly nonagenarian, Mac is still very much an active model engineer!



Neil Read describes the high speed milling attachment devised by Mac Gower to assist him with his smaller work.

By definition, model engineering involves making small (sometimes very small) components. This means that model engineers working in the smaller formats are often required to work with tiny drills and milling cutters. To work efficiently such tools require relatively high spindle speeds. Table 1 shows the recommended cutting speeds for a range of cutter diameters and cutter material types. The figures

assume that the work material is low alloy (mild) steel and that adequate coolant is available.

Achieving the higher speeds shown in this table really requires special spindles lubricated with oil mist. These are quite beyond the scope of the amateur and would be an expensive item even for a professional workshop. Most model engineers cope readily enough with small cutters and drills by being very careful, using good sense and developing a delicacy of touch which a surgeon would envy! Good modern lathes like the Myford Super 7 have a top speed in excess of 2,000rpm and many drilling machines go over 4000rpm so the problem is less severe than it was, say forty years ago.

Table 1 - Recommended speeds (rpm) for low alloy (mild) steel work material			
Cutter	Carbon	High Speed	Tungsten
Diameter (in.)	Steel (rpm)	Steel (rpm)	Carbide (rpm)
0.125 (1/8)	1,830	3,056	10,000
0.031 (3/32)	7,380	12,300	40,300
0.016 (1/16)	14,760	24,600	Not listed

*This data is a guide only as much depends on the exact grade of carbide and the surface treatment, if any, applied by the manufacturer.



However, there are many model engineers who work with older lathes with a top speed 640rpm or so. Some cheerfully accept the limitations of their equipment and soldier on; tolerating the odd broken cutter or spoilt work piece. Others analyse the problems they are having, consider the options available to them and engineer a solution. Such a man is Hubert 'Mac' Gower.

Mac Gower (photo 1) is an active, cheerful model engineer who is 92 years 'young'. He is the creator of the beautiful 2 1/2in. gauge, LMS 4-6-0 Jubilee Class locomotive (Leander) shown on these pages (photos 2, 3 and 4). It was awarded a Gold Medal and the Bill Deane Memorial Cup at the 69th Model Engineer Exhibition. Recently, your Editor and I were fortunate enough to enjoy an afternoon in Mac's company and to examine his fine model and discuss some of his manufacturing techniques.

Consider this as you study the photographs: the model is an exact miniature replica of the prototype. For example, the boiler has the correct number of boiler tubes of the correct scale wall thickness and diameter, and the platework is of the correct scale thickness. No castings were used to construct this model. Items like the wheels (photo 5) were fabricated. Each individual spoke was shaped to the correct profile and fitted to the hub and rim before the assembly was silver-soldered together. The tyres were then shrunk on to the wheel as in full-size practice. Each of the many thousands of rivets was turned in Mac's workshop. "I could manage 60 in an evening", said Mac wryly. The beading around the tender platework and the footplate was turned to size from 1/16in. stock and milled to the correct profile. The pins in the working toolbox hinges are 0.01in. diameter. Yes, you could say that Mac Gower knows a thing or two about making small components.

This brings us to the main subject of this article. To assist him in the task of manufacturing his locomotive, Mac devised this high-speed milling and drilling head (photo 6). The unit consists of a two-stage belt-drive arrangement (photo 7) that effectively increases the speed of the input spindle by a factor of approximately 6.3. So, for an input speed of 640rpm (the top speed of his Myford ML7) an output speed of 4032rpm is achieved. In principle, the device could also be used on a vertical or horizontal milling machine to enable small cutters to be used more effectively. However, the input drive shaft arrangements would have to be modified



The wheels on Mac's 4-6-0 Leander were all fabricated; no castings at all were in fact used in the construction of this magnificent model.



A view of Mac's high-speed milling and drilling head in situ on his own Myford Series 7 lathe.

to suit the machine spindle. Here we will describe the device for use with a Myford Series 7 lathe. These notes have been prepared to help less experienced workers make the head for themselves. They derive from studying the drawings and our discussion with Mac. They are not based on my own experience as I have yet to make the device.

Construction

The general arrangement drawing shows the high speed milling head in section. The output spindle is concentric with the lathe mandrel. The main spindle (Item 3) is carried in a bearing sleeve (Item 2) that fits in the bore of the main hub (Item 1). The main hub is turned *in situ* on the mandrel of the lathe and, provided the work is carried out to a good standard and the specified sequence of making these items is adhered to, then the main spindle will run true to the lathe mandrel and this will be repeatable no matter how many times the head is removed and replaced.

The main spindle is driven via a jockey pulley (Item 4). This item, the jockey pulley spindle (Item 5) and the associated adjustment mechanism (Item 6) are carried on two stout side plates (Items 10). The addition of spacer pieces (Items 11) and side and base covers (Items 15) to the side plates forms a box that simultaneously supports and encloses the mechanism. The entire unit is therefore clean in use, readily portable when off the machine and easy to store as there are no loose components to mislay.

The largest of the main spindle ball races used in the design is 1.625 O/D x 0.75 I/D x 0.3125in. wide. According to the SKF catalogue this bearing is rated for 17,000rpm when using grease lubrication. It is therefore working well within its capacity for the application envisaged but you need to be aware of this if you have higher speeds in mind. If possible, I would advise readers to purchase shielded bearings for this application. These are sealed for life and the grease stays where it is needed in the bearing instead of working its way out on to the belts shortening their life.

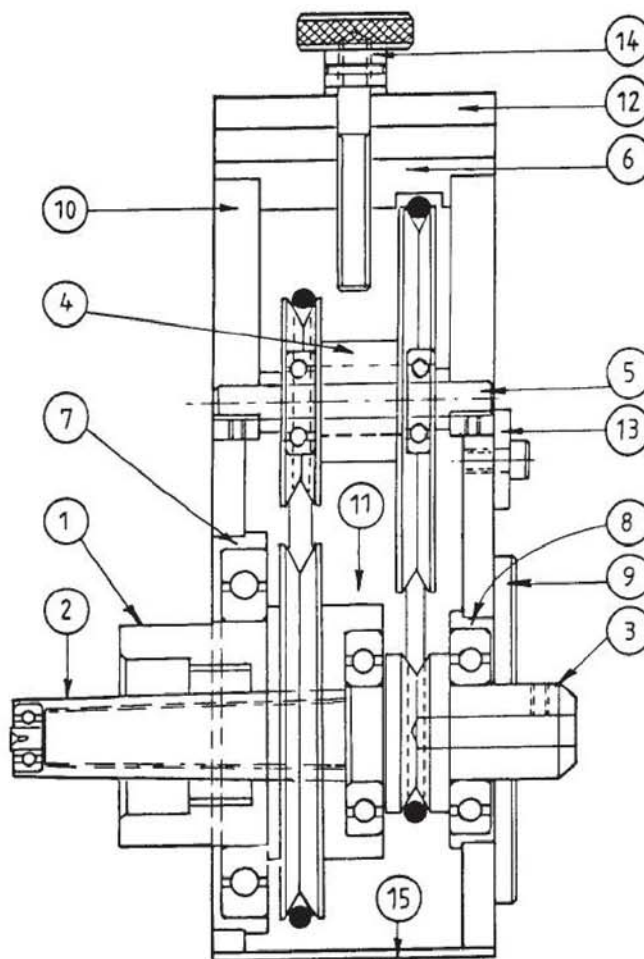
Main Hub (Item 1)

Make a start on construction with the main hub. This is a straightforward turning job from free cutting mild steel such as EN1A. However, you will need a substantial billet approximately 80mm dia. and, say 45mm long. Alternatively, you may care to use cast iron. A suitable billet of steel may be difficult to source but cast iron of any size can usually be obtained from the suppliers who advertise in *Model Engineer*. Cast iron

would also be kinder to the lathe mandrel nose.

Before starting on this component you need to pause and consider how you will check the internal thread and register which will eventually fit on to the lathe mandrel nose. The fit of this item to the

mandrel nose is critical to the successful outcome of the project, so some form of gauge will be required. This can be home made or you can use Myford Part No. 1434 'Adaptor for mounting chucks etc., in the tailstock taper'.

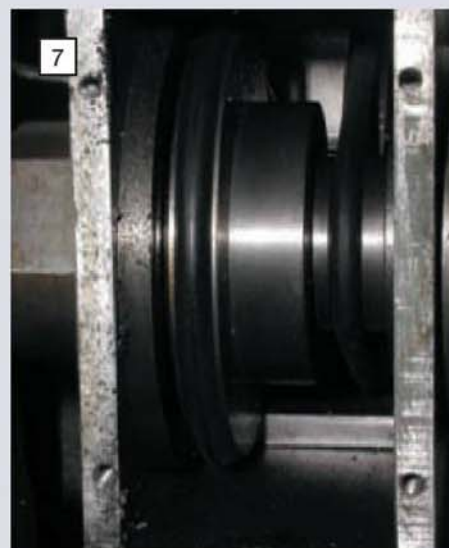


©

GENERAL ARRANGEMENT SCHEMATIC SECTION OF HIGH SPEED ADAPTOR FOR MYFORD ML7 AND LATHES WITH SIMILAR SPINDLE NOSE. (TOP SPEED ≥ 4000 rpm)

BALL RACES: 1 OFF SKF 16009 75 x 45 x 10
1 OFF SKF 624 Z (EL4-Z) 13 x 4 x 5
2 OFF SKF EE6 $1\frac{5}{8}$ x $\frac{3}{4}$ x $\frac{5}{16}$ in.
2 OFF SKF EE2 $\frac{3}{4}$ x $\frac{1}{4}$ x $\frac{7}{32}$ in.

O RINGS: 2 OFF $3\frac{3}{8}$ in. O/D $\frac{7}{32}$ in. SECTION
30 - 4BA x 10 C/S SCREWS
4 - 5BA x $\frac{1}{4}$ in. CAP HEAD
2 - 4BA x $\frac{3}{16}$ in. GRUB SCREWS



With the base cover removed from the unit, the two-stage belt drive arrangement is revealed.



Mac uses a special spanner to remove the unit from the lathe spindle nose.

Methods of screw cutting vary according to your equipment and how you were taught. My personal approach is to set the lathe top slide to 25deg. for Whitworth form threads and use this to apply the feed. Note, I use 25deg not 27 1/2deg.

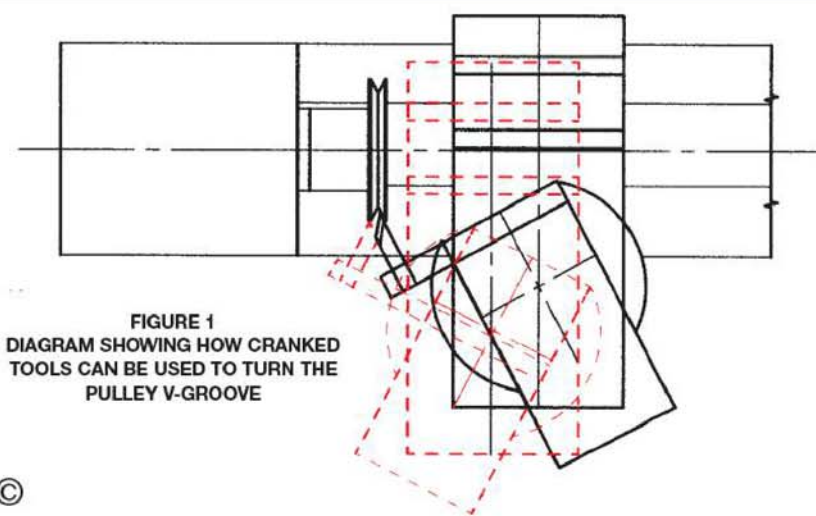
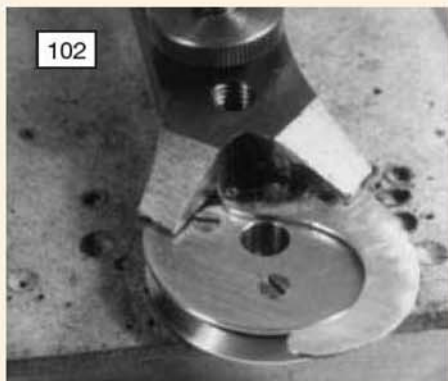


FIGURE 1
DIAGRAM SHOWING HOW CRANKED
TOOLS CAN BE USED TO TURN THE
PULLEY V-GROOVE

Before completing the turning of Item 1 it would be prudent to machine the 1¹⁹/32in. A/F spanner flats on to the 1³/4in. diameter. This will facilitate removal of the part from the lathe mandrel after it is finish turned. The operation can be done using a milling machine or on the vertical slide. Mac made a special spanner to fit the flats on his attachment and this is shown in **photo 8**.

The groove in the pulley could be turned with a form tool but I suspect that chatter will be a problem. A tool a bit like a screw-cutting tool with a 55deg. included angle and, say $\frac{3}{16}$ in. wide could be used to rough out the profile but this may not leave a particularly good finish. It would be preferable to finish each flank of the pulley in turn by angling the top slide to bring it parallel to the surface being turned. Special tools will be needed to bring your cross-slide and top-slide clear of the work and give the necessary access for machining. The sketch in **fig 1** should give the general idea but some juggling will be necessary to suit your lathe and equipment. The standard ML7/ML7R top slide does not quite swing to the required angle and you may need to make one of the several published modifications to the top slide fixing to enable you to reach the required angle. Those readers who have made the small rotary table designed by the late George Thomas will have had a similar problem when they came to machine the groove in the outer diameter of the table and should still have the tools necessary to solve it.

●*To be continued.*



The spring is clamped to the pulley for drilling the 10BA holes.

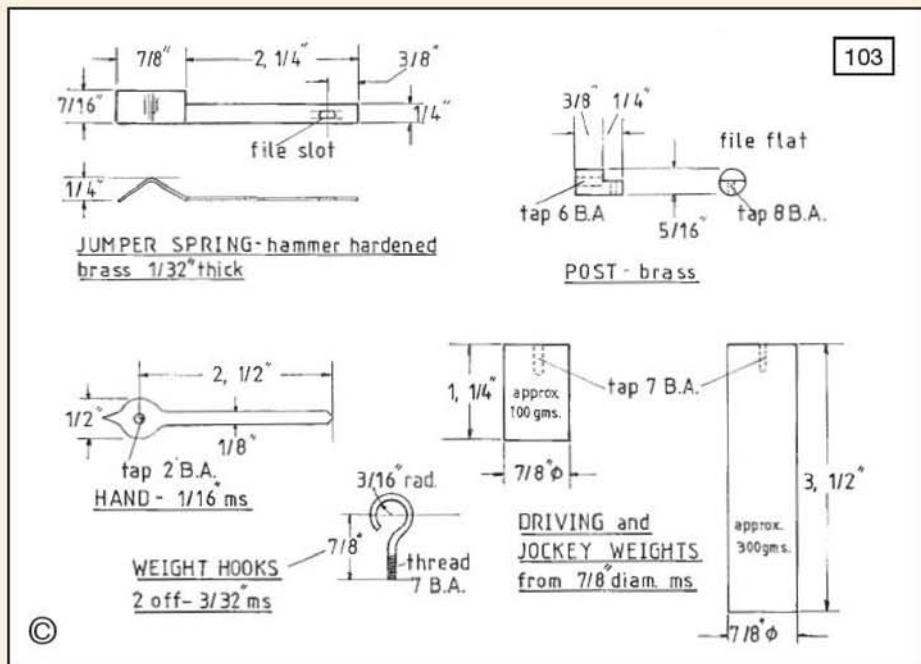
John Wilding FBHI

continues the construction of his novel egg timer with the combined click and spring gearing.

●Part VII continued from page 591
(M.E. 4161, 25 January 2002)

The combined click and spring is shown on the drawing fig 88 in the previous instalment (M.E. 4161, 25 January 2002). It can be cut from $\frac{1}{32}$ in. brass strip and the first step is to hammer harden it. It is a general rule that when brass is hammered the process tends to harden and make it more springy. The end of the stock is held on a block of iron or steel and hammered with a hammer having a slightly convex face. Neither a ball pein or a flat face hammer is suitable. The work will probably curl and then it is turned upside down and hammered on the other side to correct this. After this treatment it can be marked out and the shape cut out with the piercing saw. It can then be filed to a slight taper towards the tip which will help to remove the hammer marks. Finally, it is fitted to the pulley with two 10BA screws so that the tip is at $\frac{7}{8}$ in. radius.

Photograph 102 shows how the components are held together for drilling the No. 55 hole through the top flange and centre hub. It is not necessary to drill right through the complete assembly. The holes in the spring and flange are opened up to No. 50 size and those in the pulley hub tapped 10BA. With the spring attached to the pulley, the end is prised away from the pulley to give it a 'set' as shown on the drawing. The acting tip should be smooth and polished and it should engage with the edges of the $\frac{1}{4}$ in. holes. The pulley must rotate easily on its arbor and when the best operating position is found the arbor is



WEIGHT DRIVEN EGG TIMER

marked for drilling a No. 53 size cross hole to receive a taper pin. It should be noted that when the fabricated pulley is used, the boss shown on the solid pulley is ignored. Instead, a washer is placed between the pin, the arbor and the rear face of the pulley.

Weights

The two weights are shown in the drawing fig 103. They are formed from $\frac{7}{8}$ in. diameter mild steel; all that is necessary is to face the ends of the stock and tap one end for the weight hook. Although on the drawing the weight hooks are shown to be $\frac{3}{32}$ in. mild steel, this dimension is unnecessarily large, but on the other hand $\frac{1}{16}$ in. is a bit on the small side. Wire coat hangers are a useful source of material for this purpose. They seem to come in various gauges, but 14 gauge (0.080in.) is an ideal size and it can be threaded 8BA.

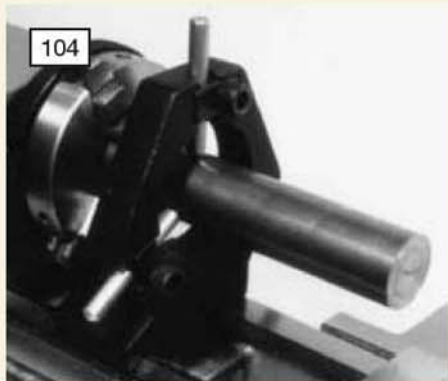
When facing work of this length in a small lathe the fixed steady is used to support the overhang. The procedure is to grip the stock in the 3-jaw chuck, if it is accurate, or the 4-jaw if it isn't. The fixed steady is then brought up as close to the chuck as possible and the fingers adjusted

to contact the work (photo 104). The steady is now slid up the lathe bed as demonstrated in fig 105. At the same time the chuck jaws are reversed as can be seen in this illustration, this will relieve the chuck of any strain should the stock be slightly out of true. After the work is faced, the 8BA hole is drilled and tapped using 'angel's breath' as a lubricant if you were successful with your butterfly net.

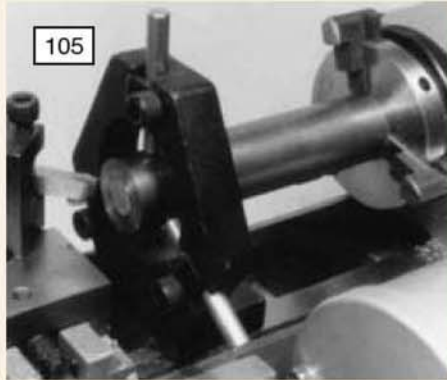
A decorative ring can be machined in the top face. The driving weight should realise some 260 grammes and the jockey weight 100 grammes. The timer requires very little driving power and remember that this weight is operating on a double fall, so the effective force is 80 grammes.

