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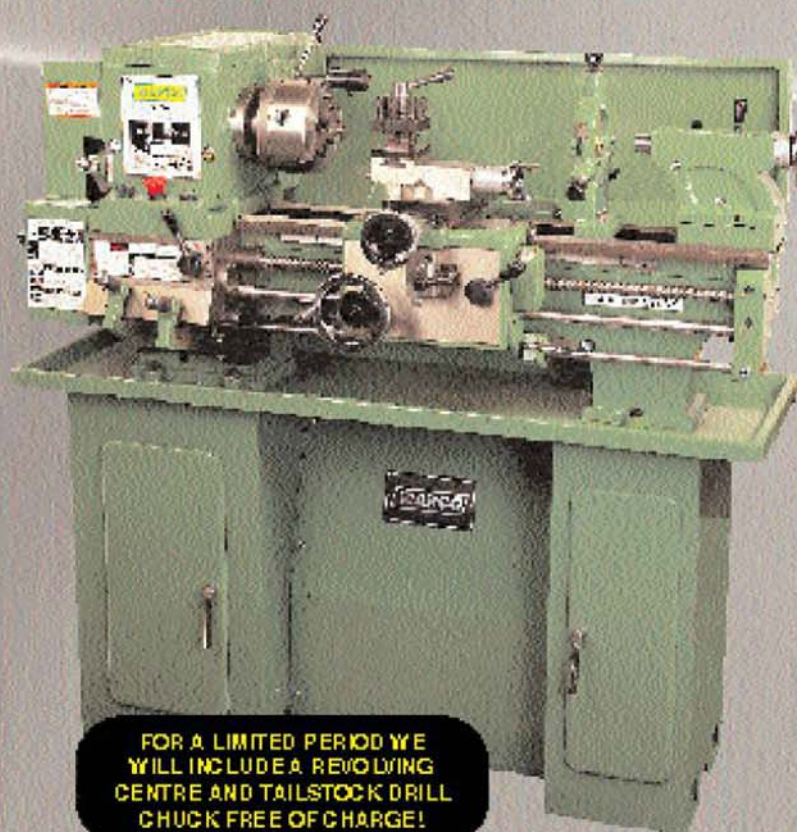
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a workshop precede notes on making the
motion work. Part XXXII.
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On the cover ...

The Mechanomorphic Sculpture featured
on our cover was built by William Dubin in
California, USA and is based on the
Stuart Turner James Coombes table
engine combined with ideas prompted
by a 19th century British model of a
Double Table Engine on display
in the Henry Ford Museum.

Named Babette and constructed using
brass, steel, silver-steel, cast iron and
sterling silver, it is animated by means
of a small variable speed motor hidden
in the base, and is illuminated
by a miniature lamp.

Babette is the second of William Dubin's
models which have much in common with
full-size engine designs without the
constraints of having to function in the
same manner.

Turn to page 14 in this issue to discover
more about this sculptor's fascinating
Kinetic Art forms.

(Photograph by William Dubin)

THE BURNT AIR ENGINE

Further features of this unique engine
are discussed before work begins on
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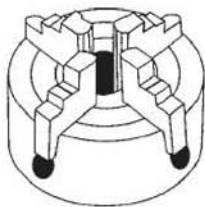
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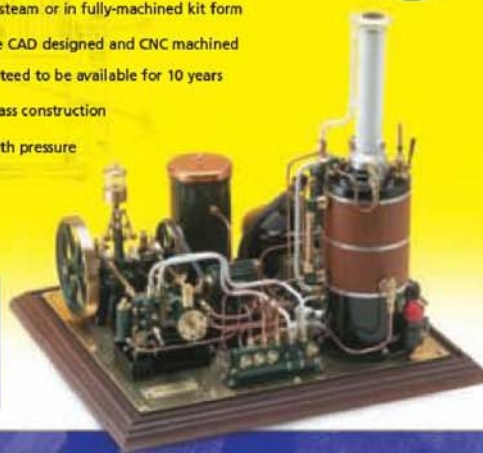
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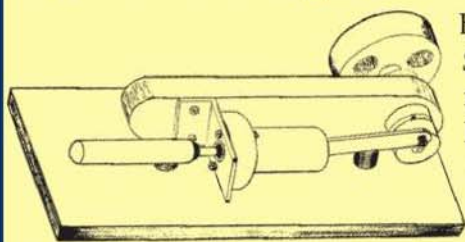
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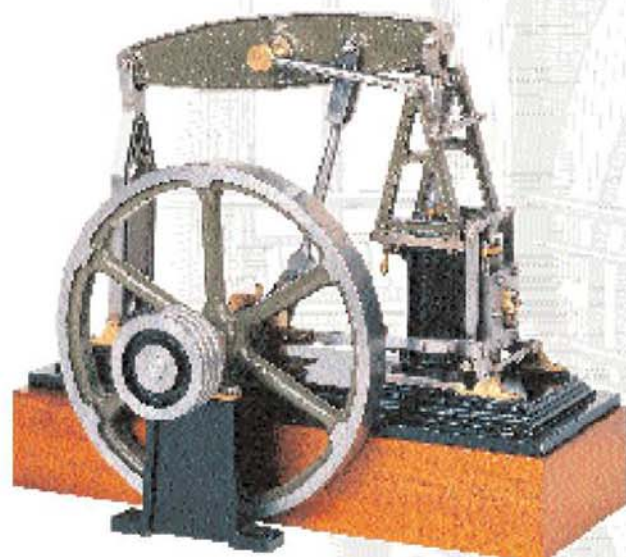
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SMOKE RINGS

With the Editors

Harry Holland

Claude Poulsen, President of the Hutt Valley Horticultural Society Inc., Petone in New Zealand, has written to tell us that Harry Holland died on 9 December 2002 after a short but serious illness. Established readers will be aware that Harry wrote several features for these pages and two more of his articles await publication.

Born in Cheshire in 1920, Harry attended East London Technical School, joined the army in 1939/40 and served in the Royal Electrical and Mechanical Engineers. He was seconded to Frank Whittle's team to work as a junior technician on the development of the jet engine, and in due course was able to return to his preferred work with REME. He rose to the rank of Lieutenant Colonel and took voluntary retirement in 1963.

During his time in the REME, he was Officer Commanding at the Base Workshops in India prior to India's independence. He also served in a commanding position in Egypt where, during 'the troubles', he was wounded by sniper fire.

It was concern for his wife Glenys' health which prompted Harry to leave the Army in the UK and to move with the family to New Zealand to take advantage of the milder winters. He joined the NZ Forestry Service as Chief Mechanical Engineer and, when offered, accepted with relish the Command of RNZEME, holding that position for some years before retiring as Colonel.

By this time, his old Tech. had become the University of East London, and in the '90s bestowed upon him an Honorary Masters degree in Engineering. The articles he wrote for *Model Engineer* include descriptions of a microscope, engraving machine and field gun. Over the years, he made several other models, all of which demonstrated a very high degree of craftsmanship. He was working on a skeleton clock at the time of his death.

Your Editor recalls with pleasure two visits by Harry and Glenys to the UK, the more recent being to the Hemel Hempstead outpost which now serves as the *Model Engineer* Editorial Office. Our thoughts are with Glenys, and Harry's family and friends at this sad time. Harry was one of the world's gentlemen, he always treated everyone with great courtesy, and will be sorely missed by all who knew him.

Cygnat Royal - erratum

Shelley Curtis has pointed out an error in Part II of his series, published on page 483 in *M.E.* 4182, 15 November 2002. Reference to the use of a stepped mandrel is made in the description of machining the crankshaft bearing housing. Mr. Curtis writes:

"The stepped mandrel referred to in this section is not the one shown in figure 1, but is to be made specifically for the purpose of holding the bearing housing for boring the seating for the front ballrace. The need for ensuring concentricity is the reason for not removing it from the chuck."

We regret any confusion which this error may have caused and hope that those engaged on this interesting project will not have been deterred by it.



Model design takes off!

Pete Clarke, aged 27, from Cheshire, is one of this year's graduates in Art & Design at the University of Hertfordshire. He has demonstrated both talent and tenacity by attaining his BA(Hons) in Model Design despite health problems which he overcame to complete his course of study.

Pete's final project, a model Apache for Westland Helicopters, has won great acclaim and was displayed next to the real thing at the formal presentation of his model to Westland in July 2002. Pete said *"Modelling the Apache was challenging and thoroughly enjoyable; the tremendous support and enthusiasm I received from Westland was very encouraging and ensured that the model was a great success."*

Ian Mitchell, principal lecturer in the Department of Design and Foundation Studies, and Programme Tutor for BA(Hons) Model Design at the University of Hertfordshire said *"Pete created this opportunity with Westland for himself, as part of the Collaborative Project in the final semester. The work was self-initiated and he continued to manage all aspects of the collaboration to a very high standard. Pete delivered a professional quality model which more than met Westland's expectations and succeeded in completing a first rate collaboration."*

Hobbymat MD65 spares

Following our recent request for information concerning the above (*M.E.* 4184, 13 December 2002), we have learned from several readers that despite any implication to the contrary, Essel Engineering is not only still very much in business but remains very much involved with Hobbymat equipment.

The confusion appears to centre around this company's removal some time ago to new premises, information which had not previously been published in these pages. Essel Engineering is now located at PO Box 52, Llanidloes, Powys SY18 6WD; tel/fax: 01686-412040. Proprietor Stephen Lacey, wrote to say *"...we are still very much involved with Hobbymat, holding most spares in stock and importing direct from the manufacturer when needed. We have a website at www.esselengineering.co.uk with direct e-mail link."*

We regret any confusion which may have been caused by the publication of our initial readers' requests for Hobbymat MD65 spares. We hope that by means of the above we have been able to set the matter straight by providing the information to all readers that this justifiably popular equipment, together with its stablemates, accessories and spares are readily available. Contact Stephen Lacey at Essel Engineering for a full listing.

CHUCK the MUDDLE ENGINEER

by B. TERRY ASPIN



POST BAG

Monty the mortar

SIRS, - With reference to your recent article on *Monty the mortar*, I enclose a photograph of my finished model. It was made using scrap mild steel which after completion was wire brushed with a power drill to give it a weathered appearance.

All machining and milling was carried out on a Myford series 7 lathe. The carrying bars and mortar shells were made by profiling the cutting tools. The frames were produced by photocopying the drawing, cutting it out, sticking it onto the work, and then milling around the outline. The finished model was then mounted on a thin piece of brass plate and stuck onto a piece of MDF board and profiled.

It makes a nice window ledge ornament. Being a recent newcomer to this hobby and reading your magazine regularly, I have always wished that when people submit details of models they also tell us what machinery they have used, and also if they belong to any model engineering society. I am sure that other people would be interested in this information.

Gerry Willis, Somerset.

Stainless steel and cast iron

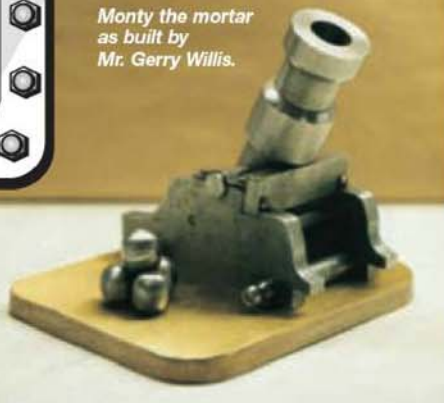
SIRS, - Mr. Halman's letter about his rusty stainless steel sink (*M.E.* 4179, 4 October 2002) raises an interesting question about corrosion to which I offer the following observations.

The corrosion resistance of stainless steels relies on the fact that chromium (present in significant quantities) oxidises on its surface to present a very tough, invisible layer that protects the whole structure from further attack. If this layer should be removed by means of a powerful reducing agent, then locally that protection is lost. Iron particles are very reactive and have a strong affinity for oxygen. This is normally taken from the water, but in the circumstances described a cell is formed in which the oxygen atoms migrate from the chrome oxide instead.

Restoration of the traditional surface of the sink can best be accomplished by local treatment with 5% nitric acid, bearing in mind the need to protect one's skin from attack by this acid. Such acid solution may be difficult to obtain, but so-called 'passivating paste' containing the acid is used by stainless steel fabricators and a gentle word in their ears might do the necessary.

D. A. G. Brown, Rutland.

Monty the mortar
as built by
Mr. Gerry Willis.



Colours and CAD

SIRS, - I have been reading with interest the letters in *Post Bag* concerning the colour coding of drawings. This is something which I, and no doubt many others that suffer from colour blindness in some form or another, do not want to happen.

This does not mean that I only see black and white, but I cannot distinguish some of the colours I see. This is not easy to explain, but can be a handicap, as when driving my *Sweet Pea* at a track equipped with colour light signals, the position of the lights being the reverse of traffic lights. I have no trouble with the latter, as I know the position and the brightness.