Hooks

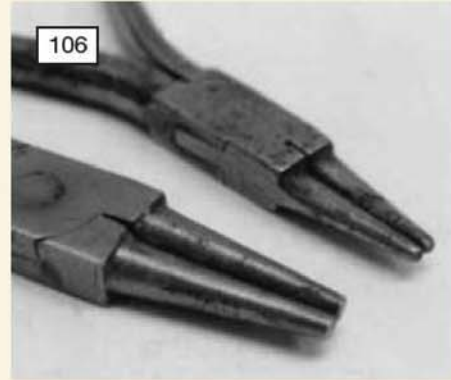
Although rod of this size can be bent cold, it will be found a lot easier and more comfortable if the work is brought to red heat in the flame of a gas torch. Round nose pliers (photo 106) will assist in obtaining nice smooth bends and a tapered punch gripped vertically in the vice as demonstrated will be found helpful in obtaining a true circle in the wire (photo 106a).



The fixed steady is initially set right up close to the chuck.



The steady is slid along the bed and the chuck jaws reversed for facing the end of the work.



Two sizes of round nose pliers for forming wire hooks.

The hooks can be cleaned up and burnished by gripping them in a pair of mole grips and offering the work up to a stiffish rotary wire brush. Prior to threading 8BA, the stem of the weight hook should be slightly tapered by filing. I show this operation in **photo 107** where you can see the loop end is held in an open jaw pin vice with the work rotating in a groove in the wooden filing block.

Pulley

This is formed from $\frac{3}{16}$ in. thick brass and is dimensioned on the drawing **fig 108**. The blank is marked out with a $1\frac{1}{4}$ in. diameter circle. This is cut out and the centre hole drilled or preferably reamed $\frac{3}{16}$ inch. The work is then mounted on the $\frac{3}{16}$ in. threaded mandrel for machining the O/D to $1\frac{1}{4}$ in. and forming the groove for the line. It will not be possible to machine this groove using a form tool in the Unimat 4, the lowest speed is too fast. Use the 'V' shaped general purpose brass turning tool and manipulate it in both directions using the feed handles then finish off with a largish round needle file (**photo 109**). In a situation like this the file must be held in some sort of handle; a pin vice is better than nothing.

The hole positions are marked out at $\frac{11}{32}$ in. radius and I illustrate the drilling operation in **photo 110**. As $\frac{5}{16}$ in. is nearing the maximum size for the Unimat 4 drill chuck, the drilling should be carried out in ascending drill sizes. Just as a matter of interest, the versatility of this tool can be appreciated by the fact that the threads on the headstock mandrel, the tailstock and the drilling spindle are the same, so if I had wanted to drill a larger hole I could have fitted the 3-jaw chuck on the nose of the drilling spindle as this would accept a larger drill. Finally, I show the recessing of the pulley being carried out in **photo 111**.

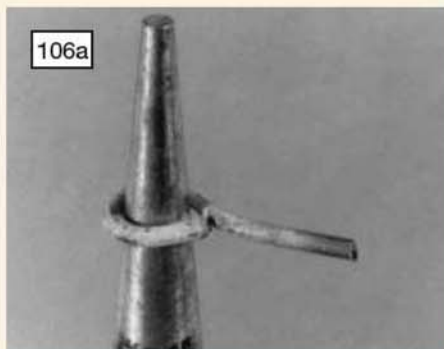
The strap or stirrup is cut from $\frac{1}{16}$ in. brass and bent round a piece of $\frac{1}{4}$ in. dia. stock held in the vice. The bend is completed by fitting the pulley bearing in place and tightening up the 6BA screw which will bring the circular bosses in close contact with the ends of the bearing. This stage is shown in **photo 112**. The two weights and the pulley are illustrated in **photo 113**. There is no pulley for the jockey weight, the line is simply threaded through the pulley hook on that side.

A suitable line for the timer is piping cord of some $\frac{3}{32}$ in. thickness obtainable from haberdashers. You will require 8ft. to give the full 6 minute run.

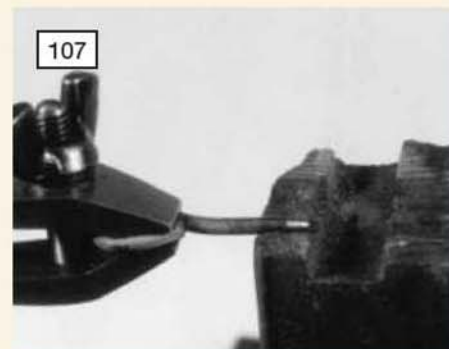
Setting going

At this stage the timer can be hung on the workshop wall. Use a roundhead woodscrew. All the pivots must be quite free in their holes. Each arbor should have end shake which means that if you hold them with tweezers they can be moved backwards and forwards a small amount. Oil should be applied to the pivots and the crank pin. Do not oil the Delrin gearing.

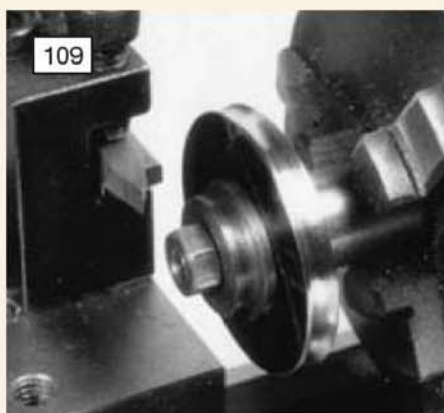
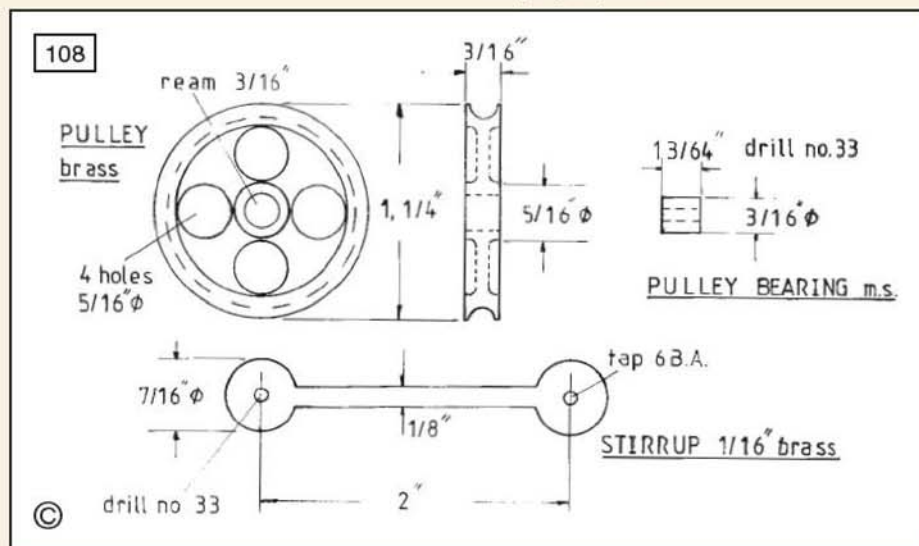
The weight line is fitted with an 'S' shaped hook at each end. The left hook is located in the hole on the cross strut. The line is threaded through the jockey weight hook, up over the drive pulley then through the weight pulley. It would then be anchored on the striking bracket which has not yet been made, so hang it on the right-hand dial pillar for the time being. As soon as the driving weight is hooked onto the pulley, the pen-



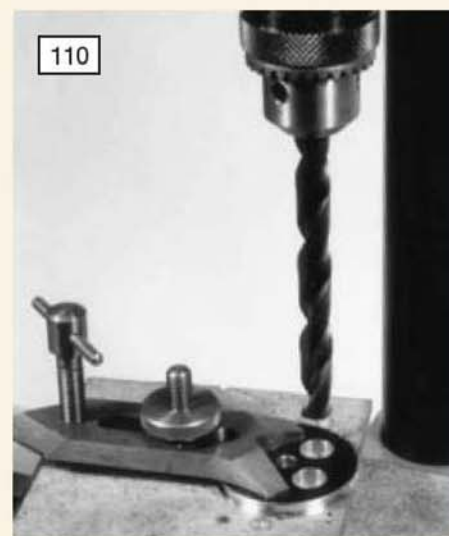
After heating, the hook can be closed round a tapered punch with pliers.



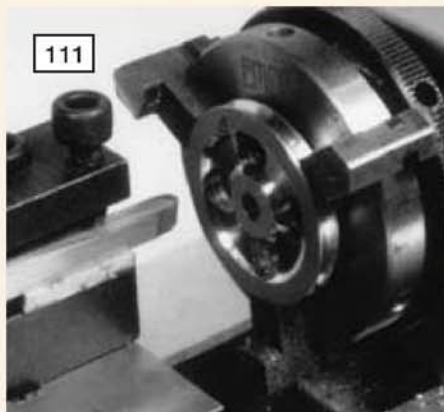
Set-up for tapering the end of the hook. It is rotated in a groove in the wooden filing block by an open jaw pin vice.



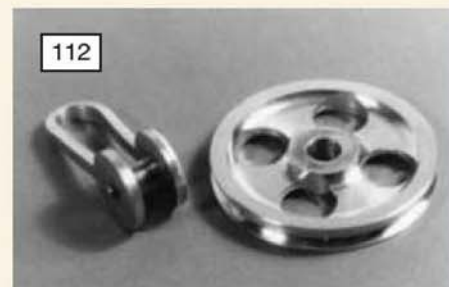
The pulley blank is mounted on a $\frac{3}{16}$ in. threaded mandrel for machining to size and grooving.



Set-up in the Unimat 4 for drilling the holes in the pulley.



Forming the recess in the pulley.



The pulley partly dismantled.

113

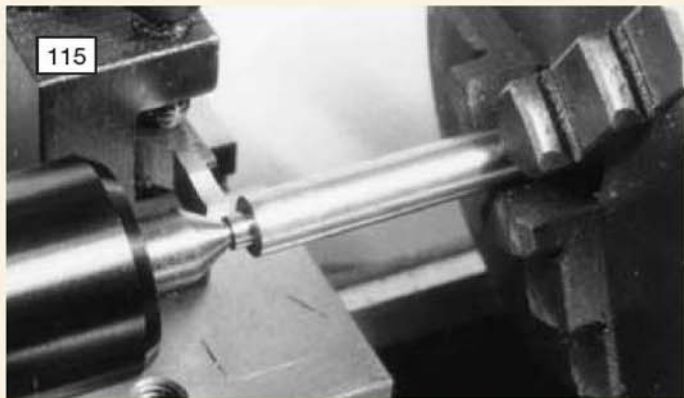


The driving and jockey weights with the pulley.

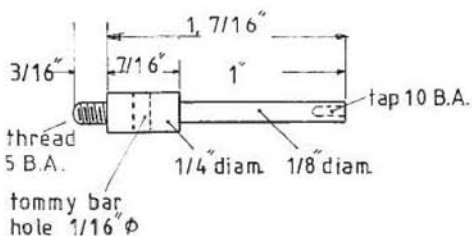
dulum should start oscillating, building up to a healthy arc of swing. On mine the crank pin travels some $\frac{5}{16}$ in. along each locking face. The action of the escapement will depend on the burnished locking faces in the pallet assembly, also the polish you obtained on the pivots and finally the freedom of the train. I am sure you will be fascinated by the escapement action.

Regulation

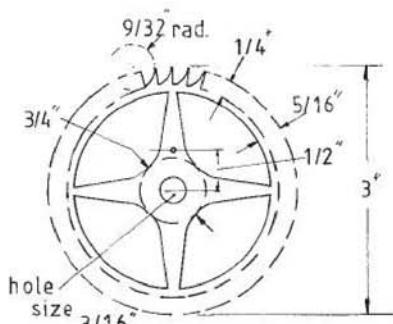
As a starting point, the two bobs can be secured to their rods with about $\frac{1}{2}$ in. of rod showing above and below the bobs. The regulation characteristics of a compound pendulum are different from those of a simple pendulum. To take the extreme case, if the bobs are the same weight and positioned equally from the pivot point there would be no restoring force. It would be like a balance wheel without a balance spring. The beats of the pendulum are counted against a clock or watch with a seconds hand over a period of one minute and the pendulum should make 80 swings. If it is fast then the operating radius of the bobs need to be equalised to resemble the balance wheel situation. The upper bob has a greater effect on the regulation than the lower one so when you are somewhere near, use the lower bob as it will be more sensitive.



The stud requires tailstock support and because of the restricted access without a half-centre a parting tool is used to provide the initial clearance.

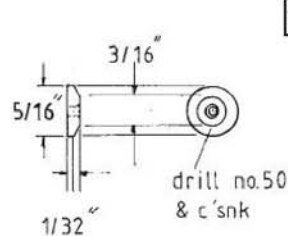


STUD FOR RATCHET WHEEL - m.s.

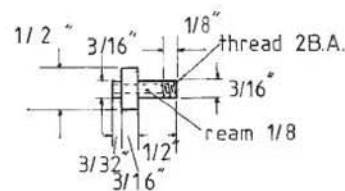


RATCHET WHEEL 48 teeth
1/16" brass

©



COLLET - brass



RATCHET WHEEL COLLET - brass

Stud

We now come to the parts of the timer outside the frames. The main component is the minute wheel with ratchet shaped teeth and this is carried on a stud. The position of this on the front plate was shown on the drawing fig 6 in part II (M.E. 4156, 16 November 2001). The hole should already have been drilled at the same time as the hole in the back plate which carries the cross strut as these components are exactly opposite each other. The $\frac{1}{4}$ in. diameter mild steel rod is cut to $1\frac{3}{4}$ in. length and held in the 3-jaw chuck with the minimum projection from the jaws and the end faced.

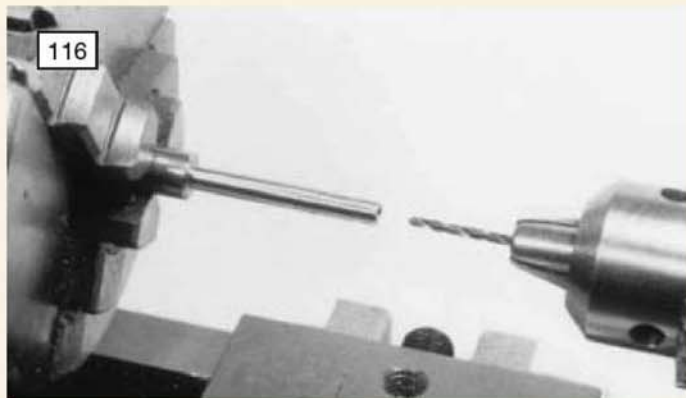
Pull the work out from the chuck until $1\frac{1}{8}$ in. is projecting, and form a centre with the small size of centre drill. The work is now supported by the tailstock centre for machining the $\frac{1}{8}$ in. diameter. Ideally the tailstock centre should be a half-centre as this would give better access to the work with the turning tool. Although I have several home-made half centres I carried out the work using the standard Unimat equipment. In photo 115 I show the extreme end of the work being machined with a parting tool in order to provide access for the right-handed knife tool.

Photograph 116 shows the end of the work being drilled No. 55 size in preparation for the 10BA tap. The work was then reversed in the chuck for machining and threading the 5BA section of the stud. It is always difficult to thread work right up to a shoulder. The tapered mouth of the die will not permit the thread to be formed right up close. Sometimes reversing the die in its holder will gain another thread.

Other options are to reduce the work down to the core size of the thread for a distance of about 1mm from the shoulder, or to counter-bore the frame to a similar depth. This is only possible if the latter is thick enough to accept this reduction; about $\frac{1}{8}$ in is all right but $\frac{1}{16}$ in. would not be acceptable. Finally, on occasions, instead of threading the spigot I have drilled and tapped the work and then inserted a length of studding securing it with Loctite.

It will be noticed that a tommy bar hole is provided for screwing the stud into the plate. It is more convenient to drill cross holes while the stock is at its full diameter, i.e. before the diameters have been machined.

●To be continued.



Drilling the end of the stud No. 53 size prior to tapping the hole 10BA.



BAILEY'S BEE

A VERTICAL CONCENTRIC HOT AIR ENGINE

Anthony Mount

describes the displacer and piston components before dealing with the bearing brackets and links.

●Part IV continued from page 540
(M.E. 4160, 24 December 2001)

I have specified stainless steel for the displacer tube (Part 8) which is also a standard size. Since the wall thickness is only 1mm, it should be fine to use it as supplied.

The only machining operation is to square

off the ends to bring the tube to length. For this you will need to set up the three-point steady. The exact length of the tube is perhaps best determined after the main body of the engine has been assembled. A number of variables can creep in, including machining allowances, gasket thickness, and linkage joints which can be checked after assembly and the displacer cut to suit.

Displacer top cap (Part 9)

The displacer top cap can be machined from mild steel. The drawing shows the displacer walls to be very thin to make it as light as possible. If you feel hesitant in aiming for such thin walls, it will do no harm to make them a little thicker.

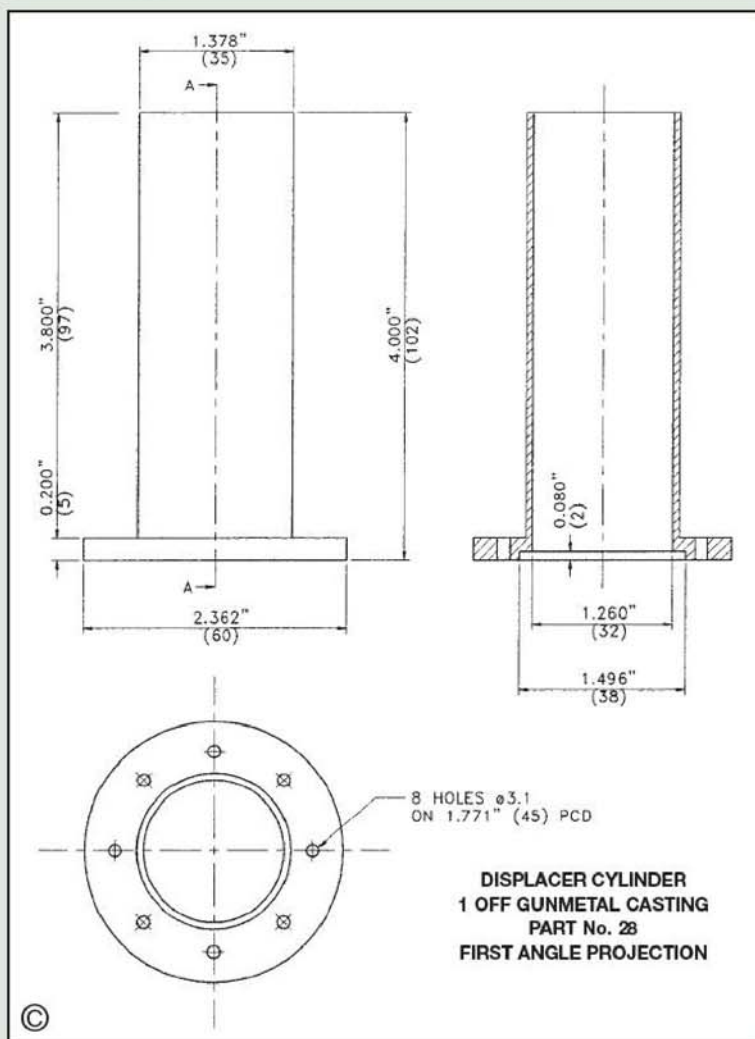
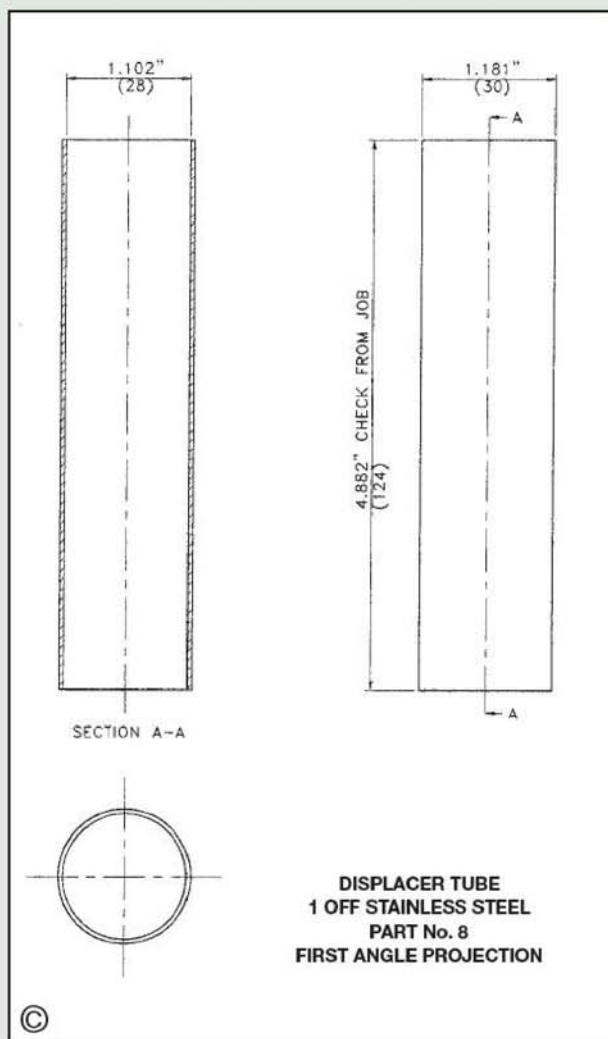
The principal reason for trying to make the displacer as light as possible is because very little power is available from a hot air engine running at atmospheric pressure. If we were able to pressurise the unit to, say 200psi then some power would be available, but such a modification is not possible with this particular design; a dedicated

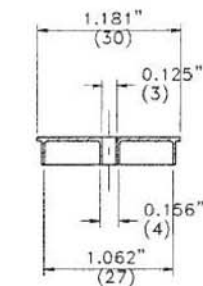
modern design would be needed.

By the way, an interesting feature of the Stirling engine is that by using an external power source to drive the engine, the hot cap will cool and the unit will become a refrigerator.

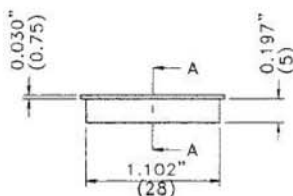
Grip a short length of 30mm diameter bar in the chuck and face off the end, then centre, drill and ream 4mm diameter. Turn down to a push fit in the tube and machine the middle section recess which may not be quite so easy as it may seem as getting a tool in causes problems with chatter. I used a $\frac{3}{16}$ in. dia. round tool bit ground to half thickness, like a D-bit with the end squared across with a few degrees of rake to give a cutting edge. I held it in a 10mm square holder split along its length and clamped in the tool post. It was then possible to plunge cut into the end while using back gear. Once the first cut has been made successfully, the others are easier as there is more room for the chips, and the cut does not have to be so wide.

Part off, reverse, and face off, bringing to finished thickness.

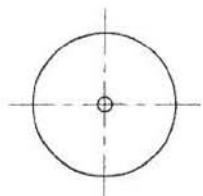




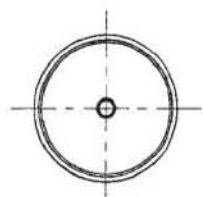
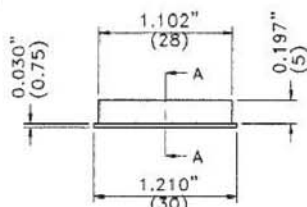
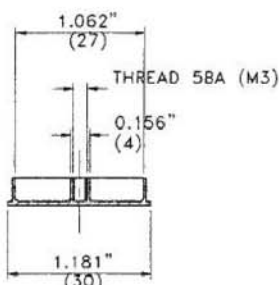
FIRST ANGLE PROJECTION



DISPLACER TOP CAP
1 OFF MILD STEEL
PART No. 9



DISPLACER BOTTOM CAP
1 OFF MILD STEEL
PART No. 10



22



Piston and collar. Note the threaded spigot which is probably best completed by screwcutting. Note also the oil grooves to improve the seal.

protruding from the holder, feed directly into the end of the piston. Start with bottom back gear and cutting oil; how fast you can run the lathe for such an operation will depend on its condition and size. I found I was able to go up to 210rpm and, as LBSC used to say, the swarf comes off with a sound like frying bacon. Just feed in for 18mm, withdrawing now and again to clear the swarf. Now reset either side of the groove and finish the recess to size.

The spigot can now be threaded. You may have to make up a special die holder if your usual one is too large a diameter to fit inside the piston. However, there is another way: it can be screwcut. Set up an internal threading tool as if you were going to screwcut a nut, but put it into position behind the spigot. Set it at the bottom of the thread and put the tumbler reverse for the saddle to run from left to right. Run the lathe backwards and feed in the tool as normal for cutting an internal thread. You will find that you have cut a

Bottom cap (Part 10)

The bottom cap is almost a repeat of the top cap except that the central hole is blind and is tapped M3.

Piston (Part 11)

The piston is at the heart of the engine and particular care must be taken with regard to its fit in the cylinder. The cylinder, which should be completed before the piston, is shown as part 28 (or part 33 for the alternative one-piece cylinder/hot cap configuration). The cylinder bore should be honed or lapped to a very good finish.

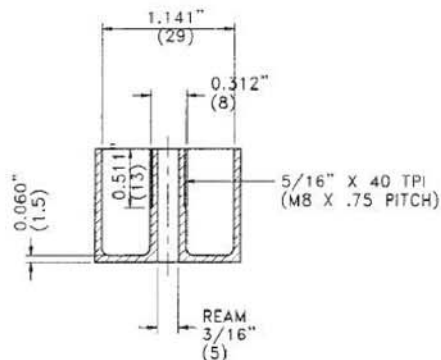
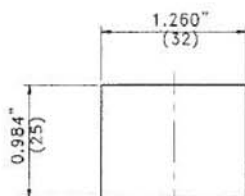
The piston is shown machined from the solid, and was made that way. It could be made from two sections assembled by silver-soldering if you are concerned at machining such a deep groove. However, I found it quite straightforward, using a similar technique to that employed for the displacer end caps, taken deeper.

First grip a length of 30mm diameter free-cutting bright mild steel (FCBMS) in the chuck. Face off and turn to 29mm dia., centre, drill down 4.6mm and ream 5mm ($\frac{3}{16}$ in.).

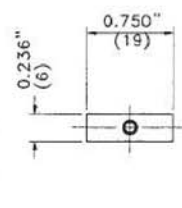
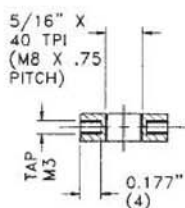
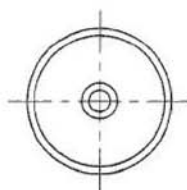
Grind up a tool resembling a D-bit from 5mm ($\frac{3}{16}$ in.) dia. high speed steel (HSS). First grind away to half diameter for a length of 6mm, then grind square across the end with about 5deg. relief to form the cutting edge. This can be held in a square section tool holder split along its length to clamp the tool tightly.

Set on centre height and with about 20mm

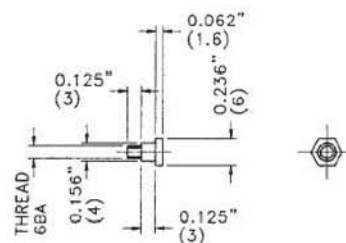
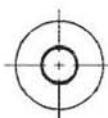
FIRST ANGLE PROJECTION



PISTON
1 OFF MILD STEEL
PART No. 11



PISTON COLLAR
1 OFF MILD STEEL
PART No. 12



PIVOT BOLTS
2 OFF MILD STEEL
PART No. 13



right-hand external thread on the spigot. The whole process took me about 5 minutes with the advantage of a screwcut thread and no requirement for a special die holder.

Now fit a knife tool and reduce the outside of the piston to about 0.05mm over size then cut the oil grooves with a vee tool. Builders with access to a toolpost grinder could be more generous with the allowance and could soon bring it down to a very good sliding fit in the cylinder. Those of us without such equipment can use the poor man's grinder: a very smooth flat file. A few gentle strokes with this as the piston is revolving at moderate speed will put a very good finish on the surface. I should not need to mention that whenever using a file, it must have a good, well fitting handle, particularly when in use in the lathe.

After a few strokes of the file, try the cylinder for fit; it might not go on or it may just start. Try another couple of file strokes and try again. When almost there, finish off with fine polishing stick, i.e. emery cloth backed against a flat board or file.

It is not easy to describe in words the fit required between the piston and cylinder. The performance of the engine depends entirely upon it. Too loose and the engine will not go and there's no way of cheating, it will just not run. Too tight and the engine won't start at all! Perhaps the best way is to describe the effect achieved by a good fit. With the piston in the cylinder and the central 5mm hole plugged, if you cover the end of the cylinder with the palm of your hand and try to withdraw the piston you will feel suction on your hand after about 6mm of movement.

When you are satisfied, part off, reverse, and clean up the end face. The completed piston and collar is shown in photo 22.

Piston collar (Part 12)

The piston collar allows for the attachment of the connecting rod.

It should be drilled and tapped to a good fit on the piston spigot. It must be free to move but without any shake. The dividing head should be used to drill and tap for the cross holes, then the piece can be parted off and cleaned up.

Pivot bolts (Part 13)

The pivot bolts are a simple turning job and need no description.

Bearing brackets (Part 14)

The brackets which carry the crankshaft require only milling and drilling operations. Cut off two lengths of $1\frac{3}{4} \times \frac{1}{4}$ in. mild steel and mill the



Far left: Set-up for drilling bearing holes in the bearing brackets.

Left: Components of the bearing brackets including bearing cap and bronze bush.

Above: Assembled pivot brackets.

ends square, bringing the bars to finished length. Mark the centre line, pick it up with a centre finder and, by using co-ordinates, lay out and drill the holes for the pivot brackets, just spotting for the bearing hole. Up-end and drill the bolt holes for the feet.

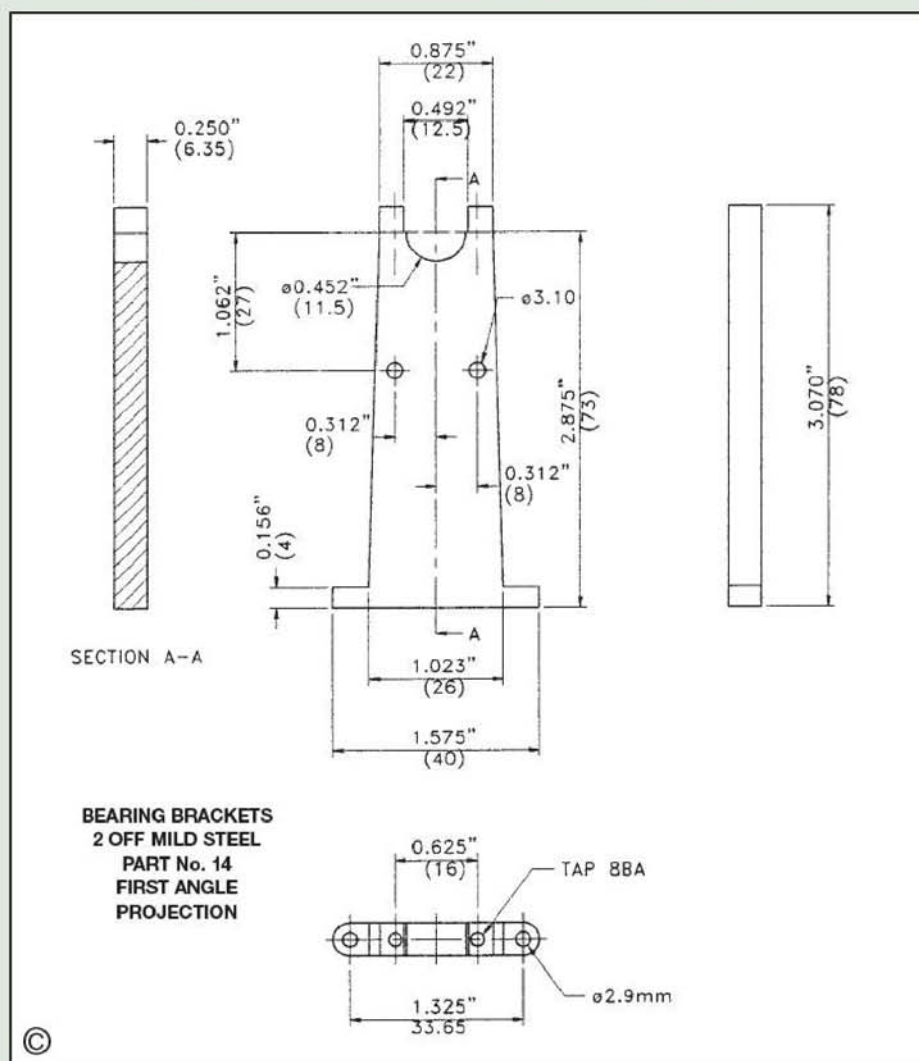
Still at the cap end, mill away at the top half to receive the cap. Place the two brackets together, with a couple of pins in the pivot bracket holes to maintain alignment and set up in the machine vice to mill away the sides. The job will be facilitated by first sawing away as much of the waste material as possible.

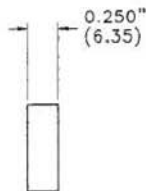
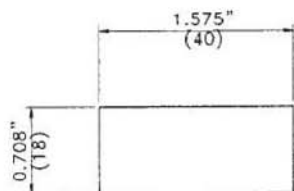
Finish off by cleaning up and removing all the sharp edges and rounding off the ends of the feet.

Bracket feet (Part 15)

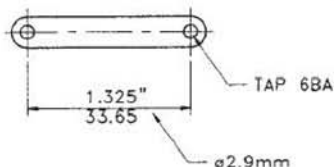
The bracket feet are small slabs of mild steel, drilled and tapped each end. The ends are rounded and the feet fit into the pockets machined in the water jacket cap.

When I fixed the feet to the water jacket cap I used some car body filler as a bed for them and finished off the junction between the feet and the cap with a fillet of filler. When cleaned up and painted the feet appeared to be part of the cap casting.

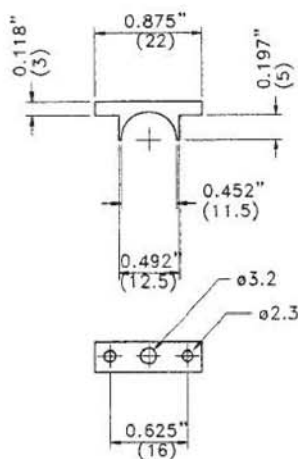




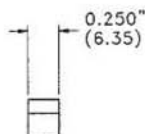
BRACKET FEET
2 OFF MILD STEEL
PART No. 15



FIRST ANGLE PROJECTION



BEARING CAPS
2 OFF MILD STEEL
PART No. 16



Turn through 90deg. and mill away the waste material. Finish by filing the end round and draw filing the edges. Remove all burrs.

Make the bearings from bronze, a press fit into the brackets. Ream the centre hole 4mm diameter. Completed brackets are shown in photo 25.

The link (Part 18)

A link is required to connect the displacer to the rocker arm. It can be milled from solid but is probably easier to make from three sections. Start by turning the two eyes from 6mm diameter mild steel rod. Chuck a length of rod, drill down and finish to 4mm diameter with a machine reamer; do the same at the other end.

Hold in the milling vice and after locating the centre with an edge finder use co-ordinates to cross drill a 3mm diameter blind hole in each eye. Return to the lathe, part off and finish to length.

Cut off a length of 3mm rod to fit the cross holes, bring to such a length that the centres are correct. Flux, bind together with wire and silver-solder together. Clean up with a wire brush, and re-ream the eye holes.

●To be continued.

Bearing caps (Part 16)

The bearing caps are machined from 8mm square mild steel. Cut off two pieces a little over length and hold in the 4-jaw self-centring chuck. Face off the ends bringing them to length.

Transfer to the milling machine and mill the rebates either side until the centre portion fits the slot in the bearing brackets. It is actually better to machine the slots in the brackets to fit the caps. Reposition in the milling vice and pick up a side and end with an edge finder. Zero the index dials and use co-ordinates to drill for the stud and oil cup holes.

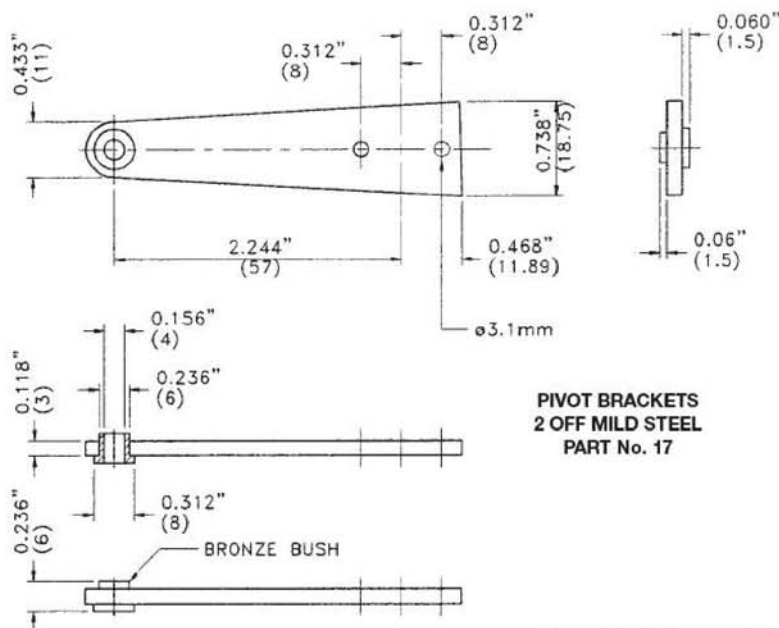
Place the caps in the brackets and clamp both in the milling vice (photo 23) to drill the bearing holes.

The caps can be painted to match the brackets, but an attractive contrast will be obtained if they are cleaned up to a bright finish. A mirror finish is not appropriate, a matt finish as achieved by draw filing is what is required. The bracket, cap and bearing are shown in photo 24.

Pivot brackets (Part 17)

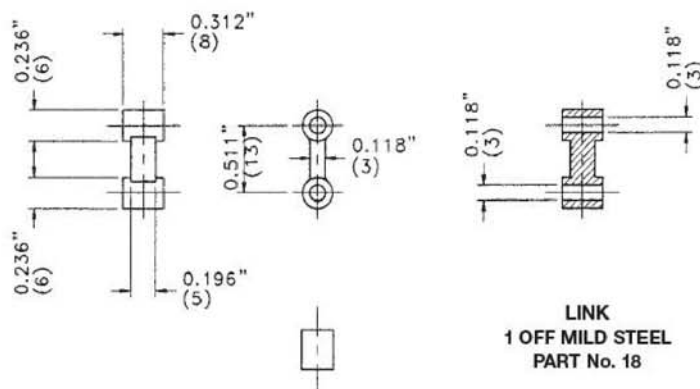
Use 25 x 3mm bright drawn mild steel for the pivot brackets. Cut off two lengths of bar and mill the ends square, finishing just a little over the finished size. Mark the centre line and the outline of the brackets.

Mount in the milling vice, use an edge finder for location and zero the dials on the centre line and at one end. Then using co-ordinate drilling, spot for the bolt and bearing holes. Drill through and ream the bearing hole 6mm.



PIVOT BRACKETS
2 OFF MILD STEEL
PART No. 17

FIRST ANGLE PROJECTION



LINK
1 OFF MILD STEEL
PART No. 18

A BALL-NOSED LATHE CENTRE

Peter Spenlove-Spenlove

takes the opportunity to describe a special centre for taper turning, and explores a few basics relating to the topic for the benefit of newcomers to the hobby.