With regard to drawings using CAD, it has been of a great help to me, for although I have worked to drawings in my work, I have never had to prepare them. Since I am nearer 90 than 80, my rate of learning is a little slower than it once was, but I do not believe that age is any excuse for not having a go. My first program was KeyCAD, which was easy to use and moderately priced, but unfortunately, it would not do a radial copy.

For those who do not recognise the term radial copy, it is the dividing of a circle, such as marking out rivet spacing around the face of a smoke-box, or holes in a division plate, etc. Next I tried AutoCAD with which radial copy was easy, but everything else needed too much learning for me. I now use Total CAD which is cheap, easy and does all I want of it.

My computer has opened new doors for me, the word processor and CAD have enabled me to write and submit articles and drawings to *M.E.* and *M.E.W.* and even have some published, something that I would never have previously attempted to attain.

There is no doubt that the possession of a computer is an asset and with the internet we have access to the world, whatever our interests.

Stan Wade, West Yorkshire.

Straw splitter

SIRS, - I was pleased to read J. W. Coulson's 'Can You Help?' letter in *M.E.* 4181, 1 November 2002, which took me back 50 years to my childhood in a small village in

Bedfordshire about 8 miles from Luton. The items illustrated have no direct connection with engineering, as they are straw splitters used in connection with the hat trade.

We lived in a very old cottage, which required a new ceiling in the main living room. When the builders took down the old sagging lath and plaster ceiling, literally dozens of strange objects came down with it. They turned out to be of two types, wooden lace bobbins and brass straw splitters that had fallen through the gaps in the rough floorboards of the room above. This room must have been used as an out-worker's workroom for perhaps a couple of centuries. My grandparents explained to me the use of the brass splitters as they had seen their parents using them.

The brass splitters were used to divide the locally grown long stalk straw along its length to produce splits that were later plaited into long lengths of plait. The plaits were then flattened using a small, wooden roller mangle and were ready for sale to hat manufacturers at the plait market.

Villages in Bedfordshire had plaiting classes for girls to learn the art of producing the intricate plait patterns. It was skilled work.

The brass splitters were of various sizes and had varying numbers of blades to cope with the variation in the diameter of the straws, as it was essential to produce splits of constant width. So a large diameter straw obviously had a larger circumference than a thin one and so had to be split into more segments. The pointed pilot of the brass splitter guided the straw onto the cutting blades. The straw was pushed past the blades until enough protruded behind to be firmly grasped then the straw was quickly pulled through the blades.

The straw plait business died out in the early 1900s due to cheap imports (sound familiar?) Many towns had plait markets, the one in Luton being particularly fine. In its latter days it was a fruit, vegetable and general market until it was demolished in the 1960s to make way for the ghastly and soulless Arndale Centre.

Examples of
Reuleaux triangles
made by Gerry
Ward in response
to our 'Why won't
it fit article'.



More can be discovered about these splitting tools by visiting leighton-museum.org.uk/gallery/ Eric Clark, Buckinghamshire.

Reuleaux triangle

SIRS, - I read with interest Neil Read's article *Why won't it fit?* (*M.E.* 4178, 20 September 2002) and submit the accompanying picture of pieces machined in order to demonstrate the phenomenon to those who say of a work piece: "It must be round because I checked it with a micrometer." Unfortunately a micrometer cannot detect the difference between a circle and a Reuleaux triangle. These pieces can be used to roll an object upon a horizontal flat surface with no vertical component to the motion.

Although clearly far from circular the pieces, when rotated between the jaws of a micrometer exhibit a constant reading of 0.855 inch. The bore of the hexagon slice into which the pieces just slide is 0.986 inch.

Gerry Ward, Alberta, Canada.

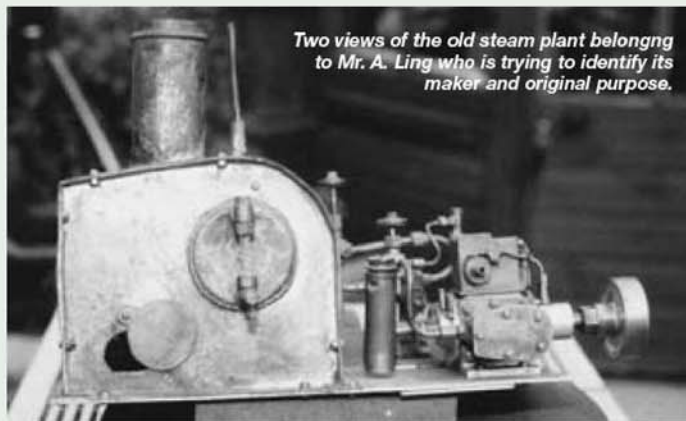
Lubricating oil

SIRS, - After a long bout of inactivity, due mainly to health problems, I have returned to model engineering. I found that the lubricators on my Myford ML7 had become stained by the oil in the reservoirs, so that the true oil level could not be seen. I decided to order some new lubricators and, at the same time, to sort out the proper lubrication of my lathe.

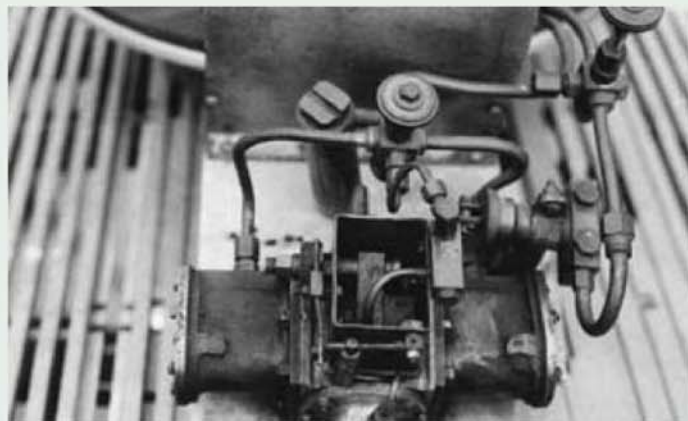
I wrote to the manufacturers who recommended Esso Nuto grade H32 for the lathe mandrel and K68 for the screwcutting gearbox. It appears that Esso Nuto is only available in 25 litre drums, so an alternative was required.

I managed to obtain a chart which compared oil viscosities in different systems of measurement and it appears that K68 is similar in viscosity to SAE 30. This is available from garden centres and DIY stores for horticultural machines and lawn mowers.

As an alternative to the H32, which is a thinner oil, I found a shell product Macron 32 which is available in 5 litre cans. This oil is suitable as a cutting lubricant as well as for



Two views of the old steam plant belonging to Mr. A. Ling who is trying to identify its maker and original purpose.



bearings and slideways, so I shall use this for everything but the screwcutting gearbox and the change wheels.

I have yet to discover how the multi-grade motor oils (e.g. 10W-40) compare with SAE grades, so if anyone knows the answer I shall be most interested. Perhaps I should add that I have no connections with any of the companies mentioned other than as a user of their products. Neil Heppenstall, Cheshire.

Clothes pegs

SIRS, - In his *Letters to a Grandson* (M.E. 4179, 4 Oct 2002) Mr. Ellis, rightly notes the problem of heat insulation when soft-soldering. When soldering small parts, I find that a good solution is to use a sprung wooden clothes peg. Clip it onto the piece to be held, then clamp it firmly in the vice. It may char a little, but it is expendable. Wooden clothes pegs are also useful for holding a threaded piece in the same way, thereby avoiding damage to the thread.

Do not steal them from the 'guy' nor'. Buy yourself a packet of your own from the 'cheapy' shop. I bought some very cheap and large ones, which were almost useless for pegging clothes on the thin rotary line, but ideal for my purpose. You can quickly drill or cut them if necessary, to hold awkward shapes.

While you are in the shop, get a packet of lolly sticks, some kebab sticks and cocktail sticks as well. You will find uses for all of these for cleaning small holes, applying oil or flux and dozens of other little jobs. R. Clifton, Isle of Wight.

Pickle acid

SIRS, - I refer to Mr. Hennessey's letter (M.E. 4178, 20 September) in which he speaks of difficulties in obtaining concentrated sulphuric acid due to its involvement in the

explosives industry. I encountered the same difficulties when trying to purchase chemicals for a salt bath. I overcame the problem by having a word with my friendly local chemist who obtained the chemicals I needed within a week of my request.

Our Editor suggests using citric acid for a pickle bath and points Mr. Hennessey to the local chemist or the home brew shop. I suspect he will meet difficulties here, too. I did. My local home brew shop no longer sells it, and my chemist had some but only three 10 gram packets. On enquiring, I was told that drug addicts use it to mix with drugs.

If, however, Mr. Hennessey goes along this path he will find his friendly chemist helpful again. I can add, too that it is far cheaper to purchase, say a half kilo tub than a half kilo in 10g packs.

Eric Parker, West Yorkshire.

Pickle acid

SIRS, - I refer to the letter (M.E. 4178, 20 September 2002) concerning pickle. I obtained 100% sulphuric acid and hydrochloric acid from a friend who worked at a metal plating firm close to where I live.

For those who wish to obtain some of these acids in small quantities it may be worth trying your local plating company.

R. C. F. Hillman, Hampshire.

Shay nameplates

SIRS, - In M.E. 4176, 23 August 2002 Graham Perry requested details of the Lima works nameplates that appeared on Shay locomotives.

By chance I was shown the Doncaster Grammar School Railway Museum. To my amazement, alongside all the British locomotive nameplates was a Lima builders plate. There were also Baldwin and Alco plates.

The school, no doubt for reasons of political correctness, is now called The Hallcross School and is in Thorne Road, Doncaster, South Yorkshire.

Mike Nicholson, East Yorkshire.

Old steam plant

SIRS, - I submit two photographs of an old steam engine and boiler that have come into my possession.

If any readers recognise the engine and can advise me of the builders name and its purpose, I would be most grateful.

A. J. Ling, Kent.

Efficacious treacle

SIRS, - I have been following the 'treacle' saga with interest and amusement. Perhaps some may not know that there were many 'treacle' mines/factories, etc., the term being used in the distant past for anything that could be used as a medicine or medical treatment. The product that we are more used to calling 'treacle' only got its name because 'quack' doctors prescribed it, and the manufacturers were not slow in using the name to sell what was a 'slow moving' product (deliberate pun).

There are several spellings, with the older tending towards the 'treacle'. I do not know how old the term is but I suspect it may be a very old term indeed, possibly of alchemical origin. I have seen an advert in a very old newspaper, where something (nasty) was referred to as 'an efficacious treacle'. I have also seen reference to a mixture of 'black strap molasses and sulfur' described as a 'treacle' for curing a multitude of ills. It would certainly stop one complaining! The term was dying out by mid-Victorian times having been more in use in the 15th to 18th centuries.

Peter J. King, New Zealand.

Dead grease

SIRS, - I read with interest *Letters to a Grandson* concerning blind bush extraction (M.E. 4179, 4 October 2002). Many years ago I was employed by an electric motor manufacturer, now defunct, not far from Mr. Ellis' home.

It was common practice in the repair of pressure dies to remove

bushes from blind holes by the 'hydraulic' method as he described.

With 3in. O/D bushes, the sharp blow with a hammer became an almighty whack with the heaviest sledge hammer available. It rarely failed. One had to be careful to use 'dead' grease as it was possible to detonate some substances with adverse effects on the workshop roof skylights!

Don Jardine, France.

Cutty Sark

SIRS, - In past years I have seen wonderful ship models at exhibitions. Most of them involve a considerable amount of model engineering to make the numerous metal parts such as mast fittings, sheaves, stanchions, etc. When the *Cutty Sark* was in Falmouth before World War II, us boys used to swim out to her for a close look. She may have been a little down at heel but she had wonderful lines. I recently saw her in dry dock at Greenwich pier on the south bank of the river Thames.

Beautifully restored and open to the public, this is a fine opportunity to examine the parts as well as photograph them. But, even more useful to the model maker is a set of three scale plans drawn 3/32in. to the foot showing just about every part and fitting with notes. Each sheet is about 24 x 30in. with black lines on white paper reduced from the originals so the writing tends to be a bit small for my eyes. A reading lens solved this. Drawn by a naval architect, I suspect, to document the *Cutty Sark* to museum conservation standards and using nautical terms, these drawings make fascinating reading and are well worth the current cost of £7.50 a set in a postal tube from the *Cutty Sark* on-board shop. Ask for the Campbell Plans. The Pitkin guide gives a potted history plus some facts and is well worth having along with the plans. The guide cost me £3.50 and is well illustrated.

The address of the *Cutty Sark* shop is: The *Cutty Sark*, King William Walk, London, SE10 9HT, tel: 020-8858-3445.