●Part II continued from page 552
M.E. 4160 (24 December 2001)

Towards the end of World War Two, I left Loughborough College and the tutelage of Mr. Tom Walshaw. Readers of *Model Engineer* will know of his writings under the pen name *Tubal Cain*. The ministry sent me to a small machine shop which made precision parts for Rolls-Royce and other well-known firms. Rejects and scrap were not permitted; our work had to be right. I was put on an old 5 or 6in. centre lathe (10 or 12in. swing), the cabinet for which contained a motley collection of centres, tools and other rather battered items.

Having finished the bores to diameter, the grinder brought me a batch of cylindrical parts. The drawing to which he was working called for the outside diameter, currently parallel, to be tapered slightly but accurately, work which would be done more quickly using my lathe than his universal grinding machine.

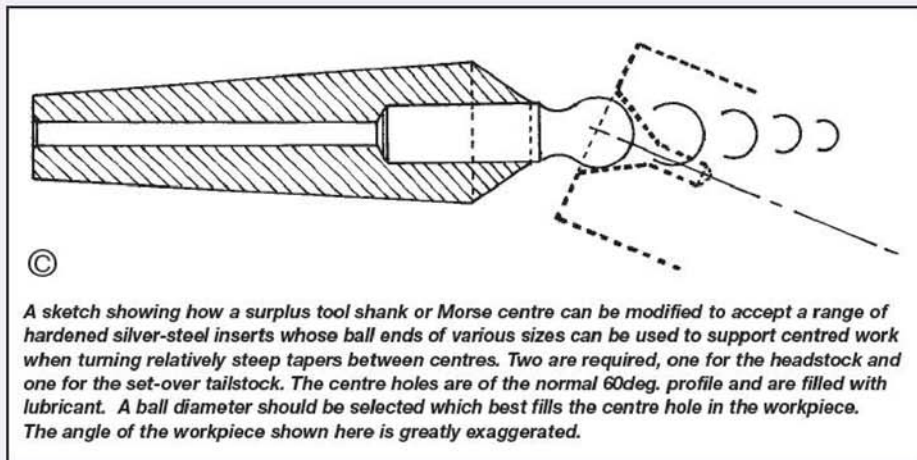
I found a standard turner's mandrel which, fortunately, had decent centre holes. Wartime shortages meant that any sort of tooling was very difficult to get hold of quickly. Sorting through the available lathe centres, I found two which weren't too badly scored and started work. The tailstock was set over, but I didn't like the condition of the centre in the lathe spindle — in fact it was awful! So with youthful enthusiasm I asked the manager if I could try an experiment "... to preserve your mandrel, work more quickly and finish up with a more accurate job." I explained my idea and, being a practical engineer, he observed "What you say makes sense. Try it by all means, but not on the 'good' centres. Use the old ones."

It worked and is so simple but readers should note that it is only suitable for set-over work.

Technique

The centres (I prepared two) were popped into the headstock taper after grinding the point away. They were drilled and bored to receive a ball ended insert driven firmly in. Our tool and cutter chap ground this for me from a piece of round tool material. I think it may have been Stellite as I can't remember seeing HSS ground toolbits at this particular firm. Stellite is a very tough cobalt alloy which will withstand high working temperatures and is the material most commonly used for the tips of masonry drills.

I asked him for a very smooth finish on a form as near as he could get to a ball bearing. The final polish was achieved by rotating the finished centre in the lathe between two pieces of wood smeared with a lapping paste. The idea worked and all the parts were finished with uniform results. Later, during a slack period, we modified two more centres but we drilled an axial hole right



A sketch showing how a surplus tool shank or Morse centre can be modified to accept a range of hardened silver-steel inserts whose ball ends of various sizes can be used to support centred work when turning relatively steep tapers between centres. Two are required, one for the headstock and one for the set-over tailstock. The centre holes are of the normal 60deg. profile and are filled with lubricant. A ball diameter should be selected which best fills the centre hole in the workpiece. The angle of the workpiece shown here is greatly exaggerated.

through as well as the bored hole for the ball tip. This was so that a range of ball tip diameters could be inserted to suit various centre holes. The ideal ball size should run just inside the centre cone; i.e. at the point where the bearing area is greatest. As with normal centres, proper lubrication is vital — ensuring that the oil goes on the inside of the centre hole. It's not enough to just dribble some on the outside. And, as before, any increase in the temperature and associated expansion have to be carefully monitored.

We need neither Stellite nor high speed steel ball tips in our home workshops. We can use silver-steel which has been hardened and tempered to dark straw and the ball end polished. Various sizes can be made to suit various diameter centre holes. The ball shanks should all be made to the same size to fit the Morse taper centre.

Any old Morse taper shank will do including the taper from an old, worn out or damaged taper shank drill or reamer. Morse taper blanks may be purchased from the suppliers who advertise in these pages. There is no reason why a home-made Morse taper cannot be used. It need not be hardened. A hole should be bored in the Morse taper shank to accept the ball insert with the taper *in situ* in the spindle nose. A through hole should be drilled to accommodate a knock-out rod.

The ball insert must be a fairly tight press fit, but not a drive fit. Hammer blows may shatter the ball. The ball end should be finished to as spherical a form and as smooth as you can get it. Later experiments with steel ball bearings weren't very successful except when turning very long jobs with very little tailstock set-over. Such work can be perfectly well completed using commercial 60deg. centres, the centre in the tailstock being of the revolving variety. In such circumstances the ball-ended centre offers only minor advantage. The ball-ended centre comes into its own for steeper tapers, not less than those encountered on say, Morse or Jacobs taper shanks.

It may be appropriate here to note that if a batch of tapered components is to be produced by running them between offset centres, the taper accuracy is affected by the length of the workpiece. If therefore there is a variation in the workpiece length, there will be a corresponding

variation in the workpiece taper angle because the offset remains constant. The actual taper angle may be calculated from:

$$\text{taper angle} = \sin^{-1}(\text{offset} / \text{workpiece length})$$

More for beginners

If you acquire some old shanks from broken drills or whatever, test them before using them. Remove the usual bruises carefully using an oil-stone slip, then wipe them clean. Clean the two taper sockets in the lathe with the power turned off. *Never, ever* clean a socket rotating under power unless you have some desire to twist off your finger. Painful. Apply a *very thin* smear of engineer's blue onto the shank and place in the socket. Give it a couple of twists in the socket and withdraw it. The quality of fit will be shown by the disturbance in the blue marking. A bright ring at one end or the other indicates an error in the taper angle; a bright ring at both ends but not in the middle indicates a hollow taper while a bright ring in the centre indicates a barrel shaped taper. If the fit seems satisfactory, wipe the blue off and insert the shank again, this time more firmly. It should stay firm and not pull out easily.

Engineer's blue is an intensely blue oily paste and should not be confused with marking-out blue (layout blue) which is a thin coloured lacquer brushed or sprayed onto the surface of the workpiece, dries rapidly, and allows lines marked using scribes or dividers and the like to show up more clearly than on uncoated metal.

Marking blue is sold in small tubes and flat tins. One such 'Micrometer Brand' will last most of us for a couple of lifetimes, but don't get it on your best shirt as it's very difficult to remove. In earlier days we made our own engineer's blue by making an oily paste containing red lead powder. It was generally called 'rattle' but, containing a lead compound, was poisonous. Red lead, an oxide of lead, is a very fine dusty powder which was once available from most paint suppliers. Mixed with linseed and other oils, engineers used it to paint structures, giving them the well-known bright red-orange protection from the weather. Red lead is rarely used these days because of its toxicity problems, particularly if it finds its way into a water course.

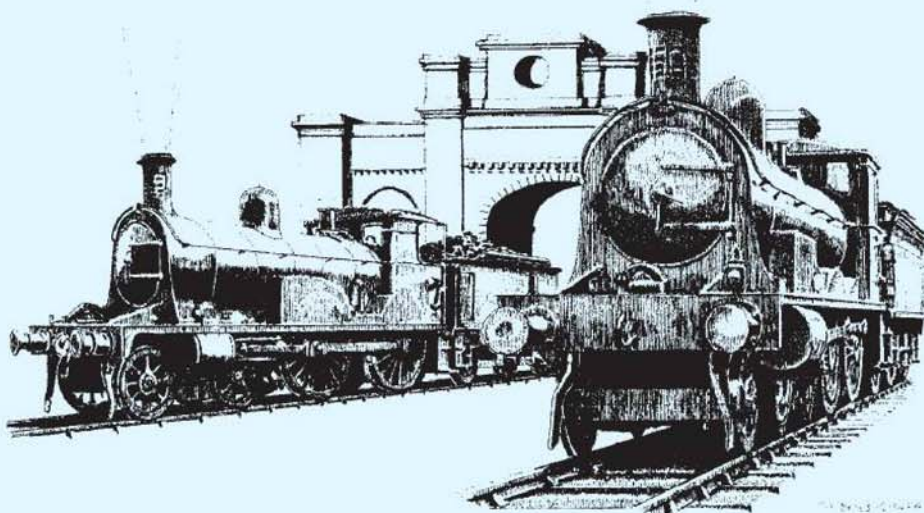
Neville Evans

deals with the reverser for the 'Big Goods' before discussing such diverse matters as paint removal, a rolling road, superheaters and Sidney Camm's designs.

●Part XII continued from page 544
(M.E. 4160, 24 December 2001)

The last major parts of the chassis, are the lever reverser and the lubrication system. As our Highland locomotives have many features in common, we can deal with the reversers together, the only real difference being in the reach rods and the distribution of the bolting down and pivot holes. One of the minor problems of small locomotive design is that it is sometimes thought necessary to beef up components to increase their capacity to perform their allotted function. I don't really subscribe to this view however as most, but not all of the forces involved are mitigated either by reduction in weight effect, according to the cube rule, which says that a model at 1:12 scale is 12 cubed or 1728 times lighter than the full size locomotive, metal thickness being the same. Piston thrust is based on squared proportions, so our piston areas are 12 squared or 144 times less than those of a big engine; this has the effect of reducing bearing loads to very manageable proportions. What has to be borne in mind though, is that our fingers are huge in proportion to a scale driver, so that we must design to accommodate the 'clumsiness' effect which is enormous, and varies in direct proportion to the thickness of the drivers skull. Or so the Dragon tells me.

Study of the accompanying photographs will show that I've thickened up the structure of the reverser stand in a few places. I leave it to the discretion of individual builders to decide whether or not to thin down the frame and lever. The notched quadrants are shown at 1/8in. thick and as these parts have to take some heavy duty wear I should leave well alone. One most important point is that the outside, or if you prefer, the left hand side of the reverser stand, must be finished flush with the frames to avoid fouling the large box which covers the coupled wheels. I must say that the placing of the tension spring which holds down the latch into the quadrant took a deal of working out. The answer was arrived at by Roger, as detailed on the drawing. One point is that the hole for the spring must be drilled before the slot is milled, for obvious reasons. A good source of these small springs and



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

other gadgets is the throw away cigarette lighter. Just break them apart and help yourself.

When making up the notches on the quadrant remember that the reach rod has to move the reversing arm on the weighshaft an exact number of degrees. On both the locomotives the forward rotation is smaller than the rearward, so that the reversing arm is actually inclined forward a few degrees, when in mid gear, as shown on the drawing. Make sure that the die block lies close to the bottom of the link in reverse and close to the top of the link in forward gear. Roger says that the prototype will notch up nearly to the middle in forward gear and runs like silk on compressed air, so I'm hoping for great things. The calculation of the reach rod length is very difficult and I think that it is best to make a mock-up first to avoid the situation where the finished reverser doesn't rotate the carriage far enough, or too far.

The lubrication system will be next on the agenda, though I shall have to leave it 'til next month. We have the choice of displacement or mechanical lubricators. I am a great fan of the late Jim Ewins, and think that his designs for fittings take a lot of beating. I shall be detailing Jim's lubricator, which can be made to supply as much or as little oil as one desires. I am using three of these devices on

the P2, as I have found in the past that they do exactly what Jim said. They are ensconced in my favourite type of oil tank, which I invariably mill from the solid. I am using a displacement lubricator on the Loch and the slight delay is to make sure that said device fits neatly under the drag beam, next to the brake cylinder and its assorted galvanics. If you decide on the mechanical pump, I would suggest that behind the buffer beam is as good a place as any. If anyone disfigures the loco with a lubricator mounted on the running board, let's just say that I'll send the boys across.

The Gresley P2

As mentioned last month, I was lucky enough to find a largely complete and nicely made model of one of my favourite locomotives the other day. Progress has been made in that I have stripped and painted the tender chassis and undercoated the tender tank, as well as reassembling it. Some of my friends have asked why I haven't finish painted the tender. Well, it may be another year before the loco is assembled, tested, finished and ready for painting, by which time the tender will have received quite a lot of stick, in the form of careless handling and general wear and tear, so to avoid the 'sports coat and trousers' effect, I decided to fin-



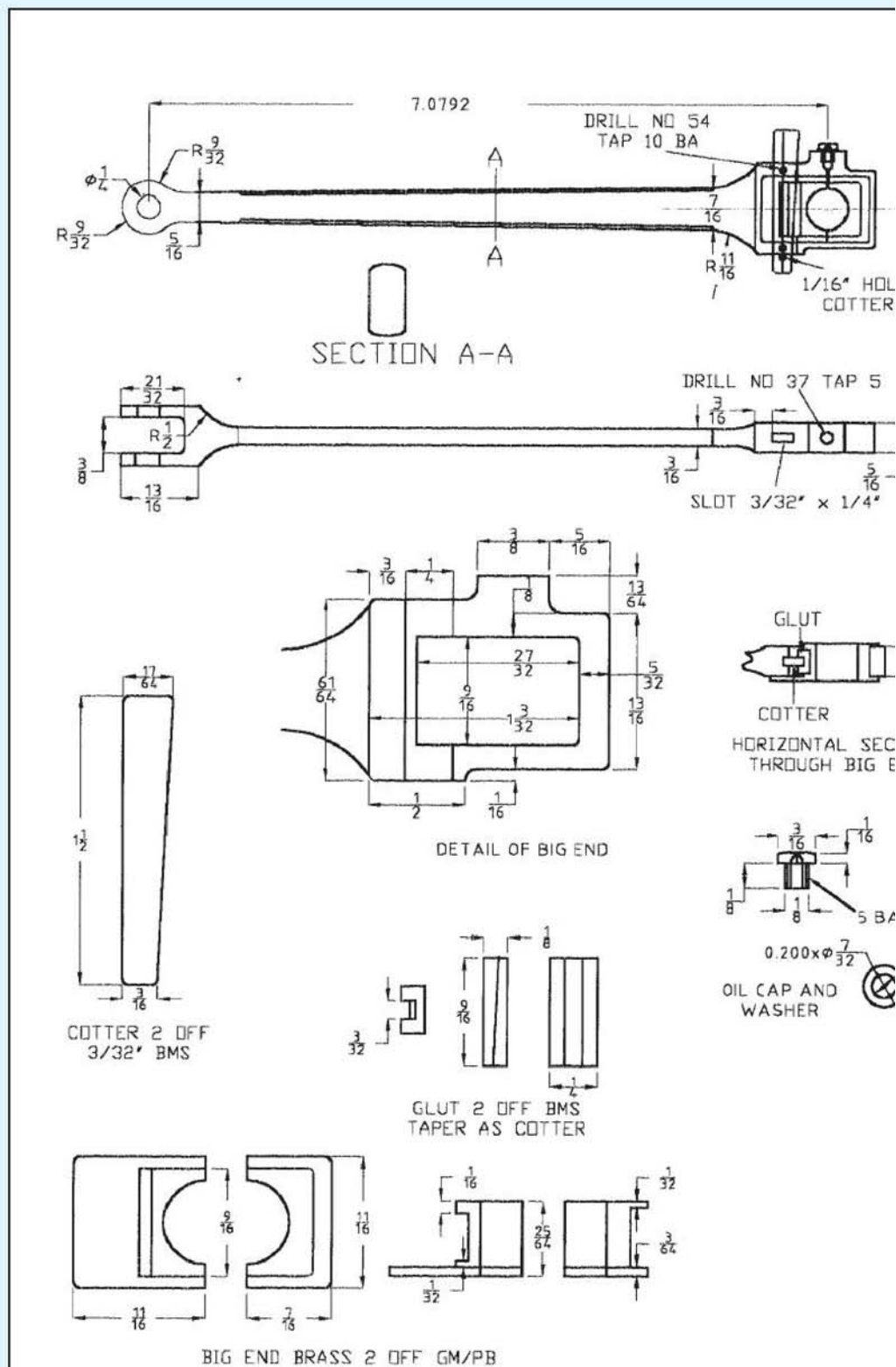
Details of the reverser on the full-size Jones 'Big Goods' at Glasgow's Museum of Transport.



ish paint them together. The de-painting of the tender incidentally was carried out by my usual method. I have a long time friend, one Tony Bussey, who owns a little firm called 'Renowheel' in a local town. Tony did a lot of motorbike work for me: aluminium polishing, bead blasting and so on, and we have remained firm friends. The upshot is that I can take a set of 5in. gauge King frames in, strip off the paint, high pressure hose it, steam clean it and then bead blast it, all in an hour, to leave a perfect surface for painting. (I do it quickly because he charges £15 an hour to use the bead blaster) You all have a 'Renowheel' or its counterpart near you, look in *Yellow Pages*. These firms also strip paint off wood and run hydraulic suppliers, or what have you, as well as refurbishing aluminium alloy wheels to better-than-new standard. The number of small companies which have bead blasters is quite astonishing. If approached in the right way, most of them will let you use their facilities for a small sum. They can save you days of work, as well as the expense of noxious paint strippers and etching primers.

As you can see from the photo the big loco is sitting on a rolling road. This ingenious and simple device was made by Ivor Roberts (aka *Ivor the Engine*) and is absolutely invaluable, as the weight of the engine is taken on its own springs, which can be adjusted prior to track testing. I have never liked the practise of putting the ends of the locomotive on two blocks, as a lot of damage can be done by letting it run without shimming the axleboxes to running height. If you don't believe me try it and listen to the clatter of the bearings and the pistons hitting the back end covers. The basis of the rig is a pair of 2in. steel angles, joined by some $1 \times \frac{1}{8}$ in. strip and a plate welded on the end. The plate has a slot cut in it to accept a $\frac{3}{8}$ in. bolt, nutted up to the buffer beam through the drawhook hole. The heart of the matter lies in the $1\frac{1}{2}$ in. rollers as per the enclosed sketch. I have included a few measurements as a rough guide, but the whole affair is so beautifully simple that you can just modify it to suit whatever materials and ball races come to hand. The rollers slip into slots in the angle irons and off you go. To accommodate a new loco, just cut a few more slots. An obvious refinement would be to couple the rollers and to incorporate some form of dynamometer, an electric motor driving against a resistance perhaps. By the way, if anyone wants to give me a ring to discuss any of the points raised in this series of articles, please feel free to do so on the Practical Scale number.

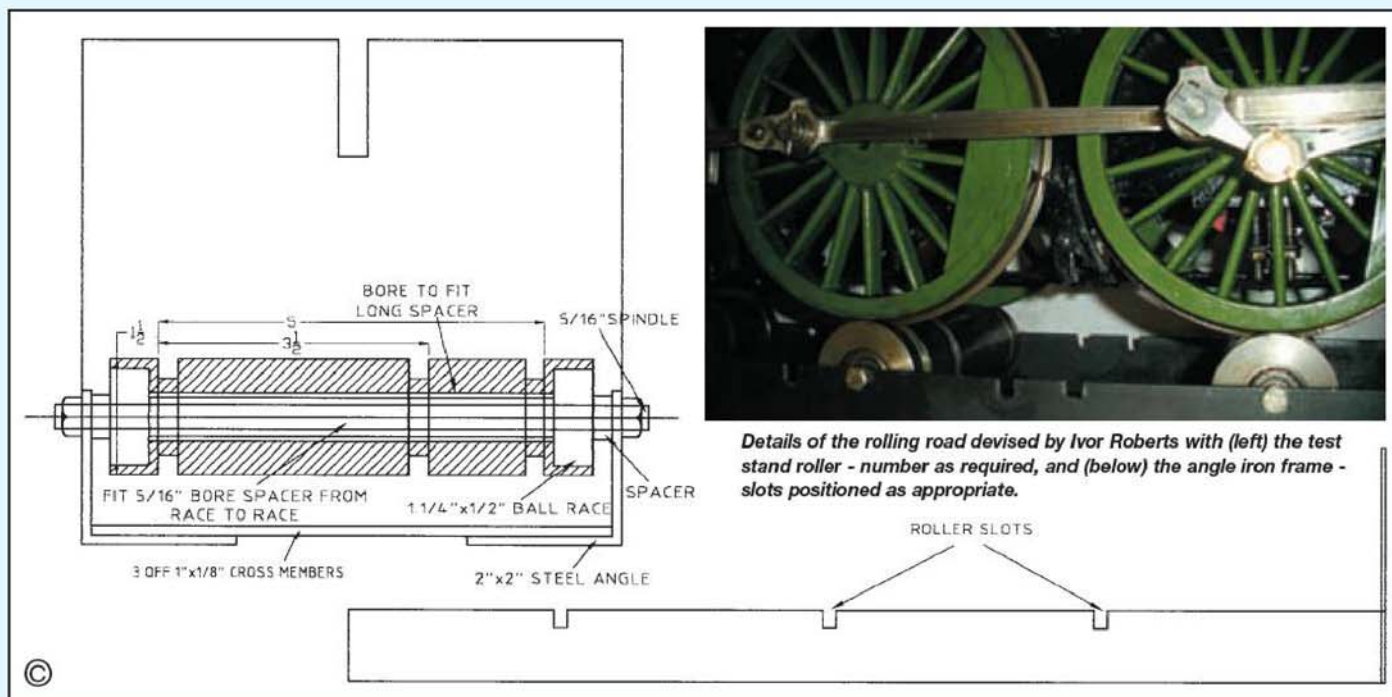
Today has been superheater day. The boiler was made about 20 years ago by Clarksons of York and is unused. It has a large combustion chamber with four superheater flues, to feed three cylinders. I was unable to use a radiant element due to the way to the firebox being blocked by some large water tubes. I shall therefore lead the elements back to the hot end twice to get a few more therms in. I am using copper elements due to the lower temperatures involved. The two Highlanders have radiant superheaters which of course have to be made from stainless steel. Paul Gammon can supply these devices to those who are unable to make their own. He's just made a lovely job of mine. I would hesitate to use radiant elements unless I had proper cast iron cylinders with cast iron rings. LBSC claimed that he had



LOCH CONNECTING ROD, MOTION

tried a radiant superheater, but that it gave too much temperature, which damaged his cylinders — another example of erroneous research giving false results. The problem was not that the temperature of the steam was too high, but that his cylinders were not up to the job. Unfortunately in

those far off days when people did as they were told and had a healthy respect for authority, his words of wisdom were looked upon as Holy Scripture, rather than one man's opinion. This tended to hold up development for quite a while. The idea, therefore, is that if you want high

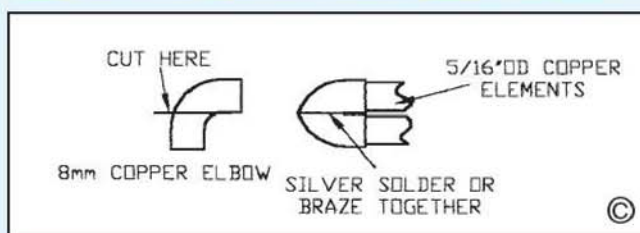
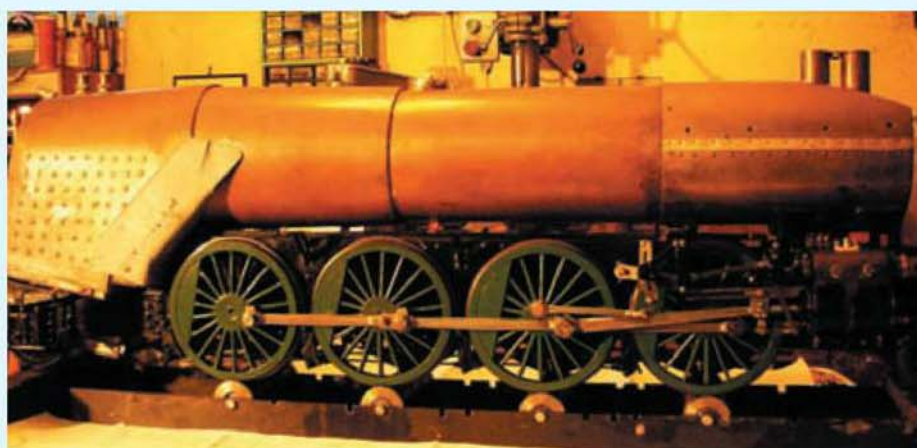


copper elbows as produced for microbore plumbing, wherein hangs a tale. Last Sunday the Dragon and I had occasion to visit our local branch of B&Q. I remembered the copper elbow situation and was somewhat bemused to see that these small items were priced at £2.42p. each. I resolved to redesign the spearheads until I discovered that our friendly local building suppliers sold them for 45p. So watch out, there are Sharks about! The finished item turned out as shown here; as ever, I suppose that the idea is as old as the hills, all I can say is that I haven't seen it before.

Leading the field

The mention by Martin Bourne (*Postbag*, M.E. 4156, 16 November 2001) of the name Sydney Camm, brother of F. J. Camm, known as *Fudge*, and editor of *Practical Mechanics* magazine for so many years, brings back many memories. Unfortunately as with so many things in this life, all is seldom what it seems. The Hawker Aircraft Company, of which Sydney Camm was chief designer, got lucky in the late 1920s when they pinched Richard Fairey's concept of the fast light bomber, the Fairey *Fox*, of 1925, which was a remarkable step forward. Using American technology in the low drag Curtiss D 12 engine and propeller, the *Fox* was able to outpace any of the fighters of its day. Sadly, due to the purchasing policy of the Air Ministry in those days of disarmament, only one RAF squadron was ever equipped with the *Fox*: No 12 Squadron, one of my old squadrons, and the best in which I ever served. The squadron badge, to the present day, is a *Fox's* head, and the motto *leads the field*, is a fitting tribute to the finest aircraft of its time.

The resulting family of Hawker aircraft, always called the *Hart* family after the first type, included single and two seaters, lasted the RAF for many years, and included the beautiful *Fury* which sadly was not as good as it seemed and certainly couldn't hold a candle to the delightful Gloster *Gauntlet*. Camm's designs (though he obviously didn't design them, any more than Maunsell designed the Nelsons) included the mediocre *Hurricane*, mainstay of Fighter Command during the Battle of Britain and highly regarded because it was tough and rugged. It was flown by highly professional, skilled pilots,



Above: Nev's new toy! His P2 sits on the rolling road devised by Ivor Roberts.

Left: Superheater spearheads for the P2 are fabricated from 8mm microbore copper elbows.

backed up by a unique and incredibly effective fighter control system. We were only too pleased to replace the *Hurricane* as our first rank fighter as soon as enough *Spitfires* became available.

The next one, the *Typhoon*, as with most Hawker aircraft with the exception of the *Tempest*, had too thick a wing to enable it to be competitive as a day fighter. As luck would have it, the combination of a thick and therefore strong wing and a huge, complex, powerful, 24-cylinder, sleeve valve, Napier *Sabre* engine, made it suitable for the ground attack role, in which it was very successful. The only Hawker aircraft that I had much to do with was the lovely *Hunter*. Sadly as with the early *Fury*, appearances only flattered to deceive. The wing was too thick for supersonic flight and the aerodynamic layout was unsound, which caused it to 'pitch up' into a turn. This unappealing habit meant that when you tried to pull a tight turn, the aircraft would suddenly and with no warning, tighten the turn, sometimes until the wings came

off. The four huge Aden 30mm cannon were too powerful for the airframe, and as they were mounted too low in the fuselage, caused a nose down pitching moment which, when the pilot inevitably overcorrected, sprayed shells all over the country. One redeeming feature of the early marques was that you couldn't fire the cannon anyway because if you did the engine went out, like it did if you opened the throttle too fast. A friend of mine, Dizzy Addicot, was at Dunsfold with Neville Duke when the first prototype joined the circuit. "Why is he doing two circuits" asked Dizzy "He's trying to slow down" said Duke. Sure enough the idiots had built a high speed jet fighter without airbrakes. The mind boggles. Later, in panic, they nailed a huge barn door affair underneath the rear fuselage. To land a *Hunter* with the airbrake extended, was not an experience to be repeated.

The Hawker *Harrier* is a very interesting, if totally irrelevant aircraft. Nuff said?

●To be continued.

Martin Wallis

continues with advice on back tank construction techniques.

●Part XXI continued from page 183 (M.E. 4157, 2001)

As mentioned last time, the *Little Samson* backtank is easier than most to make. This is due to the use of brass angle to join the plates together rather than the more common flanged plate arrangement. The big bonus is that the entire plate work for the back-tank may be prepared without any annealing. This means the lovely shiny brass plates ought to remain as such until the end. In 3in. scale the platework is $\frac{1}{16}$ in. thick brass.

First prepare your materials

It is wise to prepare all the materials before commencing construction. Purchasing the brass could be a bit of a shock to the wallet, but nothing too permanent, I trust. I invariably purchase more than I need and put the left-overs in stock. This has the double benefit both of having enough material to cover the occasional error and that your stock will steadily increase. Do check with your supplier if there are cutting charges and, more importantly, how much they are. It is not uncommon for cutting charges to exceed the cost of the material in which case the order of one full uncut sheet is much more economical.

If the brass is purchased as one sheet make paper templates for each backtank part and lay them on the material. You should have two templates for the tank sides, one for the back and bottom, one for the tank front, one for the tank top, and one for the bunker partition. Arrange them to make best use of the material, remembering to keep as many straight lines as you can to facilitate guillotining. Most engineering workshops or colleges have a guillotine. Provided the work is marked out in advance it ought to be the work of seconds.

Cut two lengths of brass angle, each long enough to go down the back of the tank, around the corner radius, and along the bottom. Allow at least $\frac{1}{2}$ in. extra, if not a bit more. Cut the other pieces of brass angle which are used to secure the tender floor, front plate and the partition that keeps the coal in its rightful place.

Making a start

I suggest the place to start is with the two brass angles that run down the back and along under the tank. These need to be bent at a radius of 1.875in., close to half way along. The really clever chaps amongst us will anneal it where the bend is to go and pull it around a former to get the desired radius of 1.875 inch. However, be warned, it is not as easy as it sounds, the brass angle will do its best to twist as well as bend. It is important that formed angle sits nice and flat on the tank side. Inexperienced builders planning to adopt this method are advised to practise on some short lengths of brass angle first.

It is much easier to cut a series of notches out of the angle (photo 1), and then pull the very much-weakened section around a former specially

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



Above: John Freeborne cut notches in his $\frac{1}{2} \times \frac{1}{2}$ in. brass angle to help it around the $2\frac{1}{2}$ in. radius on his 4in. scale *Little Samson* backtank.

Below: Copper formers were made to control the bend.



Left: John has laid the brass angle on to the tank side and drilled through for fixings.



Right: The two tank sides are fixed together using further brass angle. Careful inspection shows some countersunk brass screws fitted for the purpose. The hornplates were used as a jig to ensure the correct spacing.



David Hall is seen here riveting up his tank sides. Note the quality of the rivets, even when out of sight, and the beautiful radius achieved on the angle without any notches.

made for the purpose (photo 2). As may be readily seen John Freeborne has made an excellent job using this method. Remember, if your bend ends up a little astray of the intended radius no one is going to wave a red flag and tell you your engine must not be steamed! No one will ever notice, not even the really smart guys.

At this stage the bend in the piece of plate which will become the tank back/bottom, may be formed. It is not a sharp bend so builders should have few problems pulling it around a piece of bar or tube without annealing. In 4in. scale it will certainly be harder work but still quite possible. Pulling a strip of brass, say 1in. wide, around the former first would do no harm. Whatever happens to the brass strip ought to happen with the real piece at 6.375in. wide.

A great many rivet holes

Once these two lengths of brass have been bent they may be laid on the tank sides and the radiused corner on the tank side plate cut and filed to suit. There are then a great many rivet holes to be drilled. In 3in. scale $\frac{1}{8}$ in. diameter rivets are employed at $\frac{1}{2}$ in. spacing. The $\frac{1}{2}$ in. spacing is simply a guide and in practice the spacing may be increased/decreased a fraction, as desired, in order to achieve a neat rivet pattern. By choice I would use brass rivets which I would anneal before use. If copper rivets are more readily available, use them instead, there really is little to choose between them.

I much prefer to lay the holes out on the plates by co-ordinate drilling on a milling machine. Stan Nipper seems to be of much the same frame of mind as may be seen in photo 6. The best laid plans will always go astray when going around the bend (!) and a hand-held drill may be substituted. In the top corner of the bunker where the brass beading will fit, either decide to fit a countersunk rivet under the brass beading or leave one out altogether. You certainly don't want half a rivet head right up against the beading.



Above left: I have always had an instinctive dislike for hand held power tools and, given a chance, will always reach for a proper machine tool. It is good to see Stan Nipper using his milling machine here to drill the holes in the tank back/bottom plate. No doubt they are being co-ordinate drilled and are bound to come out in a beautifully straight line.



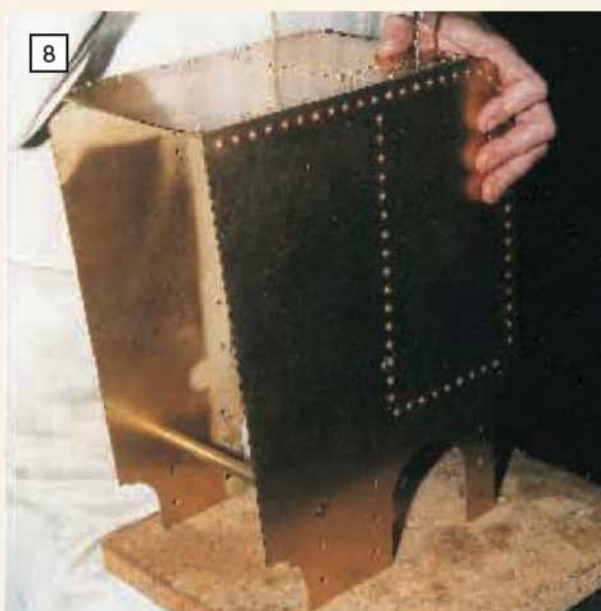
Above right: Stan spots through from a tank side into a hornplate. Note the studs already fitted for the brake bracket, and the countersunk rivets where the bracket will fit. An oval reinforcing plate has been added for the injector mounting. (Photos 6-7: S. Nipper)

When laying out the rivet patterns use a felt tip pen to mark any rivet holes that need to be countersunk because they will later end up under the backtank furniture. This includes such items as the water pocket and brake bracket. It is so easy to forget later on. Both the water pocket and brake bracket run across the rivet lines. Careful inspection of works photographs show the seat bracket sharing one of the rivets with the tank seam. The works drawings clearly show the top step clipping the top line of rivets but in practice works photos indicate the Savage fitters mounted the top step clear of them. I suggest modellers do likewise, but do check it will be clear of the winding rope when paid out through the guide roller.

Completion of the tank sideplates

Further work on the tanksides now needs to be done. The cut-outs for the back axle and second shaft need to be cut, as does the tank filling hole behind the water pocket. Also, the oval inspection hole below the water pocket needs to be made. Adjacent to the inspection hole, and as low down as can be conveniently managed, is a $\frac{5}{16}$ in. hole for the injector fitting. I notice that both Stan and John have reinforced their injector aperture with an oval plate to accommodate the studs and nuts; a sound idea.

It is wise for the moment to use screws and nuts rather than the more permanent rivets as it affords the option of disassembling if required. The water pocket is usually riveted and soldered to the tankside before final assembly, as access to the inside becomes extremely limited later. Likewise, the two studs that hold the bottom of the brake bracket ought to be soldered at an early stage. Threading in screws in from the inside and running some soft solder over the head makes the two brake studs. Arrangements need to be made to fix the bottom footstep.



David is spotting through from the 3in. scale back/bottom plate into the brass angle on the tender side. The drilling machine ensures that all the holes are nice and square. Notice the temporary rod stay to ensure the correct spacing fitted between two of the hornplate fixing holes.

Once the brass angles and any fittings on the two sideplates are complete, it is safe to remove the threaded fixings holding the brass angle one by one and replace them with rivets. This is an easy enough task as both sides of the plates are accessible. Only the rivet heads above the tank top need to have tidy rivet heads both inside and out. The rivet heads inside the water tank will never be seen so the emphasis is rather more on function than form.

Some folk prefer to 'tin' the mating surfaces of the sides of the tank and angle with soft-solder before riveting up. Others prefer to apply a soft-solder paste to the parts before assembly. Some simply clean it all up, rivet, and then run the soft solder in. The solder is unlikely to penetrate where the angle and plating are pulled up really tight, but enough penetration may be achieved to make it watertight.

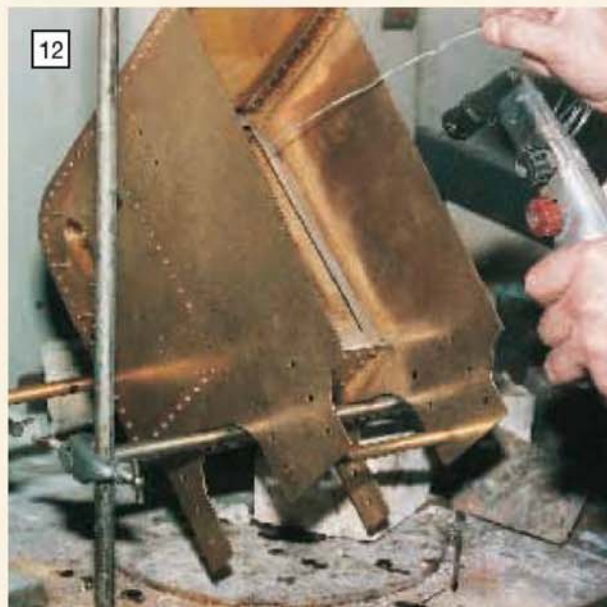
At this stage the two side plates are then very



Above left: John's 4in. scale backtank is held together with an assortment of toolmaker's clamps prior to the spotting through of further holes.



Above right: John's backtank is assembled on the hornplates; the expanse of brass in 4in. scale is certainly impressive. The hornplates are held at their correct width by the back axle tube and spectacle plate. (Photos 1-4, 9, 10: P. Kybert)



An array of retort stands balance the backtank at the most advantageous angle for soft soldering the angle in place. The tank top has yet to be fitted. David's completed tender was illustrated in the last instalment. (Photos 5, 8, 11, 12: B. Camps)

gently warmed up and the whole sweated together. The temperature required to melt the soft solder will be low enough to have very little effect on the brass plate. Careful inspection then ensues before progressing any further.

Two ways to assemble

Once the tanksides are riveted up there are two ways of proceeding, both use the hornplates as a jig to achieve the correct spacing. One is to attach the tanksides to the hornplates by drilling through for the nuts and bolts (photo 7). This will establish the ultimate orientation of the tank-side plates. The combined back/bottom plate is then offered up to the tanksides *in situ* on the hornplates and the holes drilled through from the back/bottom plate into the angles on the tank sideplates. It is best to start with the holes on the radius first and work outwards fitting and tightening each fastener as you go.

The other way is to fix the back/bottom plate on to the hornplates only with G-clamps or similar. The tank back/bottom plate is then offered up, as above, and the holes drilled through into the tankside angles. The assembly is then removed from the hornplates and riveted up. Only when the backtank is completed and soldered is it slid back over the hornplates and the holes which fix it in place are spotted through into the hornplates. This second method allows for any slight movement in the tank during soldering.