Peter Spenlove-Spenlove, Leicestershire.

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Letters destined for publication in *Post Bag* may be sent to The Editor (*Model Engineer*), Nexus House, Azalea Drive, Swanley, Kent, BR8 8HU; fax: 01322-616319.

Correspondence may also be sent to the Editor at PO Box 310, Hemel Hempstead, Hertfordshire, HP3 8AX; fax: 01442-269366; email: mike.chrisp@virgin.net or neil.read@nexusmedia.com or scalemodels@compuserve.com

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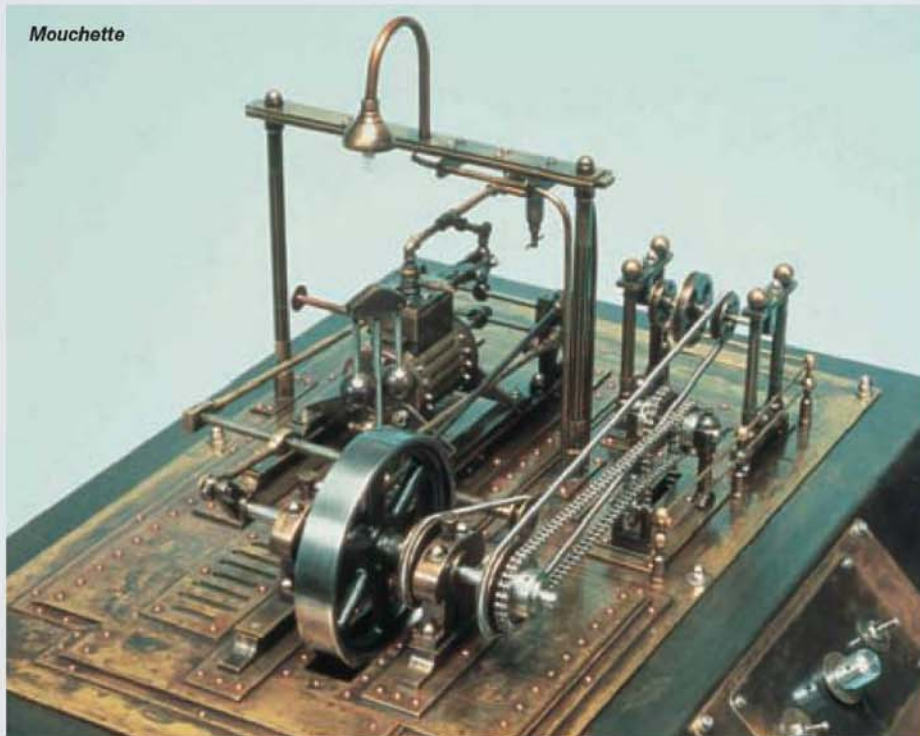
COVER FEATURE

William Dubin

in California, considers the aesthetics of precision and his own perception of the association between model engineering and artistic expression.

In the late 1960s, having finished a day's work in the studio, I went to the local magazine store and, while looking at a group of model railroad magazines, I found my first issue of *Model Engineer*. Thus began a series of events which led to the sculptures featured in this article. I was a sculptor, working in hard woods at this time, but I was aware that I was missing something which carving wood didn't offer. I understood this when I saw the photos of finished models and the plans for building them in *M.E.* What I was missing, was precision. This awareness affected me in a profound way.

Mouchette



MECHANAMORPHIC SCULPTURE

Within six weeks, I had purchased a metal lathe and a few accessories. Fortunately, this came with a very good manual, as I had no idea what to do with this equipment. A fellow sculptor with whom I shared a warehouse, constructed a metal table for my lathe, helped me level it, and gave me my first and only lesson in its use.

The first pieces I built had very little to do with steam engines. They were abstract and very organic,

with only a vague machine reference. After building four or five of these, I realised that the closer I came to an actual steam engine, the more visually successful the sculpture would be. This led to the construction of two pieces, an untitled engine with a square tube boiler, followed by *Ophelia*, a horizontal mill engine mounted on four front columns with a single large rear one. *Ophelia* was the first to be kinetic in that she had a small motor in her base

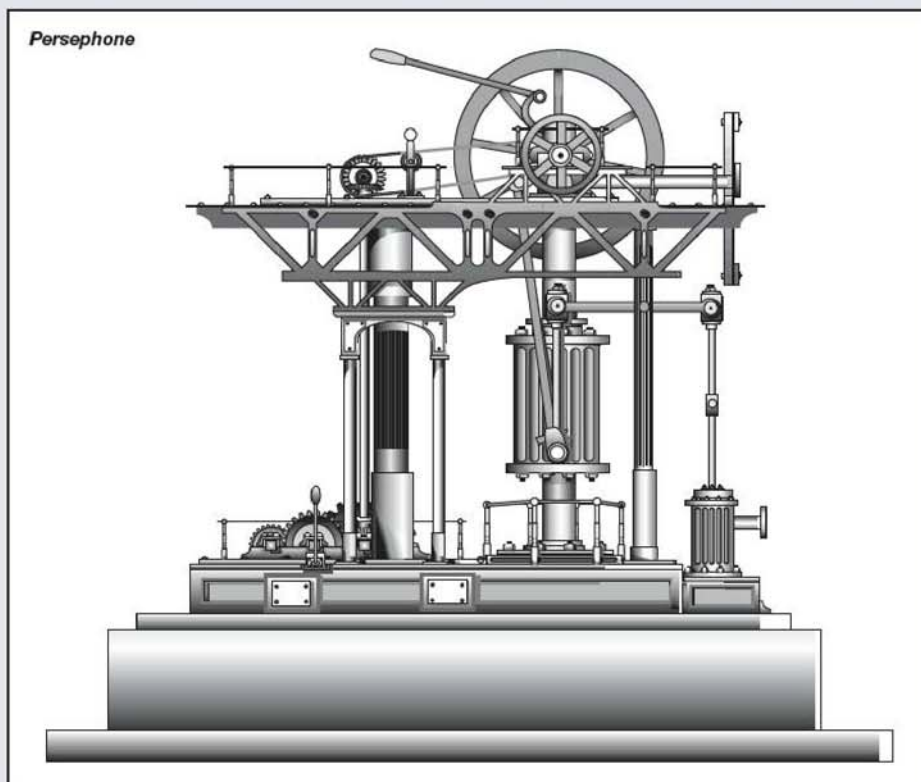
and two leather belts which went from it to pulleys on her crankshaft. Both sculptures were exhibited in San Francisco in 1972.

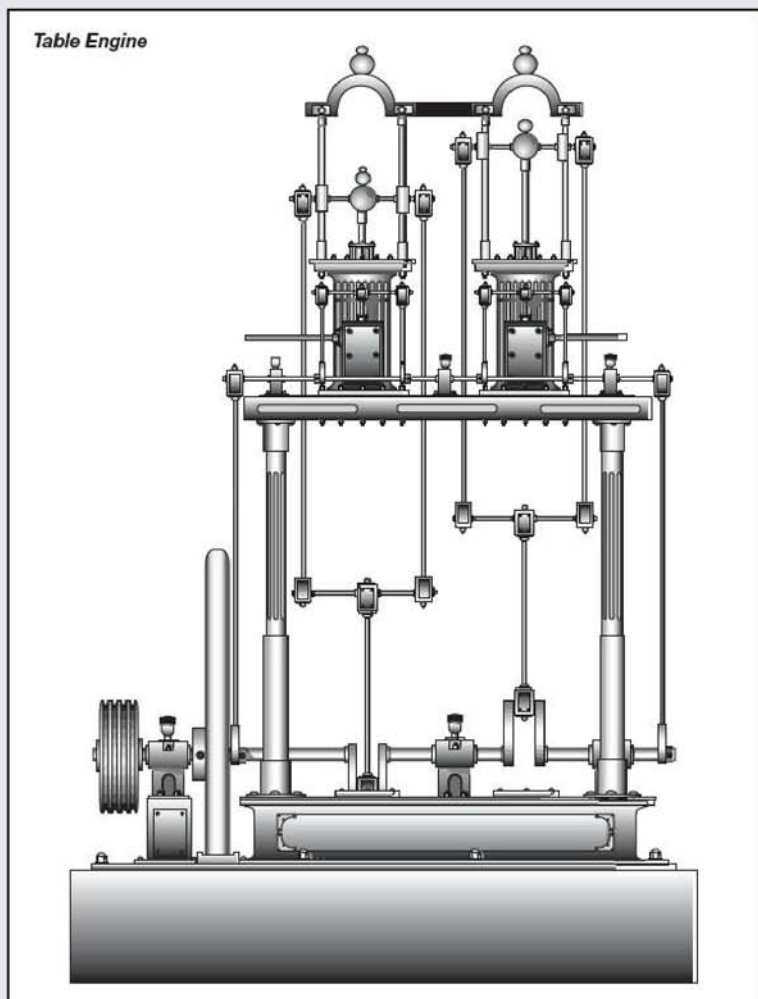
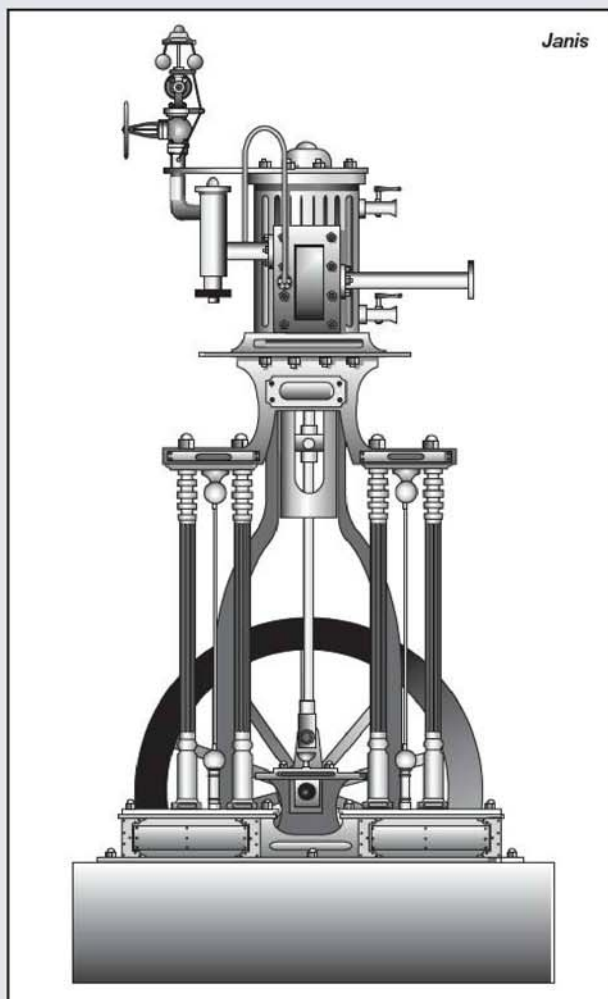
Why sculpture? Why not just model engineering?

This question goes to the heart of what I do. I am a sculptor. When I construct something, it is specifically to make 'art'. While my sculptures have a great deal in common with model engineering, it is with the *process* of model engineering, rather than the end results. My sculptures are a way for me to express my ideas and reactions to the world in which I live, and to my experience of that world. Each piece I construct constantly evolves as my reactions to what I've just built alters my ideas of what I'd like the final piece to look like. This is very different from model engineering, where the adherence to a specific prototype dictates most, if not all of the final appearance of the model. This is not to say that model engineering isn't artistic, quite the contrary. I continually see models which are amazingly artistic, however the intent of the model engineer is to closely resemble a prototype, not to create art. It is in this intent that the two differ.

There are exceptions to this position of intent, (aren't there always?) While this occurs with many examples of model engineering, I think it seems to happen most often in the work of Cherry Hill. This exception occurs when the model engineer constructs with a conscious emphasis on an aesthetic, that results in work that goes beyond engineering into making each part a uniquely beautiful object. In my sculpture, I utilise visually realistic engineering to the degree that my personal aesthetic requires it. In Cherry Hill's work, the first requirement is the engineering itself, but in looking at pictures of her work in progress, one immediately becomes aware of her visual aesthetic as well.

Persephone





This postulates two levels of engineering: the first, an aesthetic based engineering; the second, one in which the engineering does not go beyond function. In the first example, the finished piece complements the prototype, but goes past the visual impact which the prototype would make. This quality is elusive, but it exists and can be easily seen in the best work of model engineering and the fine arts.

What happens in these pieces is a meeting of creativity, craftsmanship and a highly evolved personal aesthetic of beauty combining to produce a category unique to both model engineering and sculpture.