Rivet up

Once the tank has been assembled with threaded fasteners it is time to replace them one at a time with rivets. Closing the rivets inside the tank will require extra long rivet sets, fortunately commercial rivet sets are easily adapted (photo 11). Fortunately the heads supplied free with the rivets are the ones that are seen. The home-made heads are inside the tank which, under the circumstances will inevitably be less than perfect but fortunately will never be seen after assembly.

The last plate, the tank floor, does present a poser. How do you form the heads inside the tank? The answer is not to use rivets but use either round head or countersunk threaded fixings. The holes in the tank top are drilled tapping size and then spotted through into the brass angle already riveted to the tank sides. These holes are then drilled and tapped and the holes in the tank top taken out to a generous clearance size to suit the fastening. Like the tank itself, the fastenings should be of brass. The tank top should not be finally fitted until after the sides/ends and bottom have been successfully soldered up. By far the neatest result is obtained by feeding in the soft-solder from the inside.

The last soldering operation is the fitting of the coal plate, which is nice and easy to get to. Since the coal plate fits across the manstand at



Final riveting up in grand style. An extra pair of hands comes in very handy. Yet another pair of hands was needed to take the picture.

quite an angle, each end will need a single bend to meet the brass angle on the tank sides.

Soldering advice

In my opinion the golden rule when soft-soldering is not to overheat the brass. Once the metal is hot enough to melt the soft-solder there is absolutely nothing to be gained from heating it further. The flux will be spoilt as, ultimately, will be the joint. I seem to get on best with a very gentle oxy-acetylene flame. I prefer the oxy-acetylene to gas/air as the flame is more local and easier to control. As soon as the soft-solder melts the flame is taken well back from the joint or removed entirely from the assembly.

It is worth arranging the tank so that each soldering operation has gravity working on the home side, encouraging the solder into and along the joint.

Brass beading

Builders should have little trouble purchasing the half-round beading. The beading is held in place with a few brass rivets and then sweated together with soft solder. If it is possible to install the beading in one length it will add strength to the top tank corners and the radius will be a welcome feature. If fitting it in three separate lengths it is very wise to file an appropriate radius to avoid a sharp corner. A short length of beading also needs to be added to the bunker partition.

Should supplies of beading prove a problem it may be quite quickly made by soldering round brass bar to a piece of stock and then machining half of it away. When reheated to release it from the stock any excess solder will need to be scraped off before it can be used.

I appreciate that to complete all the soldering and riveting in this month's instalment, I have assumed that the water pocket and so forth have already been made. Regrettably this is not so and I plan to cover all the *Little Samson* back tank furniture next time.

●To be continued.



A view of Merchant Navy class Bulleid Pacific locomotive *Clan Line* with tender prominent.

Peter Lewis

overcomes a few more problems in building his Bulleid locomotive.

●Part V continued from page 551
(M.E. 4160, 24 December 2001)

While starting to write about the tender, two things come to mind immediately, and they are 1: I heard on the grape vine from various sources that the brakes were a nightmare and 2: I had this great idea that having built the locomotive the tender would be a piece of cake and be finished in no time. I was wrong on both counts! First, I found that the brakes turned out well and I have made them vacuum (compressed air as opposed to vacuum/atmospheric) but more on that later. Secondly, I found that building the tender was a big job and I shudder to think about the amount of 18swg brass sheet I used, let alone the cost.

There is one other point before I go into detail. A. J. Fry has written a most marvellous book *Bulleid Power - The Merchant Navy Class* (reprinted 1996) in which he has detailed every single engine both as a 'Spam Can' and in rebuilt form. He has also listed all the tenders and, in particular, the different types with all the various alterations. By its wheelbase Keith has indicated a 6000 gallon tender, but the drawing (sheet No. 22) shows it as I have made it, is a 5250 gallon tender as ran with *Orient Line* (35008) with the top line of the tender sides going straight through from front to back. A similar tender, but of 4000 gallon capacity, is fitted to *Sir Archibald Sinclair* at the Bluebell Railway where the differences between the types can be seen. As far as I am concerned it is much easier to make as Keith has drawn it and it looks neater with the different side rake arrangement.

These reflections are based on my notes (many unreadable!) and hopes that my memory is jogged by the tender drawings. On Sheet 19 showing the frames, the width over the axlebox slots is shown as 1 1/2 in. but, by checking with the tender horns (Sheet 20) this dimension should be 1 7/16 in. I made the width of 4 1/4 in. shown over the spring pockets, nearer to 4 7/16 in. Reference to the latter reminds me that I did not

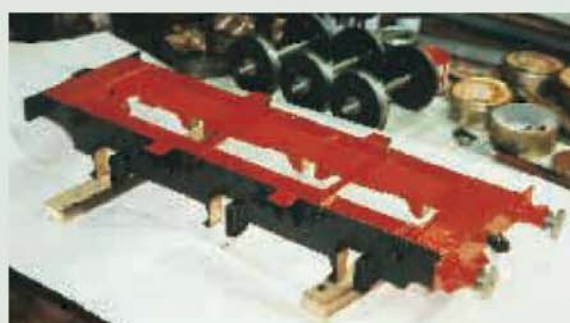
GENERAL STEAM NAVIGATION THE TENDER



Diane Carney's work is superb; unfortunately my photograph does not do these miniature masterpieces justice. Diane may be contacted on 0141-5571948.



After a bit of sawing and filing, I had a kit of parts for the tender frames for General Steam Navigation.



Work on the tender proceeds.



fit the $\frac{1}{16}$ in. cotter pin which Keith mentions in his article. The $\frac{1}{4}$ in. holes shown for the brake lever bracket pins are drawn at $\frac{1}{8}$ in. while on the brake lever brackets themselves one view shows the holes at $\frac{1}{4}$ in. and the other $\frac{1}{8}$ inch. This is a right old mix up and I think I ended up with pins with a $\frac{1}{4}$ in. head on the outside and an $\frac{1}{8}$ in. shank with a split pin through the inner end.

The overall width of the bracket to fit between the frames is $\frac{1}{16}$ in. and not the $\frac{1}{32}$ in. as shown. The guard irons are fitted on the 'inside' of the frames, not on the outside — refer to photos of a full-size tender. There is a hole lower down to take the support from the rear ladder. On the 'top' and 'bottom' plates there is more confusion, this time with the position of the $\frac{3}{8}$ in. hole shown for the handbrake rod; the various views do not seem to tie up. The wording that Keith has shown against the carrier plates: "3 off as drawn and 1 off as drawn" really fooled me for a while; it isn't the carrier plates but where the angle is fitted which varies!

Holes should also be shown in the inner end

plates for the front for the bars to pass through to the loco. I made the tank brackets with a back so they could easily be fixed to the frames.

With reference to Sheet 20, I didn't discover the snubber until quite late on; I don't think it makes a great deal of difference but a Merchant Navy has two small snubbers, one on the loco and one on the tender whereas the West Country has one as shown. Except for their length. I have made the tender buffers more or less the same as the loco buffers.

Tender brakes

Now we come to the brakes. The first thing to hit me was the discrepancy with the numbering with the bits which I believe Keith mentioned later on toward the end in his articles. I had not read that and here I was dumbfounded since No. 1 on one view was numbered No. 2 on another view right through to the end. I eventually caught on to the errors. To be fair, the braking is more or less as per full-size. I made the brake shaft arms as drawn only to find that both have the lug at the

top. In other words both are the same except the lower one has a cup instead of a hole to use for the handbrake. A careful study of the full-size is needed here.

The dimensions of the brake adjusters are all suspect and in any case, a locknut is needed each end: left- and right-hand. I didn't bother with the brake arm guards and support brackets as I had enough complications as it was. All the cross-beams turned out fine and, much to my surprise, all the rods passed clear of each other. I made the vacuum cylinders as per drawing, having fortunately fitted the carrier plates a little further apart than stated as there is virtually no room to fit the bosses. I got over this with a very thin nut on the insides of the carrier plates.

How we are expected to get the seal (GACO No. DE 175112) on the piston as shown is beyond me. I made the piston in two pieces, fitted the seal and then assembled the piston. The length of the piston rod is not correct, it has to be made to suit.

●To be continued.

RANSOMES & MAY Horizontal Engine of 1850



Stan Bray

deals with the pump assembly for this popular engine.

●Part XIII continued from page 538
(M.E. 4160, 24 December 2001)

Having had a couple of trial runs at setting up the cylinder and valve gear, we are now left with three major items to complete: these are the governor, together with the stop valve and throttle, the pump, and the flywheel. The stop valve and throttle are rather fiddly little pieces and, to get the easier pieces out of the way first, a start was made on the pump.

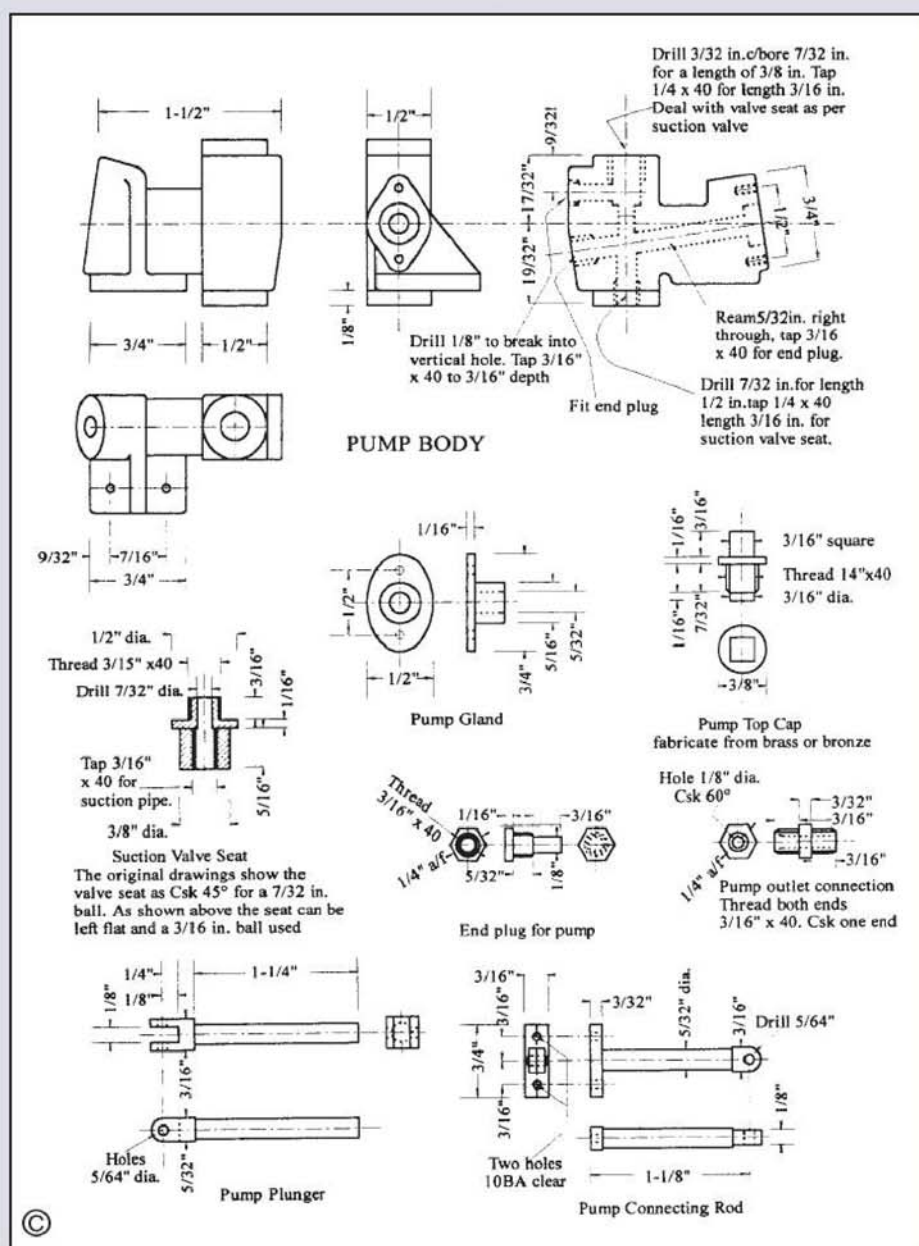
Pump body

The casting supplied was nice and clean, with a useful chucking piece (photo 98). A little fettling was necessary to bring it to the required standard and the chucking piece provided a useful means of holding the work in the vice (photo 99). Once it had been tidied up and a check had been made to ensure the chucking piece was true to the body, it was put in the 4-jaw chuck and the 3/32in. dia. hole that forms the passage for the water was drilled, counterbored and tapped to the drawing (photo 100). The boss situated at the bottom of the pump was machined at the same setting.

The drawings show tapered seats for the balls that act as valves, an idea common many years ago. The popular method now is to have a flat seat machined using a D-bit. During assembly a ball, of the same size as that used in the valve, is dropped on to the seat and given a single sharp tap with a hammer. Do not be tempted to hit it too hard, or to apply several blows, as this can destroy the seat rather than improve it. Another current, popular idea is to make a triangular valve fitted to a O-ring. This would work perfectly well in this case if you wished to adopt it.

As usual, a datum surface is needed in order to get everything true; the bracket used to bolt the body to the bed was selected for this purpose. To get it at 90deg. to the water passage that has just been drilled, a piece of steel rod was pushed into the hole. The work was then adjusted in the vice, using a scribing block to ensure the steel rod was parallel to the machine table (photo 101). The surface of the bracket was then milled flat, using the periphery of an end mill (photo 102).

The casting was then turned round in the vice and re-clamped such that the freshly machined surface was parallel to the tops of the vice jaws. I used a rule as a straight edge (photo 103). It helps if the chucking piece is cut off at this stage. It was then possible to machine the flat surface on the pump body casting which lies at the opposite end to the ram and parallel to the water passage. Once this was done, I scribed a line along the outside of the casting at the angle that the ram travels. On my pump the ram travels at 82deg. to the water passage but check your casting to make sure this will work for yours. The scribed line was then used as a guide for setting the casting in the vice at the correct angle to drill the hole for the ram. Tap the holes for the pump fittings and drill the



mounting holes. The gland mounting holes are best left until the gland is made and can be used as a drilling fixture.

Suction valve seat

This is nothing more than a simple screw-in piece, one end of which acts as the valve seat. The original drawing again shows the valve seat as tapered but the drawing here shows it as flat. The choice of type to be used can rest with the constructor. The seat should be made of bronze if the pump is to have any amount of use; if not brass will be quite satisfactory.

Pump gland

The suppliers of the castings for the engine can also supply short lengths of oval cast bronze to be used to make the pump gland. With this nothing

more is needed than to mount it in the 4-jaw chuck, machine the boss, drill the hole and part off. Here again, more modern methods may be preferred by allowing sufficient room in the counterbore in the pump body for an O-ring to be fitted rather than the soft graphited yarn packing popular when the engine was originally designed. Alternatively, an excellent seal can be obtained using a PTFE washer which need be no more than 1/32in. thick to do the job nicely.

The two bolt holes should be drilled tapping size and used to locate the holes for the studs in the body, which can then be drilled and tapped. The holes in the gland are opened to clearance size.

Top cap and end plug

In keeping with the practice of the time, the top cap has a square section and the normal technique



98
 Pump body casting as supplied, seen here resting upon the useful chucking piece. A little cleaning up is required before machining begins.



99
 The chucking piece can be used to hold the casting in the bench vice for careful fettling work with suitable files.



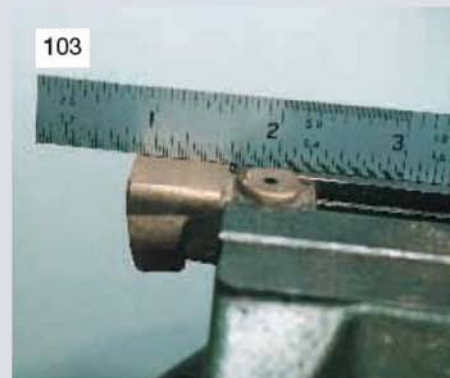
100
 With the casting held by the chucking piece, the body is drilled, counterbored and tapped, and the boss machined at the same setting.



101
 The casting is transferred to the milling machine and set by using a scribing block to check a steel rod inserted into the drilled bore.



102
 Once correctly set, the base of the pump body can be machined using the peripheral teeth of a sharp end mill. A blunt cutter will raise burrs.



103
 A steel rule can be used as a straight edge to check the parallelism of the datum surface with the vice jaws and hence the machine table.



104
 A view of the finished pump components including (left to right) top cap, valve seat, valve body and gland.



105
 The pump ram or plunger is operated via the pump connecting rod which attaches to the eccentric strap shown here on its eccentric sheave.

would be to cut the thread first and then mill the square. To make the job easier, some builders might prefer to use the following method. Machine the thread, using round stock, leaving a spigot $\frac{1}{8}$ in. diameter and $\frac{1}{8}$ in. long on the end shown square on the drawing. Drill a length of $\frac{3}{16}$ in. square brass to match the spigot and part off $\frac{3}{16}$ in. long. The two components are assembled by silver-soldering and after being cleaned up it will be difficult to spot that the top cap is not a solid piece.

The original drawing shows the end plug with a screwdriver slot. In full size, a screwdriver with a 2in. wide blade it would have been required to tighten it up, which seems highly unlikely! The pump was probably drawn with the modeller in mind and the slot is there to make life easy. In full size practice, the hole is unlikely to have gone right through, or if it did it would have been much reduced in size.

As a compromise, the drawing here shows the plug with a hexagonal head, an alternative being to make the head square like the top cap.

Photograph 104 shows the pump body, the gland, the top cap and the end plug ready for assembly.

Ram

The actual ram, or 'plunger' as it is called on the original drawings, is specified as being made from bronze. It is most likely that the ram in the pump on the full sized engine would have been of that material as the manufacture of stainless steel was then very much in its infancy and mild steel would have suffered badly from corrosion. How many readers are aware that for many years bronze was used for the propeller shafts of boats for this very reason? However, plain bronze is not the ideal material for our purposes as it would be prone to excessive wear if the engine is much used; a compromise was decided upon and stainless steel was chosen for this application.

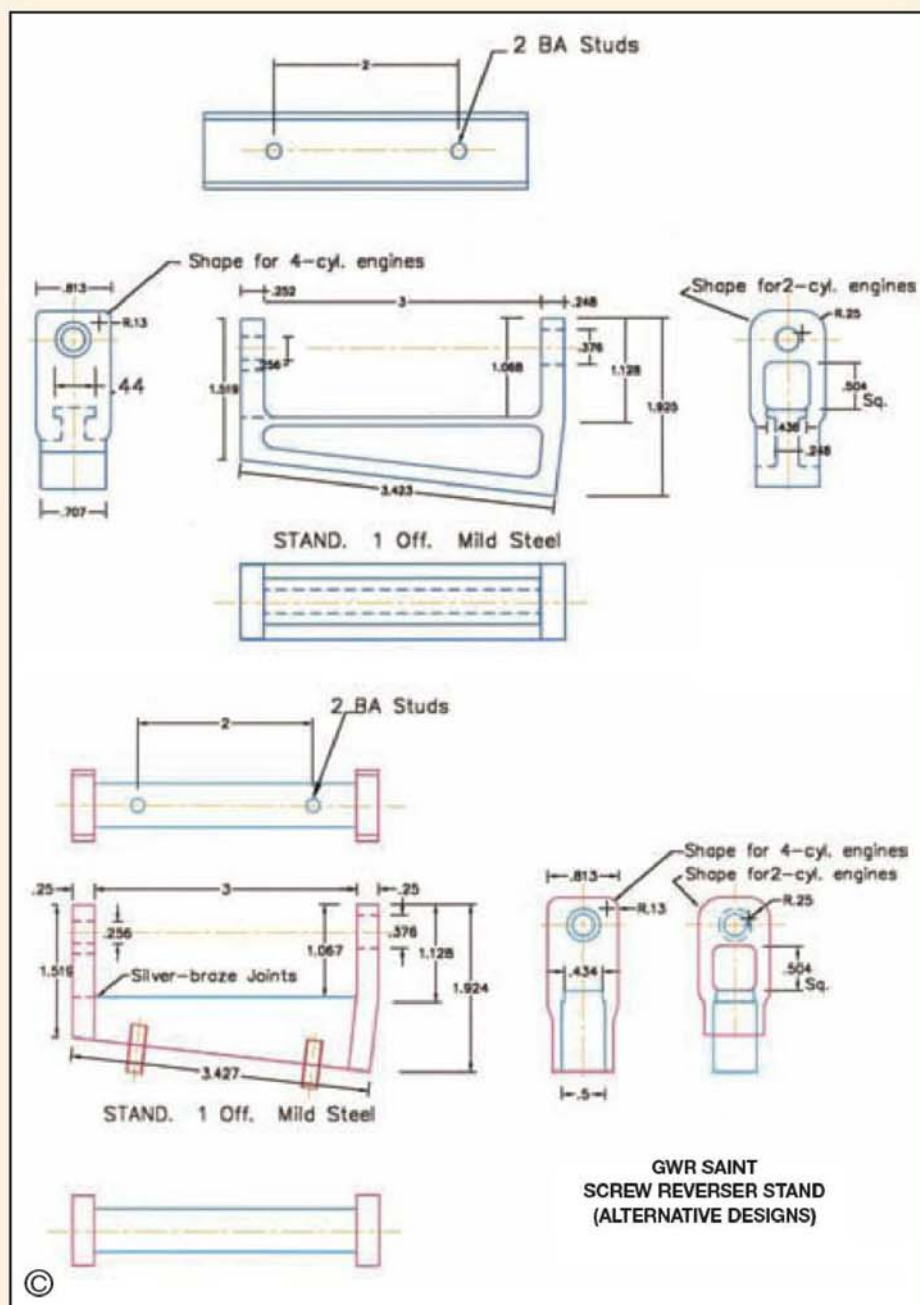
The end of the ram has a square section with a slot and holes for pivots, and it is as well to make this as a separate piece and screw it on to the ram. Don't be tempted to silver-solder these parts together. Although it is possible to silver-solder

stainless steel, it is rarely entirely successful and, after a period of time, the joint may break down even if one of the special fluxes sold for the purpose is used. Some years ago and published in these pages Dr Mark Phillips wrote about stainless steel and gave the full technical explanation as to why this was so.

The square section can be made of mild steel, once again the advice is to leave the piece on the bar for as long as possible while machining operations are carried out in order not to have to fiddle about working on a tiny piece of metal.

The connecting rod which fits on to the eccentric can also be made of mild steel. This means that it will be quite safe to silver-solder it to the flat section which will bolt to the eccentric (**photo 105**). Two flats are needed on the round section to fit into the fork on the ram, and the best way of getting these is to put the round piece in a larger square section, and clamp it with a screw. It is then relatively easy to file or mill one flat and then turn it over and do the other.

●To be continued.



of the load off the tap, and leave a better thread.

Now, a thing to remember with left-hand threads is that the tap must be used left-handed, daft as that statement reads. It really is incredibly easy to set up to tap the hole and find that you are doing it the wrong way. Will anyone give a pound for every time I have done it? I would be rich. Even in brass, this rather coarse thread puts heavy loading on the tap, so tap it slowly with some oil and frequent backings-out. For left-hand, should that be forwardings-out? And you might well find it pays, once the hole is tapped right through, to put the tap in from the other end which will help to get the thread symmetrical.

The nut should turn out to be a good fit on the screw, for the tap will probably cut pretty near dead to size. If it is too tight (try on both ends of the screw) then some fine carborundum paper will take the O/D of the screw down a thou. or so.

You may or may not be a square ...

To get the square part of the screw square, it is worth setting up a rotary table and indexing it properly. A useful device to make and keep on hand is an adapter plate. This is a disc of steel

about 6in. diameter and 1/4in. thick, with a 2in. central hole. Four holes at appropriate PCD will enable it to be clamped to the back of a 3-jaw chuck (threaded body type) with 1/4in. BSF cap head Allen screws. Four further holes on a larger PCD will serve to bolt it to the rotary table. Meanwhile, a simple mandrel of steel with one end fitting into the central hole of the table and t'other fitting accurately into the bore of the chuck, will teach it to remain axially true and, if this mandrel be hollow, the screw can pass right through and be held in the chuck jaws. I don't need to tell you how to machine the square part, and if your rotary table can be mounted vertically and horizontally, then you've now got yourself a very useful indexing tool.

The main body can be chewed from solid, built up by silver-brazing, or a casting; take your choice. The originals were bolted down via side flanges along the base, but down to our sizes there is a snag. It is one thing to reach an arm into a narrow gap 'twixt reverser and cab side and faffle about with a spanner, it is quite another to carry out much the same process when you have roughly one eighth of the gap to work in and have

to juggle about from outside with long rubber spanners. Hence the attachment with much larger nuts from below; the bottom of the stand being left open for access with a long box-spanner. Whilst some things cannot be 'scaled' there are others best left 'un-scaled!' There's nothing to stop the die-hards from putting in the flanges with dummy bolts/nuts/studs as desired.

As a matter of interest, the earlier screw-reversers (still yclept 'poles') are as I shew here, near as reasonably practicable. Later ones as on 4-cylinder engines had the reach rod coupled to the sides of the nut level with the centre-line of the screw, hence less torque on the threads. I don't know if this was then made a retrospective practice, but just mention the difference.

The lock ('clip') is tricky and not much practical use in our sizes, but it looks nice. Its purpose is to prevent the pole turning under backward thrusts from the gear. I have yet to see a model set its own gear for good running, but unlikely as it seems I have seen it for myself on a Castle. It is most unlikely with Stephenson valve gear due to the friction of the four eccentrics, but with Walschaerts it is certainly not rare. Handles are best made of stainless steel.

There must be a catch somewhere

The catch plate is a bit of a tricky job, however "vee haf vays of making zese sings" and the hardest way is probably the easiest.

Put a piece of 3/4in. dia. mild steel in the lathe, and partly part off several slices, say down to 9/16in. diameter. Then mount up this piece in a rotary table on the milling machine and proceed to cut the notches, either by using a slitting saw or a 1/8in. slot drill. Return to the lathe, drill deeply to 3/8in. diameter, and finish parting off. Voila! several catch plates. Now I know we need only one per engine, but once you have started building engines there is no known cure and they could always be useful.

These plates don't shew up in the drawings I have so I don't know off-hand how many notches there were. However, more slots than I shew would mean much narrower slots and therefore smaller bits in the lock itself, so you may take your choice. Incidentally, I shew the older type of handle as well as the modern one.

The boss is plain lathework, and silver-brazing the assembly is not difficult.

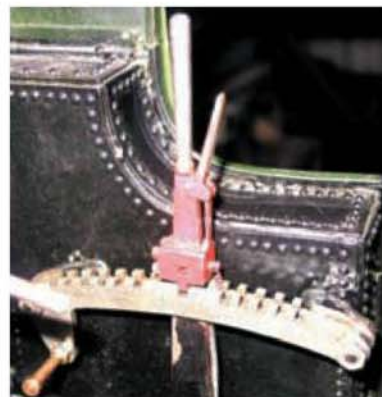
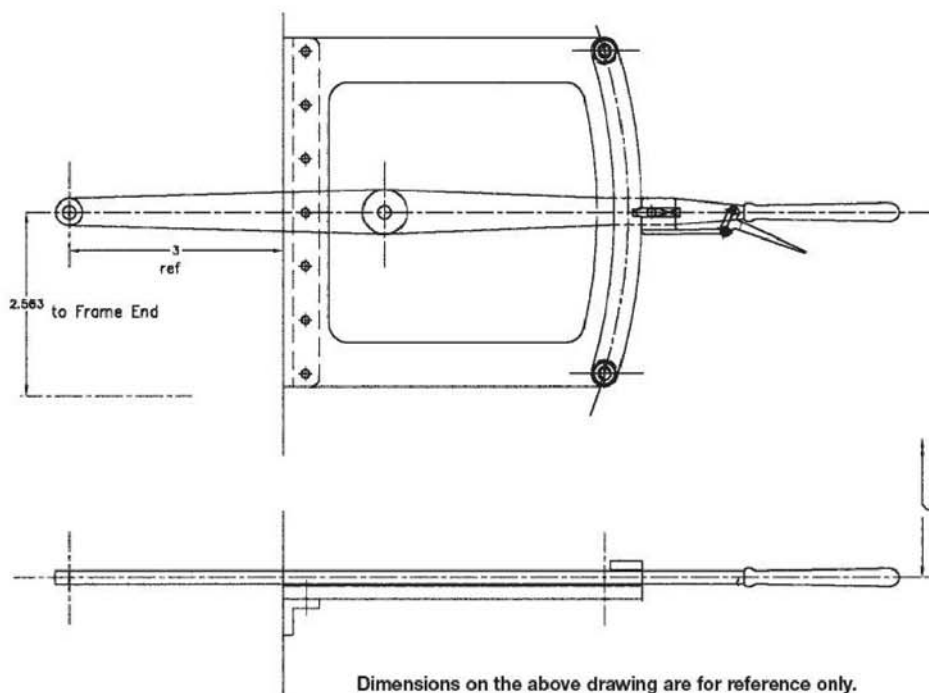
It will be noticed that the handle and screw, etc. can be assembled through the boss/catch-plate/backplate assembly into the main body and the nut being a later operation.

And, to top it all...

No instruction should be needful for the top-plate, but note that the stands for 'old' and 'new' are slightly different. For the old type the top was more rounded, and the top plate will need to be narrower: 3/8in. is about right, for having no large-size Swindon drawings of this item I have to make an informed guess, but I don't think I am too far out.

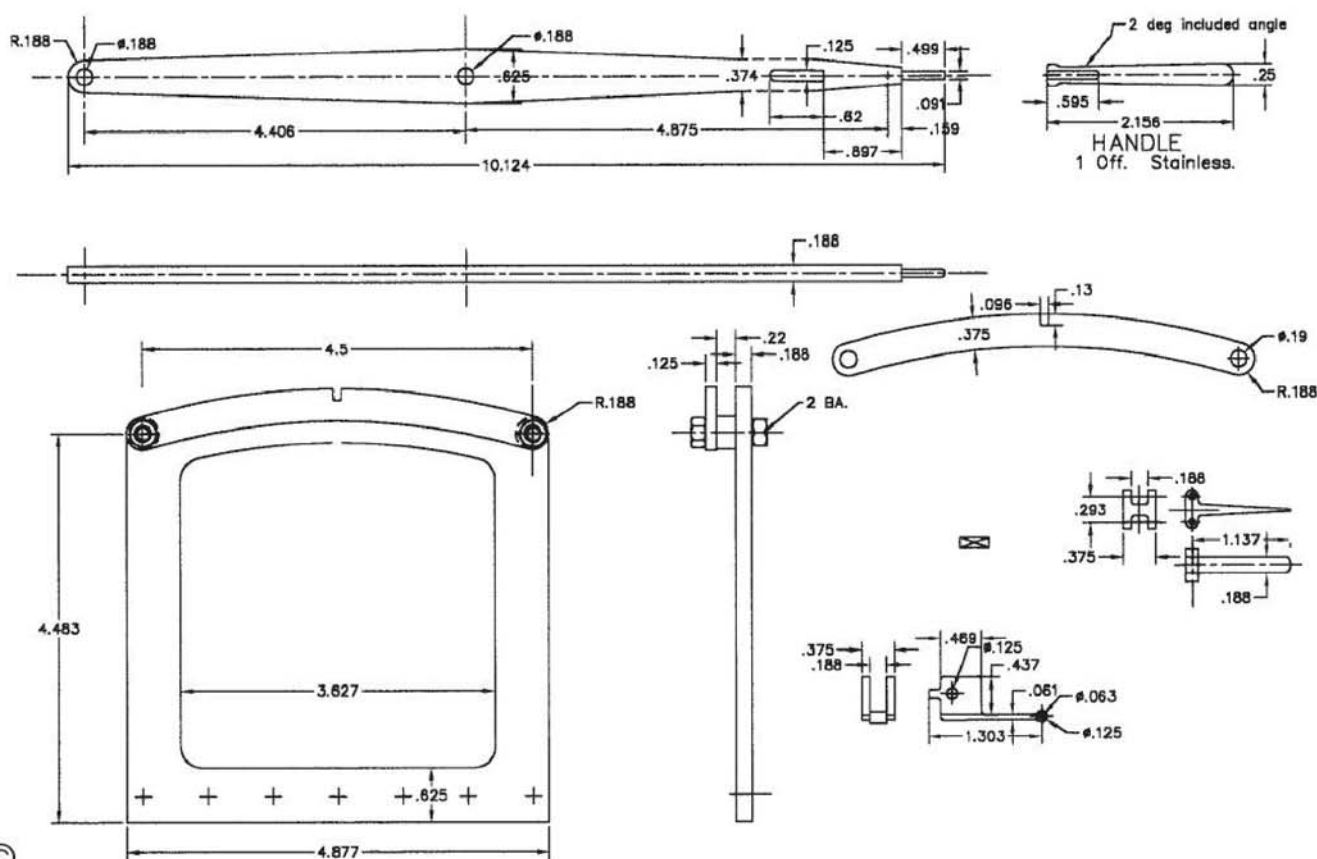
Ye straight pole

Mostly finicky bits alas. Full-size, the weight of the latch-block sufficeth for operation of the latching process, the block being so designed that it operated in two parts, one for each side of the stand. Thus it is possible to double-up on the



A full size reverser quadrant is furnished with staggered notches in order to provide better control of expansive working. This practice is somewhat impractical in miniature form.

GWR SAINT REVERSING LEVER DETAILS



number of notches, giving a finer range of settings than is conveniently possible for us.

Whilst it is in fact possible for us, 'twould be plaguey small and liable to malfunction, as well as not being much use practically. It is possible to use an external spring to imitate, augment, or replace Isaac Newton's notorious discovery connected with descending apples, but with a bit of cunning we can tuck said spring out of sight; well, almost.

I think that the drawings are sufficiently simple to merit no particular write-up beyond pointing out that there are certain advantages in making the actual handle from stainless steel; trigger as well if you like. Notches (hence 'notching up', now there's a surprise) are usually cut regular style (evenly spaced) but full-size practice was a bit different (see photograph). It is a good idea, when notch-cutting (slitting saw in t'mill), to

relieve the sides a little so that the latch tends to lock in place. Otherwise it will rattle and gradually increase the width faster than two death-watch beetles. Have as little clearance between the sectors and the latch guide block as you can manage. Note that (unlike some other designs) the actual latch is not pivoted to its lifting link; it is much more rigid if in one big piece.

●To be continued.

CLUB CHAT With Stan Bray

UK News

Among many other problems caused elsewhere, the long periods of wet weather experienced in the UK in recent years have weakened the surface of the roadway leading to the headquarters of **Cambridge MES** and allowed deep ruts to form. These are of some concern to drivers of vehicles, particularly those with low slung exhausts. Members are hoping to obtain a suitable supply of material to enable repairs to be carried out in time for the start of the running season. In order that club members may be more easily recognised by their visitors on public running days, views are being canvassed regarding clothing bearing a suitable logo. The nature of this logo seems to be a matter for discussion, some being of the opinion that it should relate to the track, known as **Grantchester Woodland Railway**, rather than the abbreviation **CMES**. Subsidence, again caused by the large amount of rain, has meant that the hugely successful 16mm scale track is in need of some attention; this too is expected to be complete in time for the running season. A portable track to the same gauge is also being built and, in addition to being taken to various functions, since it will be more easily visible to children than the permanent track, it will also be erected and used during the public open days.

Peterborough MES set aside an evening in January for a talk and discussion concerning the feasibility of the club adopting limited liability company status. This subject has been discussed in general terms for some time but it now seems likely that the necessary steps will be taken to proceed. The club will be holding their Locomotive Rally during the first weekend in June and members will be attending the **Sacrewell Farm Rally** in July at which the main attraction will be model road vehicles supplemented by a general display of members' work, plus running on the portable track.

The exhibition by **Bradford SME** at the **Bradford Museum** proved even more successful than they could possibly have hoped for. As well as drawing in the crowds, their display received attention from radio, television and newspapers, bringing a knowledge of the hobby, and their club in particular, to thousands of people. During the event the annual club competition was judged from the exhibits on show

with the following results: *Tempest*

Trophy: HMS Sheffield by Matthew Brear;

Northcliffe Trophy: 7 1/4in. gauge

Sweet Pea by Brian Ward; *Roland*

Sutcliffe Trophy: 3in. scale Fowler

Ploughing Engine by Ian Holt; *Jack*

Ashworth Trophy: Beam Engine by

Gary Park; *Barber Tidsworth Trophy:*

Emergency Power Generator by

Chris Eddison; *Fletcher Hudson*

Trophy: 7 1/4in. Kerr Stuart

Locomotive by David Hodgson;

Meeson Trophy: Unfinished Rotary

Bentley Engine by Peter Brown;

Handicraft Trophy: '0' Gauge

Bandstand by Gordon Eddison.

Throughout the ten weeks duration

of the exhibition, visitors were

asked to record their vote for their

favourite exhibit for which the

museum donated a signed edition of

a book *The History of Yorkshire* as a

prize. It was won by Duncan

McKay for his model of the loco-

motive *Britannia*.

A good response to an appeal for

funds to enable members of

Bournemouth DSME to construct

a new railway at **Littledown** has

given them the opportunity to

inform the local council that plans

will soon be submitted seeking per-

mission to proceed. The search for

the best venue at which to hold

regular monthly meetings is still

on and involves the use of three sepa-

rate locations between January and

March. One of these is **Littledown**

where they plan to build the railway,

so it is possible that this will be the

eventual location for regular meetings

as well as for use of the track.

Having obtained planning per-

mission in April 2001 to build a

ground level 5-7 1/4in. gauge ground

level track, it was 'all stops out' for

members of **Romford MES** for the

rest of that year. Pegging out started

in early May, a trench was dug,

lined with **Terram** to prevent weeds

coming through, and 10 tonnes of

granite chippings poured in. From

then on progress was very rapid

indeed, hundreds of feet of steel bar

being welded together for the rail.

Considerable expertise went into

the construction of the dual-gauge

pointwork for which members were

very grateful for help in its con-

struction from friends in **Canvey**

R&MEC with previous experience

of such work. The next priority was

to paint the rail with red oxide paint

which we are told appeared every-

where, particularly on the volunteer

painter, although we understand he

sticks to the story that he used a

brush and not himself as a paint

roller! The new track was officially

opened by local Councillor Mr E.

Cahill and the Principal of **Havering**

College of Further Education, Mr

N. Otley on 16 September. Fortu-

nately the day proved to be fine and

warm, allowing everyone to enjoy

the celebrations. The hope now is

that members will be so highly

motivated that they are all now

beavering away in their workshops

building 7 1/4in. gauge locomotives.

After considerable effort, members

of **Reading SME** have succeeded

in making their new (second hand)

container completely watertight and

work continues on insulating the

roof to minimise the condensation

which can spoil items and equip-

ment stored within. The container

has been fitted with electric power

and lighting, and in no time at all

after completion it was well stocked

with all those items which seem to

accumulate in such places. An

immediate benefit was the facility

to prepare Christmas decorations

for their Santa Specials and to be

able to store them safely in the con-

tainer until they were needed.