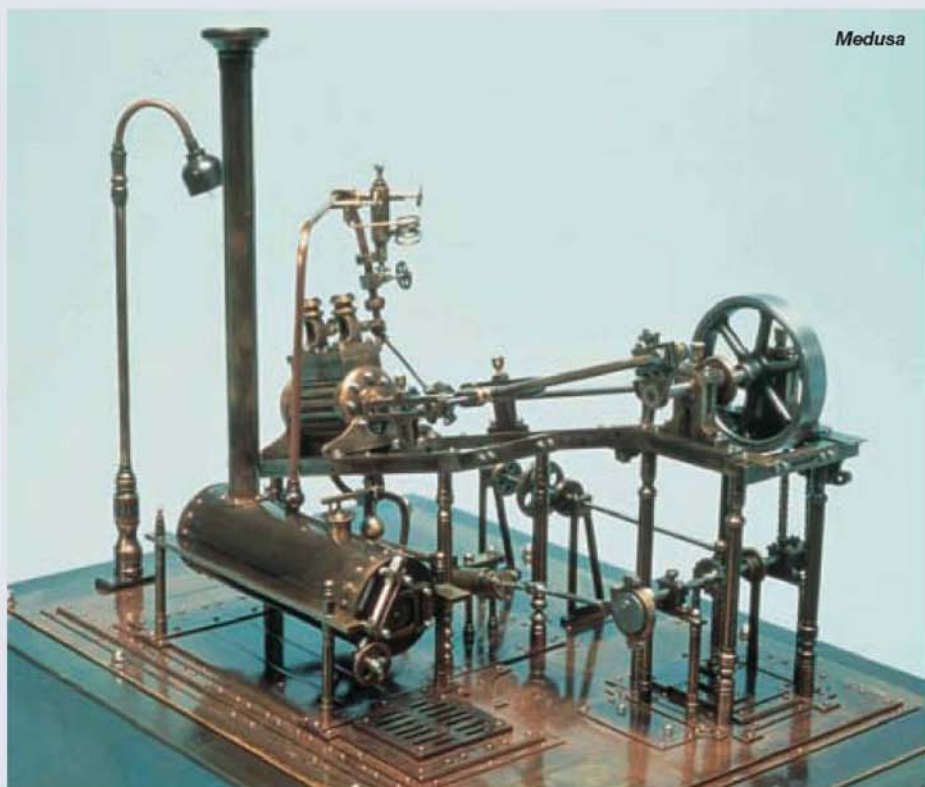
Working method

I come from the time period in art (the 1950s) when Abstract Expressionism defined my creative experience. Nothing could be further from the process of precision required to construct either a well engineered model or my sculpture. I reached a compromise with my requirements for creative freedom versus the need for precision, by not relying on a blueprint or set of plans to follow. Instead I make decisions as I go along. My method is to sketch an idea based on the configuration of the machine: mill engine, beam engine, etc. Once I have a basic idea, I move to the computer, where I use a drawing program: Corel Draw. This allows an intuitive approach to drawing, rather than the mechanistic feel of a CAD program. It also utilises shading for dimensional roundness and the ability to use shadows. The sculpture is further refined on the computer until I have a clear idea of its general shape. This drawing will continue to change as the piece is constructed. I try to record the evolution of my ideas in this drawing. The drawing of *Persephone*,

which is based on the Bodmer sliding cylinder engine serialised in *Model Engineer*, demonstrates the point at which I started the sculpture.

The first parts built are the floor, which I think of as a landscape. You will notice I use a lot of rivets. Rivets allow two things to happen, they are

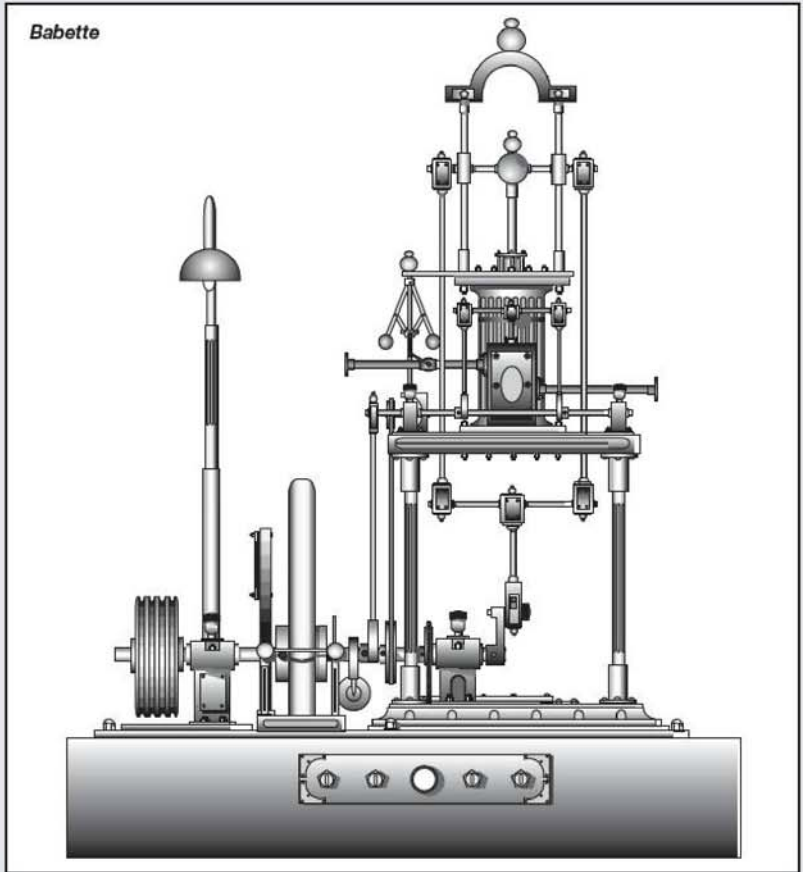
excellent fasteners, and they provide visual reference points for the eye to follow. Once the landscape is complete, I build the entablature and the columns that support it. It is these columns which differ so much from any prototype, there is no way an engine of this size could operate on 'legs' ▶



Babette



Babette



this skinny and not vibrate itself to pieces. But here is one of those instances where the difference between model engineering (following correct engineering principles) and art diverge. As a sculpture, there is less need for principles of engineering than for principles of aesthetics. Fortunately, the builders of many early steam engines allowed their imaginations free rein, especially in the beam engines, so I have some prototype examples to work from.

The last parts made are the mechanical ones: the crank, rods, shafts, valve systems, etc. I have it easy here. My piston rod goes through a gland, but there's no need for a piston inside the cylinder. The same is true for the valve, it isn't there. In all other ways, my sculpture utilises the same working parts as you would expect to find on an actual engine. Oh, one other difference, I finish my sculptures by using chemical patinas instead of paint. I think of my pieces as artefacts, left by another, older culture, abandoned on some unknown landscape where they exist as enigmatic objects. The patinas enrich this concept.

Tools

My tools are identical with those used by model engineers, with the possible exception that I might use more tools specific to jewellers. I have a Sherline lathe and milling machine with DRO, and a Sakai ML 360 lathe for larger parts. I think of these tools as part of my creative process. I use them for creating in real time: for example turning the decorative elements on a column. This is done free form, moving the cutting tool in and out until I get a shape with which I'm happy. What I want is to let the shape simply 'happen', to develop it with as much spontaneity as I can. This makes it a little difficult to duplicate parts. It's important to me that the freedom to create the shape independent of a plan remains primary. Of course, it is also necessary that a shape be made to fit, but this aspect is secondary to my process.

Spontaneity is the primary goal.

This brings up craftsmanship. In art school at the time I attended, craftsmanship was considered the enemy of creativity, the belief being that you can't have both spontaneity and craftsmanship. This obviously isn't true, but it does present a difficult contradiction through which to work. My solution has been to increase my technical abilities with each new sculpture, by pushing myself in areas I've not yet tried.

The machine in art

There are a handful of important artists who have contributed to my direction, and it might be helpful in understanding my sculpture if I briefly mention them. Of great importance is Marcel Duchamp who, in paintings like *The Bride* (1912), interchanged mechanistic parts with biological parts in ways that

suggested new species, neither human nor machine. Roberto Matta took these ideas and transferred them to a science fiction realm (outer space) where they engaged in horrific mechanical combat. Jean Tinguely built actual machines, assembled from junk parts with motors and wheels that moved and ended their existence in acts of self destruction. These artists influenced me before I started this series of sculptures. After building my first machines I saw the work of Don Potts, a San Francisco sculptor. Don constructed a series called *My First Car*. These were about 3/4 scale dragsters, each slightly different but all based on a 'master' Car. These sculptures were totally unique at the time.

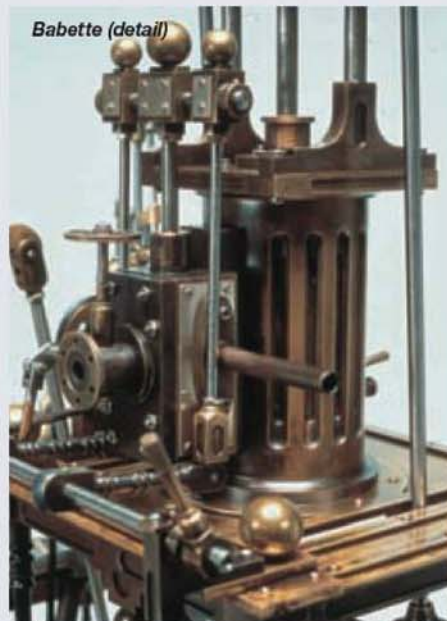
What I saw in Potts' Car, was the fact that something could reference the idea of a prototype, but not be a model of it. His sculpture was no more a 'dragster' (even though one version contained a drone aircraft engine and radio controlled movement), than my sculptures were steam engines. They are alterations. This awareness has allowed me to get closer to a prototype steam engine while maintaining a critical distance from both the prototype and the idea of a model.

Three sculptures

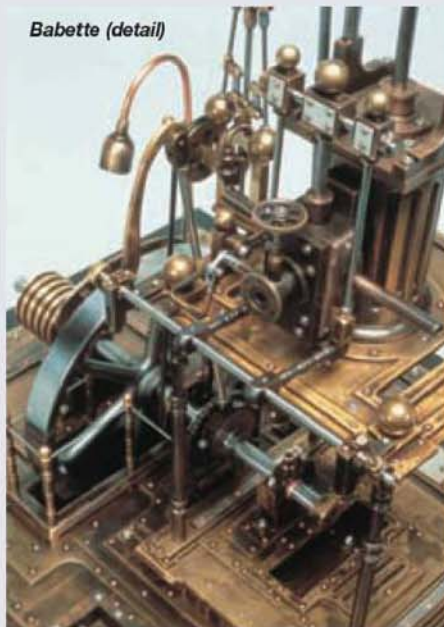
Mouchette started from my fascination with the Side Rod Engine described by Stan Bray in *Model Engineer*, 1987. The more interesting points of this engine were crossed with ideas from the Stuart Turner mill engine *Victoria*. The sculpture resembles neither engine. *Mouchette* gave me the opportunity to put lagging around the cylinder. I used 1/4in. wide brass strips, milled a 1/8in. decorative channel in it, and attached each to the cylinder using 00-90 screws. *Mouchette* also has an overhead lamp based very loosely on an overhead gantry, and a very oddly designed line shaft with work pulleys. *Mouchette* is a fast engine. She runs from an approximate 35rpm up to 250rpm.

Medusa started from a desire to build a diagonal engine based on the advertisement from Reeves.

Babette (detail)



Babette (detail)



Something got crossed up in the drawing I did for her, and I ended up adding a horizontal section. This required elevating the piece, and I got interested in the problem of descending columns on a slant. About the time I figured this out, I got the pamphlet published on the Robey engines, and immediately knew I had to adapt *Medusa* to a bevel gear driven shaft with 'drop valves'. Of course the 'drop valves' aren't there, but the four tiny eccentrics are, and they do work, the illusion of a drop valve system survives.

Having gone that far, I found I had room for a feed pump, which I added, and then decided to add a boiler. Of course the boiler is just an illusion, there's nothing inside. Of interest perhaps was my solution for seeing 'water' in the water gauge. I used a piece of $\frac{3}{16}$ in. silver wire, which catches reflections exactly like glass and water do.

Babette is my second attempt at constructing a table engine based loosely on the James Coombes engine. My first attempt worked, I did everything correctly, but the thing was plainly ugly. It's hard to describe, but everything about the engine I had designed was visually wrong. The word 'clunky' describes it best. This sculpture was disassembled a few hours after it was completed and a few of its parts were used in other pieces. The rest remain as a reminder. What this taught me was an odd lesson. I had designed this sculpture with principles of engineering in mind: would the entablature hold up on thin columns, or did it require thicker ones? This type of thinking is absolute for an

engineer, but I'm an artist, and the question had little meaning. As a result, *Babette's* entablature stands on very thin columns, but ones that visually complement the sculpture.