Having made great improvements

and spent much time and money on

their track at **Haynes**, it has been

suggested that **Bedford MES**

should consider re-instating the

track at **Old Warden** airfield for use

on a regular basis, both for the ben-

efit of members and also as a means

of raising extra funds for even more

improvements at **Haynes**. A number

of members are involved in the

preservation of aircraft at the

Shuttleworth Collection at **Old**

Warden, and for some time these

and others involved with the **Collection**

have been pressing the society to

organise some form of permanent

running as an added interest for visi-

tors. A Day of Action has been

scheduled in March to bring the

track at **Haynes** up to scratch for the

forthcoming season; members are

being bribed to attend by the

promise of free bangers for lunch

and free tea and coffee all day long!

New machinery and tools have

been obtained by **Tonbridge MES**

to replace those damaged beyond

repair when the club was flooded

during the 2000/1 winter, and the

opportunity has been taken to

install equipment unlikely to be

found in home workshops

giving members the opportunity to

use machines generally larger

than those they have at home.

Accompanying a **Colchester** Master

Lathe, there is also a grit blast

cabinet and a honing machine, in

addition to various other tools

considered necessary to make a

comprehensive workshop.

A mammoth effort by members

resulted in the new ground level

track of **Saffron Walden DSME**

being completed in record time

giving them an opportunity for a

special 'test' run on New Year's Day

to welcome 2002. Work had been

carried out from each end of the cir-

cuit and excitement mounted as the

two teams drew within sight of each

other when it became apparent that

the ends would meet. The track was

completed 28 November when the

Chairman performed a **Golden**

Rivet ceremony, except that the

rivet wasn't actually gold and we

aren't at all sure that it was really a

rivet! Whatever it was, it was an

excellent excuse for a celebration

with a special lunch provided com-

plete with champagne and wine.

Incidentally, this too was another

first, being the first lunch break the

members had ever had without

making a brew of tea.

World News

Japan

The latest copy of the *Bulletin* from

the **Japan Coupler Friends Club**

contains a total of 110 pages of

news and information. Since it is

mostly written in Japanese, the read-

ing and speaking of which is not one

of your Club News Editor's strong

points, readers should not expect a

synopsis of its content. As well as

organising their own running days

and social events, members have

made a number of overseas visits.

The publication includes some

excellent constructional articles

with fully dimensioned drawings

and well detailed photographs on

boiler making, steam and vacuum

braking and a delightful 0-4-0 tank

locomotive. There is also a good

constructional article describing a

non-steam 0-6-0 locomotive with

outside cranks, with a novel method

for setting the cranks correctly.

Canada

Work on the first phase of **Ottawa**

Valley Live Steamers' new raised

track began 30 May and the first

support post was set 4 July last year.

Work was done in stages of setting

posts and attaching the side boards

until 100 sections had been com-

pleted, the rails then being laid in

place. This completed a total length

of 638ft. and a special ceremony

was arranged for 24 October when a

number of locomotives were to be

seen in operation. In addition to the

track, steaming bays and a traverser

from the old system are being used

and everyone is delighted with the

results. The old track was dismantled

prior to work starting on the new

one and from the photographs we have seen it was a massive affair with heavy steel rails and concrete bases. While suggestions for its disposal were considered, it was set aside; however, it has now disappeared — nobody saw it go and no trace of it can be found!

New Zealand

Members of **Hutt Valley MES** who attended a meeting to see a vintage 1913 P&M motorcycle restored by David Gwymmm spent a particularly interesting evening. Readers knowledgeable about such matters will be aware that P&M refers to Phelon & Moore of Cleckheaton, England who were later to produce the well-known Panther motorcycle. As well as having the opportunity for a close look at a unique machine, they also heard the story of its rebuild from what amounted to nothing more than a pile of bits, most of which were virtually worn out. The drive on the vehicle has two gear ratios, obtained from two primary reduction chains, each of the large sprockets having an expanding band to act as a clutch. A wedge moved by the gear lever takes up either clutch to engage the drive.

In December, **Maidstone MES** received an invitation for members to attend Morning Tea hosted by the newly elected Mayor of Upper Hutt. The event was arranged so that the Mayor could meet volunteer workers from various organisations which benefit the community. It seems

In Memoriam

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

Jack Baker
Bernie Buckland
Vic Dawson
Des Fawcett
Stan Pearson

Melton Mowbray DMES
Cambridge MES
Melton Mowbray DMES
Steam Locomotive Society of Victoria
Teeside Small Gauge Railway

that social gatherings have been to the forefront of recent club activities as the annual club dinner was held at a local restaurant at which a very good turnout of members brought the year to a most satisfactory conclusion. Both **Hutt Valley MES** and **Maidstone MES**, which share the same newsletter, report that particularly poor weather at the latter end of the year prevented activities on the track.

Australia

Members of **Hornsby ME Co-operative** celebrated the 28th Anniversary of their Galston Valley Railway with an Open Weekend 12-14 October 2001. Club Patron Kevin Rozzoli MP performed the official opening ceremony and there was a good turnout of visitors from other clubs. Prior to the event much hard work had been carried out to improve the grounds and facilities, including the construction of a new workshop, some new track work and an axle-weighing machine. This last provided visitors with an opportunity to check the springing of their locomotives, a facility which most were only too pleased to make use of. The weekend of running was

augmented with an extensive exhibition covering the whole range of model engineering interests.

A special edition of the *Melsa Newsletter* has been published to celebrate the 25th Anniversary of the formation the **Model Engineers Association Maryborough**, although we understand that it nearly wasn't published as the editorial computer decided to give up the ghost at the eleventh hour. Prompt efforts by a couple of members well versed in such matters, together with the services of the local computing consultants sorted it all out, leaving editor Robyn Chadbone with almost sufficient time to get it published on schedule. Traditionally, the club exhibits each year at the Heritage Spring Festival which, last time it was held, was renamed Trainfest 2001 in honour of the fact that the town has always been associated with the construction of railway locomotives by the firm of Walkers Ltd. While no longer makers of steam locomotives, during Trainfest this company's latest products: tilting trains, were on view to visitors. During this event, exhibits displayed by club members were judged for the annual awards, the

Locomotion Trophy and *M. Kuskie Award* were both won by Mr G. Punter for a magnificent *Cliff & Bunting Traction Engine*, complete with driving wagon, and *The Lynton McWatters Award* was won by Bill Olds with a chassis for an Australian DD-17 locomotive. An innovation this time was the presentation of an *Encouragement Award* which went to Paul Jones for a model of *Sweet Pea*.

Normally there is no public running by the **Steam Locomotive Society of Victoria** during January which is a peak holiday time for members; it has also been found that the New Year celebrations make it difficult to recruit sufficient members to man the track. An exception was made this year, and a special run was organised to raise funds for an extension to the garden railway which has been very popular since its inception. At an end of year meeting the annual club awards were judged by a guest from the **Melbourne SMEE** and were won as follows. *Marcus Trayleen Trophy*: Ian Davies with a 5in. gauge Victorian Railways H22 locomotive. The award for *The Most Popular Exhibit of the Day* went to Chris Murray for a 3 1/2in. gauge Great Northern Railway Atlantic, and *Quiet Achiever Awards* were made to Wayne Layton for his ongoing production of signal and point control components and to Kath Elliot in recognition of her many hours of work in the sales kiosk.

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.

FEBRUARY

- 8 **Colchester SMEE**. Auction. Contact L. G. Hammond: 01376-511686.
- 8 **Hereford SME**. Joe Nemeth: Signalling and its Components. Contact John Arrowsmith: 01432-265151.
- 9/10 **Festival of British Railway Modelling** at Doncaster Exhibition Centre, Doncaster Racecourse. Advance booking (to 25 January 2001): Adults: £4.50, Children: £3, OAP: £4, Family (2+3): £15. Information and Ticket Hotline: 01778-391134/80.
- 10 **Durban SME**. Bits & Pieces. Contact David Martin: 031-5635755.
- 10 **Southland SME**. Teddy Bears' Picnic. Contact Peter Stark: 03-21-89702.
- 10 **Sutton MEC**. Track Day. Contact Mike Dean: 0208-657-5401.
- 11 **Bedford MES**. Dick Billington: Boilers for the Layman. Contact Ted Jolliffe: 01234-327791.
- 11 **Erewash Valley MES**. Dave Turner: Dart Engine Failures. Contact Jim Matthews: 01332-705259.
- 11 **Frimley & Ascot LC**. Meeting. Contact Bob Dowman: 01252-835042.
- 11 **Melton Mowbray DMES**. Video Night. Contact Phil Tansley: 0116-2673646.
- 12 **Birmingham SME**. Colin Garratt: Special Illustrated Presentation. Contact John Walker: 01789-266065.
- 12 **Crawley ME**. Robin Davies: Chat Night. Contact Allan Sinclair: 01293-888203.
- 12 **Northampton SME**. AGM. Contact Pete Jarman: 01234-708501.
- 13 **Birmingham SME**. Chat-Chat Evening. Contact John Walker: 01789-266065.
- 13 **Chingford DMEC**. Working Models Night. Contact Martin Masterson: 0208-989-5552.
- 13 **Harrow & Wembley SME**. Vic Priddle: Vintage Steam Slide Show. Contact Dr. Roger Greenwood: 020-8427-2755.

- 13 **Historical MRS (East Midlands Area)**. Videos, Slides & Modelling - Members' Evening. Contact Mark Shipman: 0194-983-6311.
- 13 **Norwich DSME**. Alf Stevens: Tool Sharpening. Contact Barry Steel: 01603-743372.
- 13 **St. Albans DMES**. Frank Banfield: Films. Contact Roy Verden: 01923-220590.
- 13 **Staines SME**. Egg Race. Contact Mike Kingham 01932-788793.
- 14 **Cardiff MES**. Forum. Contact Trevor Jenkins: 029-20755568.
- 14 **Halesworth DMES**. Chat Night. Contact Chris Walliman: 01362-695735.
- 14 **High Wycombe MEC**. Meeting. Contact David Savage: 01494-527402.
- 14 **Leyland SME**. President's Trophy Presentation. Contact Alan Wilson: 01942-715072.
- 14 **Sutton MEC**. Ron Churchill: 13th Century Coinage & The Brussels Hoard. Contact Mike Dean: 0208-657-5401.
- 15 **Rochdale SMEE**. Video Night. Contact Mike Foster: 01706-360849.
- 15 **Romford MEC**. J. F. Rumble: The Ongar Railway. Contact Colin Hunt: 01708-709302.
- 15 **Romney Marsh MES**. Video Evening. Contact John Wimble: 01797-362295.
- 15 **Worcester DME**. Meeting: Isambard Kingdom Brunel. Contact M. Lane: 01905-425972.
- 15-17 **Brighton ModelWorld** at the Brighton Centre. 10am-5.30pm; Adult: £5, Child/Senior Citizen: £3, Family: £15. Contact Tim Steven: 01444-254057.
- 16 **Reading SME**. Club Running. Contact Graham Bustin: 01189-615450.
- 16 **Southland SME**. Winton-Lumsden-Kingston Bus Tour. Contact Peter Stark: 03-21-89702.
- 16 **York City & DSME**. Steve Boulton: Hovercraft. Contact Ken Bateman: 01904-421445.

- 16/17 **Erewash Valley MES. Steaming Weekend.** Contact Jim Matthews: 01332-705259.
- 16/17 **Scale Rail - North West 2002** at Bolton School Arts & Conference Centre, Bolton. 10 am-6pm (5pm Sunday 17th). Adults £4, Senior Citizens £3.50, Children £2. Contact Iain Gammack: 01204-852681.
- 17 **Frimley & Ascot LC. Club Run.** Contact Bob Dowman: 01252-835042.
- 17 **York City & DSME. Running Day.** Contact Ken Bateman: 01904-421445.
- 18 **Leicester SME. 0-Gauge and 16mm Evening.** Contact Raymond Wallis: 0116-285-8824.
- 19 **Basingstoke DMES. Stationary Engines.** Contact Ian Shanks: 01420-561741.
- 19 **Chesterfield MES. K. Horan: Slides.** Contact Mike Rhodes: 01623-648676.
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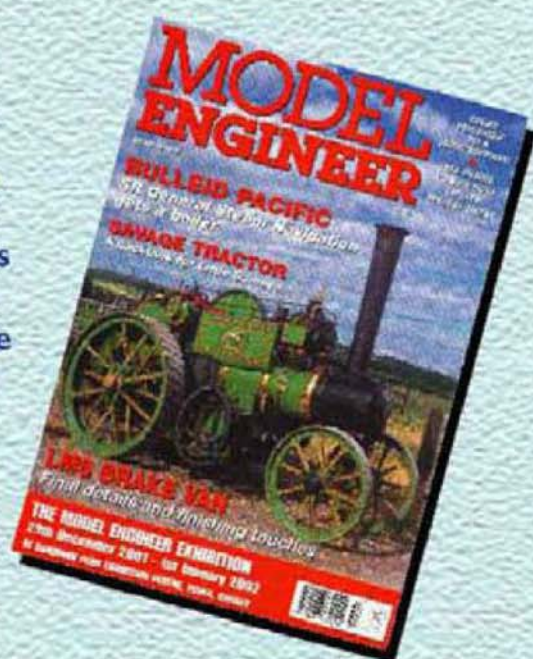
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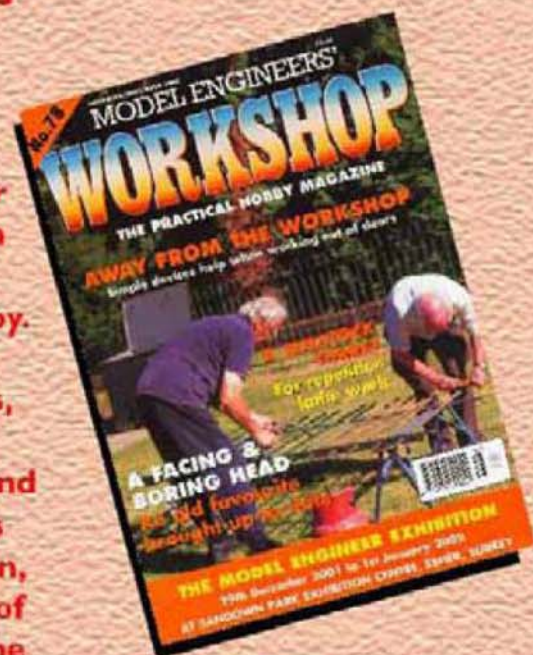
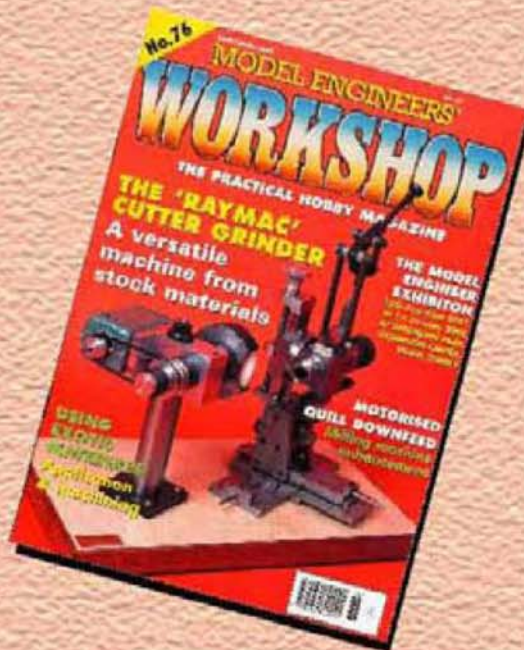


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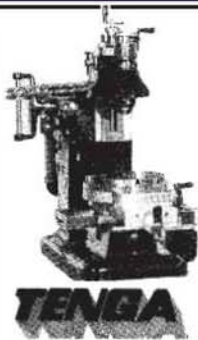
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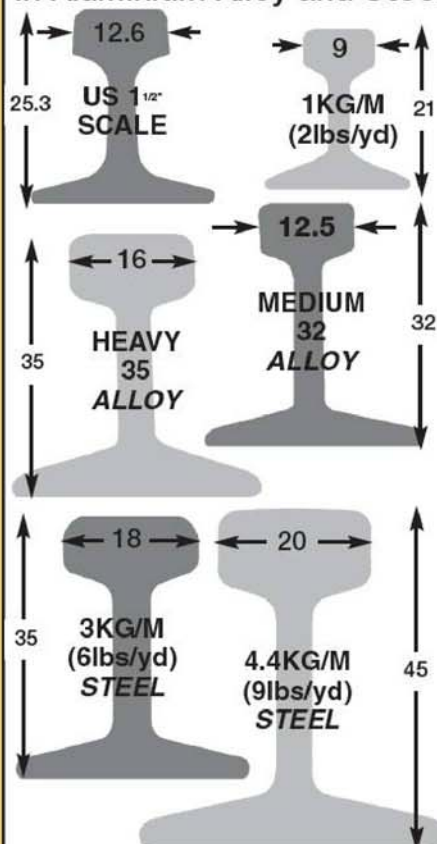
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- Bed of threads HT
- Cast side travel 70mm
- Bed of threads (mm) 270x254x500



£850

Price include VAT
& Delivery UK

Model B-Super

- Swing over bed 4200mm
- Swing over bed 4200mm
- Bed length 2000mm
- 3 bed casters 100-2500mm
- Bed of threads (mm) 125mm (range) 0.25-1.5mm
- Motor 100W
- Max weight 15kg
- Bed of threads 2000mm
- Bed of threads HT
- Cast side travel 70mm
- Bed of threads (mm) 270x254x500



£725

Price include VAT
& Delivery UK

Comet Lathe

- Swing over bed 2500mm
- Swing over bed 2500mm
- Bed length 2000mm
- 3 bed casters 100-2500mm
- Bed of threads (mm) 125mm (range) 0.25-1.5mm
- Motor 100W
- Max weight 15kg
- Bed of threads 2000mm
- Bed of threads HT
- Cast side travel 70mm
- Bed of threads (mm) 270x254x500

£1155

Price include VAT
& Delivery UK



Centurion

- Swing over bed 4200mm
- Swing over bed 4200mm
- Bed length 2000mm
- 3 bed casters 100-2500mm
- Bed of threads (mm) 125mm (range) 0.25-1.5mm
- Motor 100W
- Max weight 15kg
- Bed of threads 2000mm
- Bed of threads HT
- Cast side travel 70mm
- Bed of threads (mm) 270x254x500



£1395

Price include VAT
& Delivery UK

Craftsman Precision Belt Drive

- Swing over bed 3000mm
- Swing over bed 3000mm
- Bed length 2000mm
- 3 bed casters 100-2500mm
- Bed of threads (mm) 125mm (range) 0.25-1.5mm
- Motor 100W
- Max weight 15kg
- Bed of threads 2000mm
- Bed of threads HT
- Cast side travel 70mm
- Bed of threads (mm) 270x254x500

STANDARD EQUIPMENT

- 6" 3-jaw chuck with reversible jaw
- 8" 4-jaw chuck with reversible jaw
- Steady rest - follow rest
- 3-jaw rest - follow rest
- 4-jaw rest - follow rest
- 4-jaw rest - follow rest
- 4-jaw rest - follow rest
- 4-jaw rest - follow rest
- 4-jaw rest - follow rest
- 4-jaw rest - follow rest



£1725

Price include VAT
& Delivery UK

Cub 620/630

- Swing over bed 3000mm
- Swing over bed 3000mm
- Bed length 2000mm
- 3 bed casters 100-2500mm
- Bed of threads (mm) 125mm (range) 0.25-1.5mm
- Motor 100W
- Max weight 15kg
- Bed of threads 2000mm
- Bed of threads HT
- Cast side travel 70mm
- Bed of threads (mm) 270x254x500

STANDARD EQUIPMENT

- 6" 3-jaw chuck with reversible jaw
- 8" 4-jaw chuck with reversible jaw
- Steady rest - follow rest
- 3-jaw rest - follow rest
- 4-jaw rest - follow rest
- 4-jaw rest - follow rest
- 4-jaw rest - follow rest
- 4-jaw rest - follow rest
- 4-jaw rest - follow rest
- 4-jaw rest - follow rest



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