With *Babette*, I wanted to try an experiment about which I had been thinking for a while. Part of my interest in the steam engine is based on my reaction to the erotic content I feel is inherent when seeing the engine in motion. I had purposely used longer crank webs and longer connecting rods to accentuate this and, to take it even further, I felt that if I slowed the speed to a crawl, the effect would heighten the eroticism, and add a nearly

hypnotic tone to the sculpture. Using gearing and a very slow motor, I brought *Babette* to a speed of 5rpm and a top end of approximately 35rpm. This is so successful visually, that I'm planning on *Persephone* running at one quarter rpm. This awareness of the erotic content I feel with the steam engine is purely personal, however it is a necessary element to the understanding of my art.

Babette is named for my Grandmother, who was my introduction to the elegance of the Victorian period. As an elegant sculpture, she required elegant materials to be used, and so I added decorative pieces of sterling silver. This works very well with the steel and polished flywheel rim. *Babette* is the most complex sculpture I've built to date, she required nearly a year of work to complete.

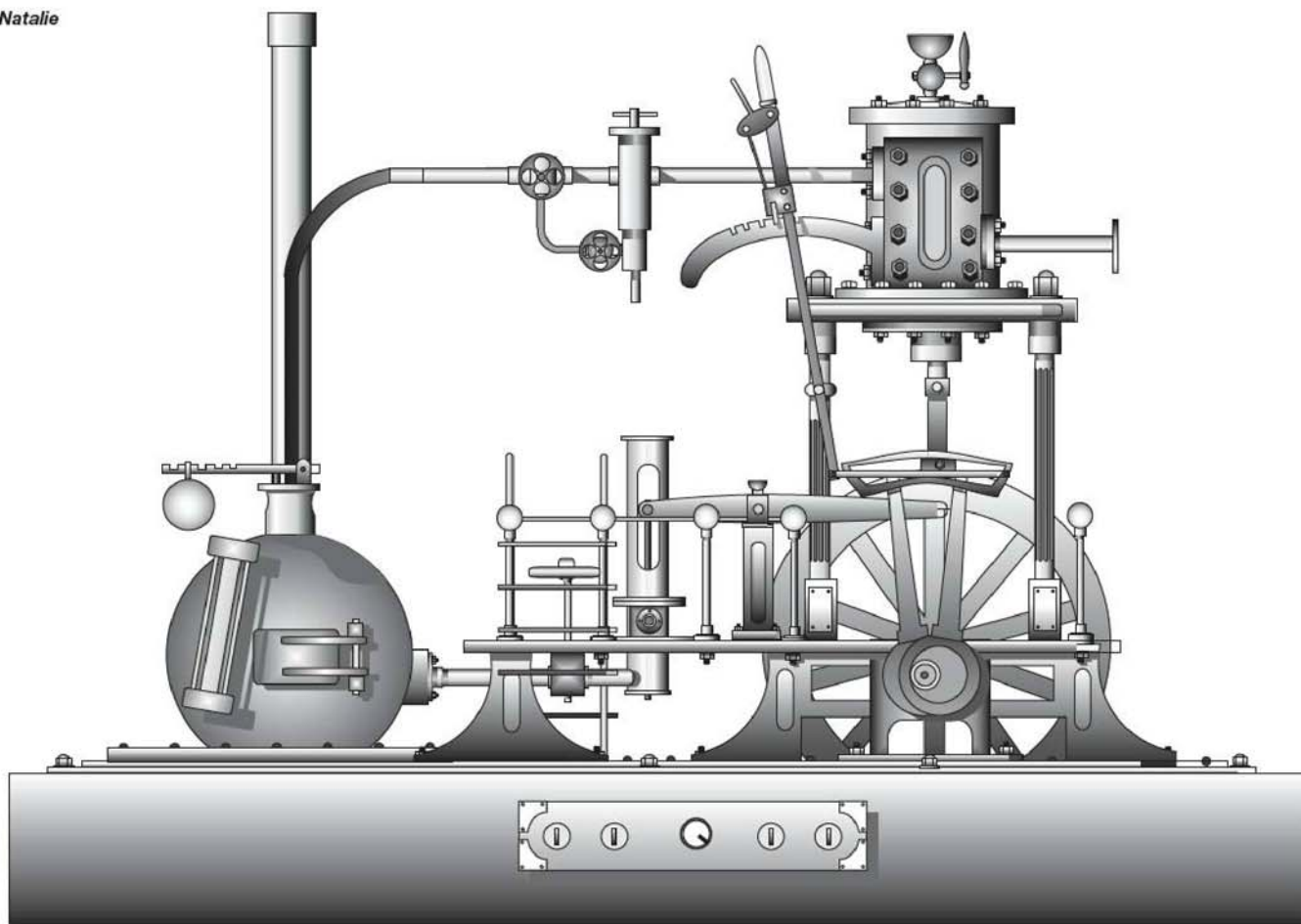
The artist as a model engineer

For the artist, it is crucial to maintain a necessary balance between technical achievement and creative content. My sculptures share both these qualities, and holding an equilibrium between them is the most difficult part of what I do. Each new image I devise requires a machining technique to produce it in such a fashion as to not overwhelm it, and yet allow it to function. The trick, I believe, is to take these two realities, and to create a third, totally unique conception from them. It is this unique conception that my sculpture is finally about.

For more information, photographs and video footage, please visit my web-site at: <http://www.mechanamorphic.com>



Natalie





THE JUNIOR

A STATIONARY INTERNAL COMBUSTION ENGINE

Stan Bray

revisits the cylinder block to make the valve guide holes before dealing with the cylinder liner.

●Part VI continued from page 589

(M.E. 4184, 13 December 2002)

At the start of this series I said that it would be necessary to move from one piece of the engine to another and then to return for another operation; we now come to an example of this. In M.E. 4182, 15 November 2002, the idea of marking off the holes for the valve guides in the cylinder block by punching them via the crankcase was proposed, but taken no further at that stage. It is now possible to assist readers with photographs showing the punching operation (photos 42-44).

Even when the punch marks have been made our troubles are not quite over as, although there is room for the required drills to pass the bolting flange, it is not possible to start the hole with a normal centre drill. The centre drill itself will pass the flange but, owing to its short length, the drill chuck will foul. Since we need high standards of accuracy in this operation, it is essential that a centre drill is used. It is a simple matter to make up an extension centre drill by chucking a suitable piece of bar, drilling a hole in its end, and securing a centre drill in the hole with a retaining compound (photo 45). You will probably still have the one made for the work on the crankcase.

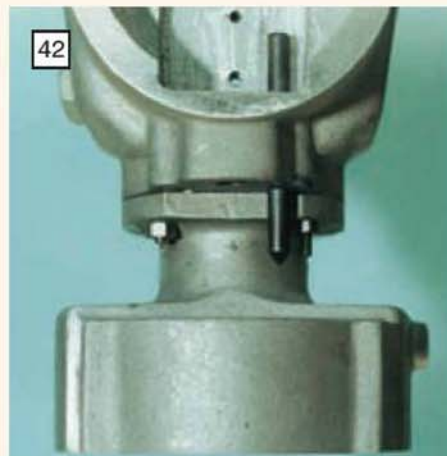
Cylinder liner

There is nothing particularly difficult in making the cylinder liner. Simply a tube ending with a small lip, it is a job that can be done in a 3-jaw chuck (photo 46). Any slight discrepancy due to the inaccuracy of the chuck will not matter. Although it is essential for the bore to be truly parallel to the outside diameter, it is not important if it is very slightly eccentric to it.

The liner is best made from cast iron, in which case a piece of 1 1/4in. dia. material will be required. However, cast iron is relatively expensive and it may be cheaper to use mild steel, which will be satisfactory as long as the engine is not to be used extensively. If mild steel is chosen, it is best to avoid the free cutting varieties. Unlike cast iron, mild steel has no 'skin' and a length of 1 1/8in. dia. material could be used. Carbon steel is an excellent compromise, and any car breaker should be able to supply a half shaft, which will be made of suitable material. Select a broken one, which will be sold at scrap metal price, not one that is still useable.

Having decided on and acquired the material, it is simply a case of gripping it in the 3-jaw chuck and machining it to the sizes shown on the drawings. There is no need to get the outside diameter dead smooth; a little roughness will help to retain it in the cylinder. The bore, however must be machined to the best possible surface which, if possible, should be finished by lapping.

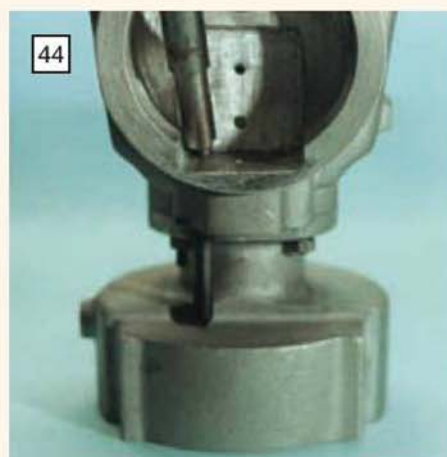
It is up to the individual builders to decide how to retain the liner in the cylinder. It can either be an interference fit or held with a retaining compound.



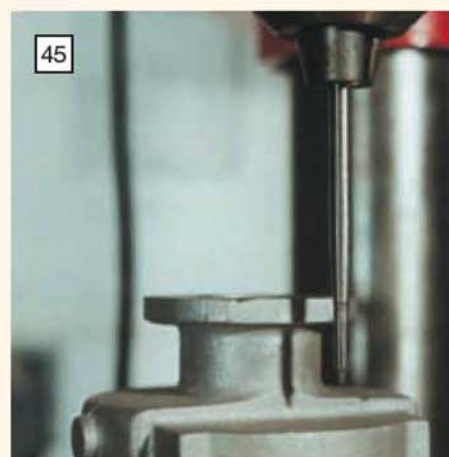
The cylinder and crankcase are bolted together and the punch is introduced into the crankcase.



The punch is then pushed right through the tappet hole until it touches the cylinder block.



Now, using a hammer and drift, the position of the valve guides can be marked on the cylinder.



An extended centre drill is used to pick up the punched marks and begin the drilling process.

If the latter method is used the diameter of the liner should be about 0.002in. smaller than the bore to leave clearance for the retainer to do its work.

If the liner is to be an interference fit in the bore, the diameter of the liner should be 0.0015in. larger than the cylinder bore. Any greater interference could lead to trouble for if the liner gets stuck in the cylinder because it is too large it can be very difficult, if not impossible to remove it or push it further with the end result of damage to the liner and possibly to the cylinder as well. A cast iron liner could well crack under excessive pressure. The end furthest from the lip should be tapered for about 1/2in., the minimum diameter being 0.0005in. less than the diameter in the block, thereby allowing the liner to be set into the block ready for pressing home.

Do not hammer the liner into the cylinder. Not only is the liner likely to be damaged, but it is also impossible to ensure that it will enter the bore perfectly straight. A better technique is to squeeze it in using well protected vice jaws, assuming a

vice of adequate capacity is available. Another alternative is to use your drilling machine as a press. Put the cylinder block flat on the table and insert the liner as far as it will go, making sure it is square. Put a hardwood block known to be parallel across two flat faces on the liner, and fit into the drill chuck a short length of bar of the maximum diameter it will take. The protruding end of this bar must have been faced square. By lowering the drill chuck it should be possible to squeeze the liner home while keeping it perfectly square.

Yet another approach, although one that should only be used if all else fails, is to protect the ends of both the liner and the cylinder with wooden blocks and to use a large clamp to squeeze the liner into the cylinder bore. Unfortunately, with clamps it is difficult to ensure the liner will be accurately placed.

The use of a retaining compound avoids all these problems; it is simply a case of cleaning the surfaces, applying the retainer and slipping the liner home. Do not cover the whole of the outside



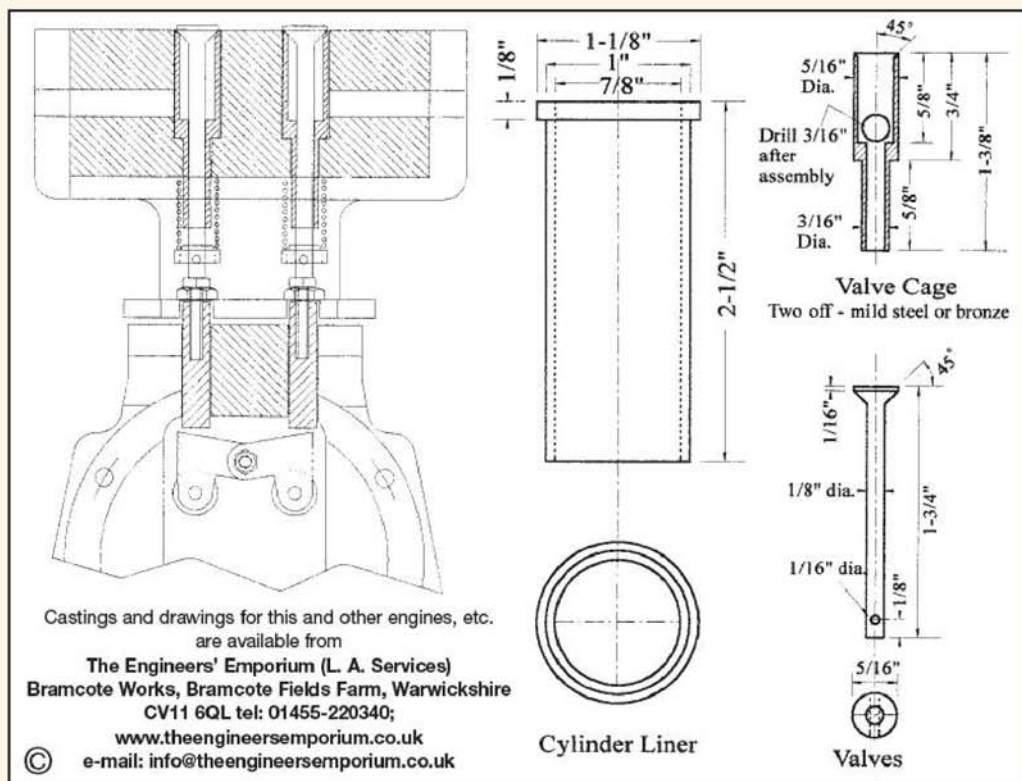
The finished cylinder liner is simply a tube with a flange at one end.



The cylinder liner is fitted into position so that its top is flush with the top of the cylinder block.



The liner protrudes from the bottom of the block to form a location spigot to fit the crankcase.



of the liner with the retainer; four or five drops spread around it will be more than sufficient to do the job (photos 47 and 48). Having used only a few drops the liner can be removed later, if necessary, by simply heating the assembly. If the whole surface of it is covered, it may never come out.

Valve cages (guides)

Before proceeding any further we will need the guides or cages for the valves which fit into the cylinder block. Little really needs to be written about the manufacture of these items; they are a simple machining and drilling exercise that anyone who has got this far will be able to manage while standing on his or her head!

The 45deg. angle can be cut with an ordinary countersink bit. I would advise you to make and use a D-bit style countersink which will cut cleanly. Many builders, however may choose to use a traditional 'rose' type countersink bit which is notorious for chatter and likely to give an uneven finish. In the latter case, once the countersink has done its job, a small piece of emery paper can be fitted between it and the work and the lathe started (photo 49). In no time you will have a smooth

surface ready for the final grinding in.

The bottom of the larger holes should be squared off with a D-bit. After assembly, they will be drilled for the inlet and exhaust. Like the liner, the guides can either be made a push fit or secured with retaining compound and, in either case, do not need an ultra-smooth finish on the outside diameters. Any slight unevenness will help to keep them in position. The same remarks apply to these items as were given for fitting the cylinder liner. If you choose to use a retaining compound, go for one of the extra strength variety, such as Loctite 638 which keeps its strength at higher temperatures than the normal grades.

If the guides are a push fit, insert them by using a length of 5/16in. dia. brass rod in the larger diameter hole and tap it home with a hammer. Whatever happens, do not try and drive them in by applying force to the chamfered top.

The drawings supplied with the castings simply show the guides as being made from steel or brass; frankly, neither is a very suitable material for this application. It is better to use silver-steel, which can be hardened. The alternative, if you are looking for an easy life, would be to use bronze.

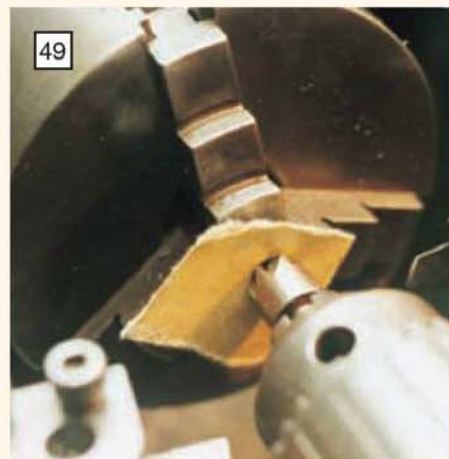
Valves

I had to exercise the grey matter somewhat before arriving at a method of manufacture suitable for the less experienced among us when making the valves, which are 1 3/4in. long. It is this length which the problem since the stems are only 1/8in. dia. and they need to be perfectly smooth in order both to give a nice smooth action and also to prevent fuel or oil from leaking past them. In full size they would be ground to size, but few readers are likely to have facilities to do this at home.

The original drawings show the valves as being made from mild steel, a material which is really only suitable for an engine which will not run much. Mild steel will wear away rapidly if left in its 'normal' state. A good quality case hardening steel such as EN32 could be used, case hardened to a reasonable depth but in the process there is every chance that the stems will distort making them useless. The best approach is likely to be to use silver-steel, but this makes the task of machining the stem to the required diameter even more difficult! Nevertheless, mild steel should definitely be avoided.

Next time I will describe two methods of making the valves and will leave the final decision as to how to proceed with the reader.

●To be continued.



The Author's method for cleaning up a countersunk surface with chatter marks.

EARLY DAYS

Martin Evans

returns to Noel Street with some recollections of his first locomotive design, visitors, and staff in days which sadly have long since gone.

●Part II continued from page 583
(M.E. 4184, 13 December 2002)

When I first arrived at the *Model Engineer* premises, I was shown around the various offices and was very pleasantly surprised to find that there was a large basement which had clearly been used for practical model engineering, although it looked a bit run down. The equipment included a Myford lathe, a small EW lathe, a drilling machine, gas brazing equipment and a very large test boiler! I was told that most of my time would be spent either in this basement or in one of the offices on the third floor. Here I was given a board, next to the company's draftsman, and I was told to take my initial orders from Maskelyne, whose office was situated next door.

One morning, Maskelyne came in to suggest that my first task might be to make a Gauge 1 steam model to one of his own early designs. I was delighted with the idea. The model was a freelance 4-4-0 with outside cylinders and gas firing. The necessary castings were available, duly arrived and I was able to make an early start. The idea was that as I built the model, an article was to be written in



The late J. N. Maskelyne takes the regulator. At the rear of his train is the late Bill Hughes.

suitable form for publication in *Model Engineer*. Each part had to be photographed as I made it — there was a full-time photographer on the premises

surprised at the quiet, relaxed atmosphere at Noel Street, and I found working there to be a real pleasure. The Maskelyne 4-4-0 was eventually



A fine 3 1/2in. gauge Jubilee 2-6-4T to the Author's design.

— and it did not take me long to get into the 'swing' of it. Progress was made quite quickly.

As I mentioned in my first article I was very

finished and tested. It was now time for something more advanced and discussions were held between the Editor, Mr. Maskelyne and myself as to the next project to be undertaken. It just so happened that all this coincided with the Jubilee of *Model Engineer*, and it was decided that the next model locomotive was to be named *Jubilee*. After considerable discussion, it was agreed that the model should be a scale model of the LMS Stanier two-cylinder 2-6-4 tank, a handsome and successful design in full-size. Suitable castings were obtained from Reeves of Birmingham, and I was started on the drawings, which took some weeks to complete, during which I had some help from Maskelyne, who at that time was spending his last few months in harness before retiring



This formal pose recalls early days of the Model Engineer Exhibition in the Horticultural Hall in London.

Workshop equipment

I had not been working very long at Noel Street before a new phase came along. Following Maskelyne's retirement, the company needed someone to take over the handling of the technical queries from readers, most of which were either about model engineering, model steam locomotives or the full-size railways. By this time, Editor Howard had realised that I had a good working knowledge of full-size railways, so all queries on this subject were now passed on to me. This quite suited me, in fact I found dealing with the various queries most interesting, as many of them came from abroad, from countries including Australia, New Zealand, Canada, the United States, South Africa, and even from Saudi Arabia and Tasmania!

Meanwhile, work was proceeding with *Jubilee* and I soon found that the use of some kind of milling machine was desirable if progress was to be made, particularly where parts such as coupling and connecting rods were concerned. So, Oliver Smith and I approached the General Manager with the request that a milling machine should be obtained. I was somewhat surprised when the GM agreed to the purchase, as long as we did not expect a grand new machine. So my colleague and I started looking through the small advertisements



Above: the late Bill Carter at the regulator of his superb 5in. gauge 'Atlantic' on the Beech Hurst track. Riding behind him is the late K. N. Harris.

Top left: the late John Neville Maskelyne with a gauge 1 live steam locomotive to his own design and built by the Author.

Bottom left: In conversation with Gilbert Harding, Nevil Shute (left) was a great admirer of Edgar Westbury, hence his best-selling book: Trustee from the Toolroom

in *Machinery* and some other magazines. We did not quite see eye to eye as to whether we should go for a vertical or a horizontal machine. Oliver favoured a vertical mill, while, with thoughts of coupling and connecting rods in mind, I had a slight preference for a horizontal milling machine.

As it turned out, we came across a very nice Tom Senior horizontal machine in very good condition and at a reasonable price. We accordingly went for this and some ten days or so later, the machine was installed in our workshop and immediately put to work. At about the same time, the company acquired a second Myford lathe so that Oliver and I could carry out our lathe work without having to share the one machine. While I am not certain, I have the idea that this second lathe was actually a gift from Cecil Moore, Founder and Managing Director of Myford Ltd. This was a definite possibility — Cecil was a most generous man, as I was to discover later on. In fact, he gave LBSC a Myford Super Seven lathe at about this time!

Welcome visitors

One of the delights of working at Noel Street was the arrival of visitors. While many came from America and Australia, we used to get visitors from countries all over the world. It goes without saying that they were always shown into the Managing Director's office at first, from where they would follow a call to Leslie Howard's office and then, of course, to see Edgar Westbury. Visitors would nearly always insist on seeing the basement workshop, where I would probably be found working on one of the Myford lathes. Readers can imagine how the conversation would then continue.

One of my most interesting visitors was Robin Riddles of British Railways. Maskelyne was previously informed of Robin's impending arrival and came up specially from his home near Reading to meet him. Nearly all the more important regular writers in *Model Engineer* would call at the office from time to time, and all would want to see what was going on in the workshop — so there was never a dull moment! Writers such as Bill Hughes, H. H. Groves, Geoffrey K. King, K. N. Harris, E. H. Jeynes, Harry Clarkson, John Crawley, David Curwen, and many others, were all welcome visitors from time to time.

I was once asked if I knew Henry Greenly, my response has to be not really, as there was too much of an age difference for the great man to take any notice of me. I have always admired Henry Greenly and am aware that his work has been much criticised in recent years. In fact, he was a great engineer and model engineer. He was extremely versatile, designing models for '00'-gauge yet able to cope with full-size engineering both Civil and Mechanical. I am sure many readers will know of his fine 15in. gauge locomotives which are still running today.

It is very easy to criticise Greenly on the grounds that he favoured locomotive boilers built up in the traditional way and caulked with soft solder, but propane blowpipes were unknown in Greenly's time. One could not just pop round to the nearest LPG distributor as we can today. No, Greenly was a fine model engineer.

At one time he employed A. P. Campbell, a craftsman who built many of his models for his

customers. He came to work for me for a short time when I had my model business near Victoria, and was a very fine craftsman. Among many other fine models, he built the 1in. scale GW 'King' which once graced Paddington Station.

Editorial meetings

My first promotion came in 1962, when Edgar Westbury retired and I became Technical Editor. As it turned out, this did not make a great deal of difference to my work — I continued to spend at least half of my time in the workshop, but something which I recall clearly were the Editorial meetings which were held once a month in the MD's office. Present would be Editor Leslie Howard, Edgar Westbury (up to his retirement) Oliver Smith, the company photographer and one of the editorial staff. At these meetings I would naturally be putting forward the locomotive side, Smith would be pushing for more articles on model ship building, while Westbury would generally take a more middle line. Tempers sometimes got a little out of hand, and I always used to admire the way Westbury managed to cool things down, often with a well-chosen joke!

As can be imagined, Westbury was a very fine model engineer, in fact I would go so far as to state that Edgar Westbury was the greatest of all the well-known model engineers. Just consider how he kept the *Model Engineer* going right through the War! It was shortly after Westbury had retired that the row over the LBSC articles reared its ugly head. But this I must leave until next time.

● *To be continued.*

A FERRIS WHEEL CLOCK

Richard Stephen

explains how to position the lifting tube and contact assembly on the base plate.

●Part XI continued from page 592
(M.E. 4184, 13 December 2002)

The brass base plate for the clock can now be prepared; it is shown in fig 44. Looking back at part VII of this series (p291, M.E. 4178, 20 September 2002) I note that the recess sizes in the feet of the wooden test base (fig 27) were given incorrectly. All is not lost however as some quick work with a chisel or a milling cutter will soon open up the recesses to the required size and allow the base to sit in them as intended. Sorry about the mix up! The location of the movement on the base plate can be gauged from the position adopted on the wooden test base and the holes for the fixing screws drilled accordingly or marked out using the little 'spurs' prepared earlier.

I have not provided any detailed drawings for the positioning of the lifting tube and the contact assembly. The precise point that the ball rolls off the Ferris wheel determines the position of the contact assembly. It is unlikely that a Ferris wheel made by a reader will drop a ball at exactly the same position as the one that I made for my clock, even if the movement is positioned as mine.

Attach the assembled movement, excluding the pallets, to the base plate and secure the base plate onto the test base you made earlier. Using a spirit level, check that the surface of the base plate is level. Place a ball in one

of the slots and allow the wheel to rotate very slowly until the ball just rolls out of the slot. Stop the wheel at this position. Now rest an engineer's square on the base plate with the blade of the square just touching the periphery of the slot the ball rolled out of. Mark the position of the blade on the base plate but do not use a scribe, as this will require the expenditure of significant amounts of elbow grease to remove the mark when polishing the base plate! Repeat the above for all the slots in the wheel. If the drop off positions are all the same ($\pm 0.5\text{mm}$) you can proceed, if not you will need to adjust the profile of the wheel using a fine file until they are.

Measure the height from the base to the point on the wheel where the ball drops off ('h' mm) and make a note of it. This measurement is required



The contact assembly and quarter hour strike mechanism attached to the front time bar.

from the front long edge of the base plate to the point midway between the two sides of the wheel. Draw a line on the base plate this distance parallel with the long side. Locate the point 'D' on this line and mark a point ('d' mm) from 'D' on the line. This is the position of the 6mm hole for the locating peg at the base of the contact stand. Before drilling this hole repeat the above and check the position very carefully. *If the hole is drilled incorrectly the base plate will be scrap.*

Fit the contacts on the stand into the hole in the base and line up the contacts with the wheel. Place a ball in one of the slots and check that it drops off and runs smoothly down. If you have an electrical test meter, check that the ball closes the circuit as it runs down between the two contacts. When you are satisfied with the position, drill and tap the three 2mm dia. screw holes that are used to secure the contact assembly to the base.

The lifting tube can now be attached to the base. The position of the lifting tube is not as critical as that of the contacts. The centre of the lifting tube is situated 'b' mm from the front long edge of the base and approximately 35mm from the side edge. The entrance for the balls in the lifting tube has to line up with the

contact assembly.

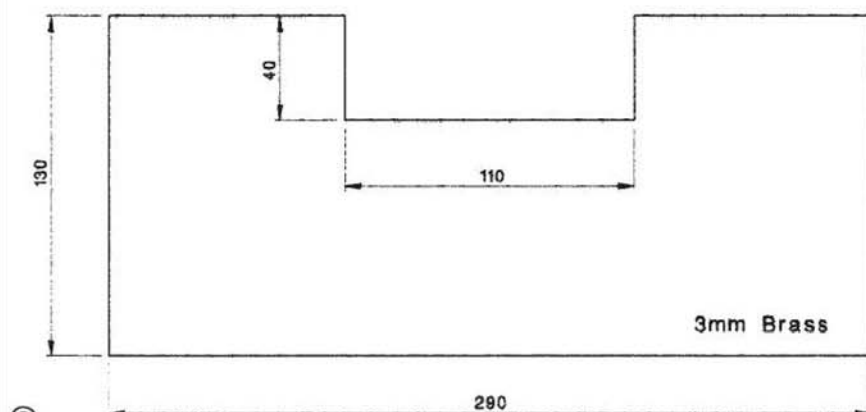
Drill and ream a 5mm dia. hole in the base plate. Fit the Archimedes screw on its arbor in the lifting tube. The arbor fitted in the 5mm hole will make it a lot easier to orientate the lifting tube for drilling the holes for the screws. Drill and tap the three holes for the 2.5mm dia. screws that secure the lifting tube to the base. The 5mm dia. hole in the base is now bored out to a diameter of 22mm.

The track rods that connect the contact assembly to the lifting

tube should be fitted now. The track for my clock is illustrated in the photographs. The track rods are not straight but are slightly curved to provide clearance for the balls to run under the bottom pillar of the movement. The curvature of the track rods and their length depends on the relative positions of the contact assembly and the lifting tube. As a result I am afraid that fitting the track in place is a matter of trial and error. I used a piece of wire bent to the approximate shape to estimate the length and then added on 5mm. I gradually reduced the length until I got the track to fit between the lifting tube and the contact assembly.

Reassemble everything and check that the balls drop off and roll smoothly down the track into the lifting tube.

Figure 44 - Base



later. Now move the square 12mm away from the drop off line with the blade midway between the sides of the wheel. Place a ball in a slot and allow the wheel to rotate until the ball drops off. When it drops off, the ball should just touch the edge of the blade. If the ball does not just touch the blade of the square, reposition it until it does.

Carefully mark this position on the base, which we will refer to as 'D'. Draw a horizontal line on the side of the contact assembly you have just made 'h' mm from the base. The point where this line meets the edge of the contact we shall call 'A'. Measure the distance ('d' mm) between the point 'A' and the central axis of the stand. We are now able to determine the position of the 6mm hole in the base plate for the locating peg at the bottom of the contact stand. Measure the distance ('b' mm)



Above: a view of the quarter hour strike mechanism reflected in the highly polished brass base plate of the clock. Note the snug fit of the bell under the track.

Top right: the contact support and entrance track for the prototype clock. This photo gives some idea of the curve required in the track rods.

Right: the Archimedes' screw looking from below. The edge chamfers and the hooked shape of the leading edge of the screw are apparent.



Finishing the Archimedes screw and getting the balls to lift

The thread of the Archimedes screw needs to be filed to shape before it will work. The pitch of the thread was made to be equal to the diameter of the balls and the depth of the thread 0.50mm greater than the radius. As a consequence, the separation between the threads is less than the diameter of a ball (the separation is 14.2mm, the pitch 15mm minus the thickness of the thread, 0.80mm). The photograph shows the profile of the thread from my clock, which will give you an indication of how to proceed. Again, it is a matter of trial and error.

As the motor has not been fitted, the screw will have to be turned by hand. To make it easier to turn the arbor of the screw with your fingers, knurl a short length of 20mm dia. bar and secure it to the screw arbor with a grub screw. Begin the shaping by chamfering the underside of the top of the thread. Carefully file the bottom of the thread until a ball fully enters the screw and rests against the shaft. The bottom of the thread should be filed to the hook shape shown. This ensures that as the screw rotates, the initial contact of the thread against a ball pushes the ball vertically. If the thread initially contacts a ball slightly on the side, the thread will push the ball outwards causing it to jam against the side of the lifting tube.

The four balls on the track provide an adequate force to hold the ball resting on the platform in a position to be cleanly picked up by the thread. Turning the screw should pick up the ball on the platform cleanly, lift it past the non-return catch and allow the catch to drop back down leaving the ball in the vertical track. Finally check that the lift works with the vertical track filled with balls. If you do not get the screw to work initially you will have to persevere until you do get it to work. It took me some time before I got mine to work. It now works perfectly and has done so for many months.

Finishing the track

All that remains to be done is to complete that part of the track down which the balls roll onto the wheel. Figure 42 (see Part X in this series, p591, M.E. 4184, 13 December 2002) shows this section of the track. This section of track is held in place by two grub screws and supported by the curved section silver-soldered to the front vertical

track rod and secured with a screw passing through the bracket. The two track rods are silver-soldered to the bracket.

Like many of the parts of the lifting mechanism, this section of track has to be made to fit. A close examination of the front of the track shows that the front of the two rods have been chamfered. The clearance between the front of the track and the wheel should be as small as possible. The

overall height of the vertical and delivery track should be such that the balls roll smoothly from the track onto the wheel. The vertical track rods were initially made a little overlength; these will have to be reduced in length to make the delivery from track to wheel smooth.

Quarter hour strike

When a ball drops off the Ferris wheel every 15 minutes, I felt that in addition to just producing a clatter, the drop of the ball might as well strike a bell. The bell I used was one I picked up years ago among some horological odd and ends. The size of bell I used is 50mm diameter by 20mm high. Any other bell that will fit under the track will do equally well.

The details and dimensions of the striking mechanism are shown in fig 45. The position of the hole in the front time bar for attaching the strike must be arranged to suit your bell.

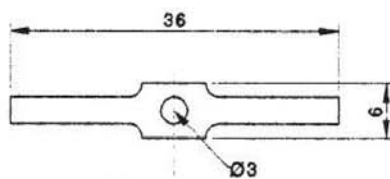
Motor drive

The motor I used for driving the ball lift is a Buhler 12 volt unit with an integral gearbox, geared down to 60rpm. The motor spindle is fitted with a 20 tooth pinion wheel which drives a 60 tooth wheel fixed to the arbor of the screw giving a further speed reduction to 20rpm. The motor is powered by four alkaline D cells connected in series to provide 6 volts. At this reduced voltage, the motor runs at approximately 10rpm. At this drive voltage the torque delivered to the screw is more than adequate to lift a column of thirteen 15mm dia. steel balls. The Buhler motor is available from Motors Direct as specified in Part I of this series (p177, M.E. 4186, 5 April 2002). The Buhler motor has proved to be an excellent choice for the following reasons:

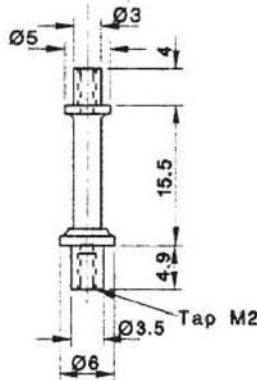
- 1: There is no significant over-run when the motor is turned off.
- 2: Power consumption is such that the clock runs for at least 4 months on one set of alkaline D cells.
- 3: Motor and gearbox are almost silent.
- 4: At £7.50, cost is very reasonable.
- 5: The 6 volt supply for the motor also supplies the electronic control board.

My latest information is that the actual motor which I used is no longer available from Motors Direct but that a suitable alternative is offered.

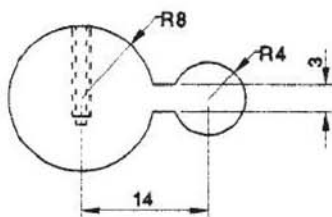
Figure 45



Striker Arm (adjust as necessary)

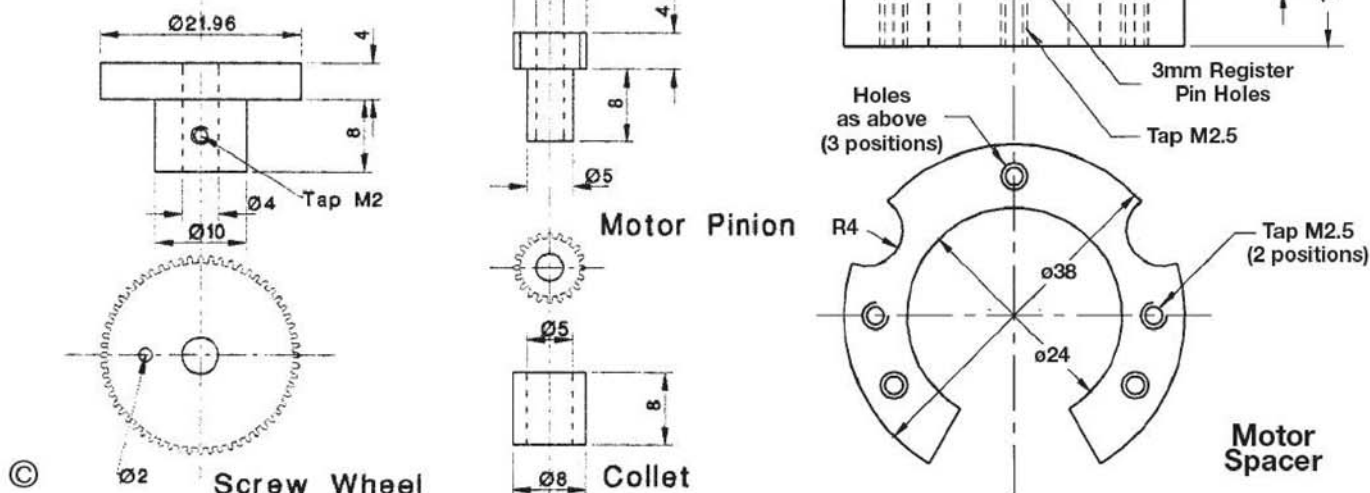


Bell Strike Arbor (adjust as necessary)



Bell Hammer

Figure 46
Archimedes Screw Drive Components
First Angle Projection



The replacement has a different output speed, which can be accommodated by modifying the gear ratio between the motor and the Archimedes screw. The design is flexible so there is no reason why another type of motor could not be used. It is simply a case of the appropriate modifications being made for mounting the motor. Readers who have come this far with the clock should have no difficulty sorting out the necessary details.

Mounting the motor

My motor is mounted on a piece of 3mm brass sheet 50 x 80mm (x, y). Begin by drilling the holes to secure the motor to the piece of brass sheet. Start by drilling a 3mm hole, the diameter of the motor shaft, at the position x = 25mm, y = 35mm. Positioning the holes for the screws that attach the Buhler motor to the mounting plate is rather awkward as the screw holes are not symmetrically placed with respect to the shaft.

My method was as follows. The motor was held in the vice in the milling machine with the long side of the casing parallel with the x-axis of the mill. Using the centring microscope, the centre of the motor shaft was picked up and the x and y digital read-outs zeroed at this position. Using the microscope, the co-ordinates of the three holes relative to the centre of the shaft were measured. The mounting plate was then clamped to the bed of the mill with the long edge of the plate parallel to the x-axis. The centre of the hole drilled for the shaft was then located using the microscope and the digital read-outs zeroed. The three 3mm dia. holes for the screws were then drilled and countersunk at the previously measured co-ordinate positions.

Alternatively, you could adopt the method used to drill the holes to screw the movement to the wooden test base. You will need two short lengths of 3mm steel screwed rod (the screws for mounting the motor are 3mm). Holding the screw rod in a collet or 3-jaw chuck, turn a sharp point on the end of each piece. Screw one of the pieces into one of the threaded holes in the motor and using the motor shaft as a centre, scribe an arc. The screw hole will lie on this arc. Measure the distance of the centre of the hole from the long side of the motor casing. Adding 2mm to this measurement mark a point on the arc this distance from the long edge of the plate. Drill a 1mm dia. hole at this point. Now screw one of the

Archimedes' Screw Drive Gears				
	Module	No. of teeth	Pitch Circle Dia. (mm)	Full Dia. (mm)
Motor Pinion	0.35	20	7.0	7.96
Screw wheel	0.35	60	21.0	21.96



The Buhler 12V motor and its mounting as devised to drive the Archimedes screw and described by the Author for his prototype clock.

threaded points into a second hole. Again using the shaft as a centre, scribe a second arc. Screw the second threaded point into the first hole. Using the 1mm hole just drilled as a centre, scribe a second arc to intersect the one just drawn. The intersection of the two arcs is the position of the second hole. Again drill a 1mm dia. hole at this point.

Repeat the above to mark the position of the third mounting hole. This last hole can be drilled 3mm dia. and countersunk. The two 1mm dia. holes can now be drilled out to 3mm dia. and countersunk. Check that the holes drilled in the

plate line up with the holes in the motor casing and that the screws tighten up easily.

Motor pinion and Archimedes screw wheel

Details of the motor pinion and screw wheel are given in fig 46 and the adjacent table. The motor pinion is made from a length of EN1A mild steel rod and can be cut quite satisfactorily using a wheel cutter. There is no need to harden and temper the pinion. The collet for the pinion is also made from a piece of EN1A mild steel. I fitted a collet which made it easier to drill and tap the thread for the 2mm dia. grub screw. The wheel is best made from a length of 25mm dia. brass bar. The collet can then be made as an integral part of the wheel.

Depth the wheel and pinion and mark the position of the screw arbor on the motor mount. Drill and ream a 2mm dia. hole. With the 2mm dia. hole as centre, mark the positions of three 1.5mm dia. register pins and two 2.5mm dia. screws on the circumference of a circle having a 15.5mm radius. Drill the holes for the register pins and the screws.

Spacer

The motor should be mounted 10mm below the base plate of the clock to provide space for the motor pinion and Archimedes screw wheel. Figure 46 illustrates the details and dimensions of the required spacer. The spacer is attached to the base plate by three 2.5mm dia. screws positioned as shown in the drawing.

The spacer is made from a 12mm length of 38mm dia. (1.5in.) brass bar. Begin by facing off both ends of the length of bar. Reduce one end for a length of 2mm to 22mm, the diameter of the hole bored in the base plate. Fit the 22mm dia. end into the hole in the base plate and mark the positions of the 2.5mm dia. screws that attach the spacer to the base. Drill and tap the holes for the screws. The holes must be no deeper than 6mm.

The holes for the motor mount register pins will be drilled in the same positions on the other side of the spacer. The spacer is now bored out to 22mm, the diameter of the hole in the base plate. Access for the screws that attach the lifting tube to the base plate are cut with a 6mm slot drill.

●To be continued.

Neville Evans

discusses the construction of the cab for the 'Big Goods' and replies to a letter from a reader.

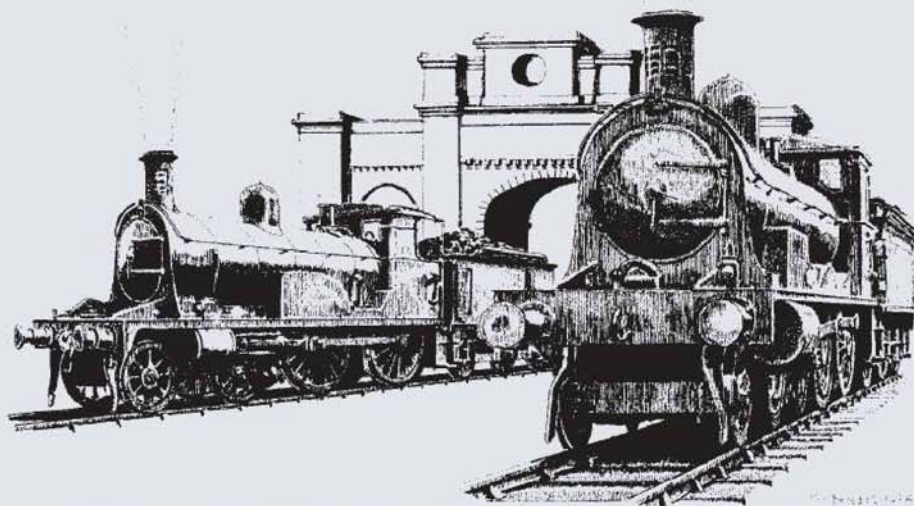
●Part XXII continued from page 596
(M.E. 4184, 13 December 2002)

The Highland Railway cab is usually ascribed to William Stroudley, who was responsible for the training of so many eminent locomotive engineers. Graham King, my Hibernian ally, thinks that the idea came from Mr. Steele-Brown, who was Stroudley's boss at Cowlairs, when he worked for the Glasgow and Edinburgh Railway in about 1861. I can't find any mention of this design on the Highland prior to Stroudley's arrival, so presumably he brought it with him.

Before we start on the cab proper, so to speak, I feel that a few more words on the subject of material thickness are called for. For 5in. gauge models of standard gauge locomotives, one inch (full size) is represented by 0.089in. or 89 thou. if you prefer, or even 2.25mm, on the model. With the 'Big Goods' and the 'Loch', the platforms are made of $\frac{7}{16}$ in. thick steel plate, which scales out pretty well to 1mm. Add a coat or three of paint and you're there. The only other plain edges that spring to mind (and it's only the edges that we need worry about), are the cab ends and the edges of the various angles and 'T' sections.

In full size, I think the cab sides are made of $\frac{1}{4}$ in. plate, which can be conveniently modelled from 0.022 in. thick material. My personal preference is to use 24swg tinplate, which comes in large mirror finished sheets at about £5 each, from your friendly local tinplate stockist (see *Yellow Pages*). I have detailed nominal sizes for sheet thicknesses, as most people will make up the platework from whatever they consider to be appropriate, or indeed what comes to hand.

The principle feature of the cab is its rather elaborate roof. Before we get there however, I should draw attention to the joint between the top and bottom halves of the cab. The bottom half is finished with a 'T' section strapping which should be made in steel. Brass won't do here as the unpainted, polished steel is quite a significant feature which continues, to form the rounded end



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

to which the large stanchion is bolted.

The best way to make this part is probably to mill out the section from a piece of steel plate, leaving about $\frac{3}{8}$ in. or so to hold it, and then milling off the excess after turning it over in the machine vice and holding it by the bottom leg of the 'T'. The corner piece can be turned from 1in. round bar steel, cut off at a 90deg. angle, and the three parts silver-soldered together. Another piece of steel is lapped around the cab cut out. This is polished on the outside and painted on the inside, as can be seen in the photos. I think that this particular part had better be a 'T' section, soldered up from strip for the outside, with the inside cut from a thinnish (e.g. 20 swg) plate.

The top to bottom cab joint is made with a line of round headed bolts, with nuts on the underside, as per the drawing. I have shown 10BA bolts which really are a bit too big for this application. We do, however, have to strike a happy medium between scale and practicality, and I think that a size smaller might be a size too small. Suffice it

to say that 10BA round heads are available from our advertisers and in my opinion they fit the bill. Both the 'T' section, and the angle that bolts onto it, are sweated onto the cab side with soft solder. In full size, they are held on by small rivets as can be seen from the photograph. These rivets scale out to $\frac{1}{32}$ in. heads at $\frac{1}{4}$ in. spacing. They are best simulated by using a rivet press that I shall be describing shortly for use on the GWR 4-6-0s.

Cab roof

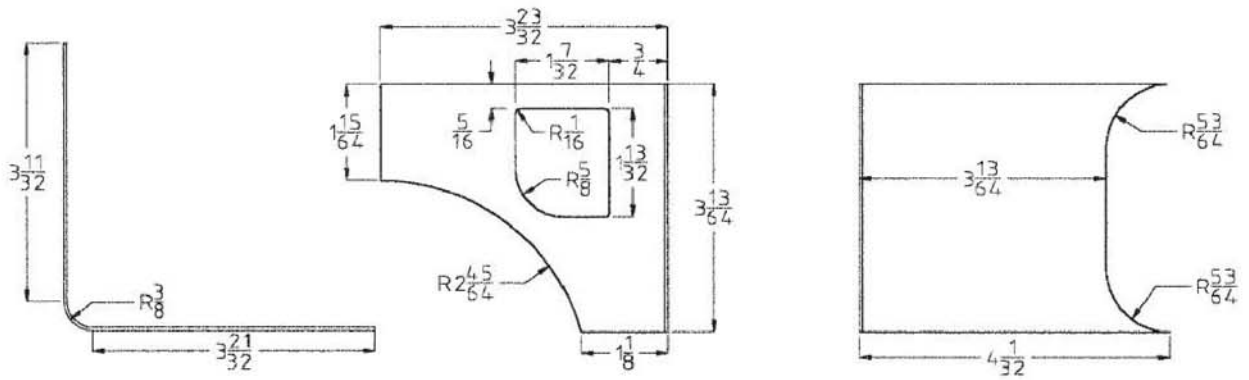
The top of the cab side sheets is finished by a $\frac{3}{16}$ in. brass angle. This angle has yet another angle superimposed upon it and the roof itself sits in the space made by the uppermost angle. It all sounds rather complex, but a short perusal of the drawings and photos will make it quite obvious. I would suggest that the angle corners be fabricated, in the same way as the lower angles. Bending over a former is the only alternative, but as this is quite beyond my skills I really can't recommend it. I always seem to flatten or split the vertical bit, no



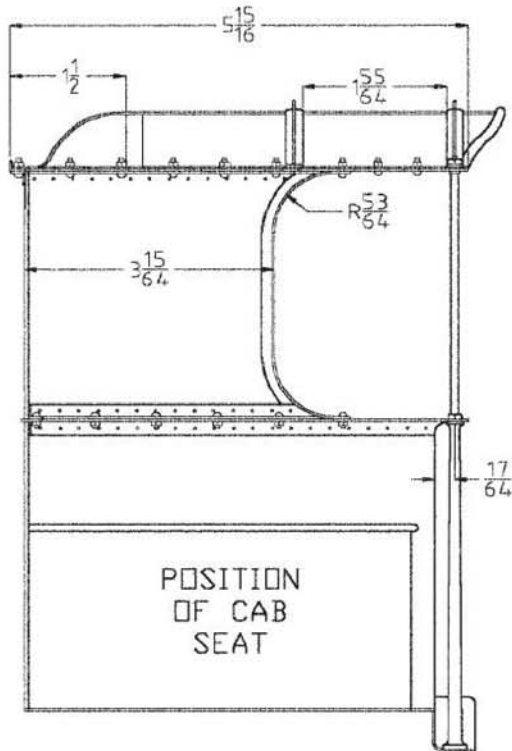
Cab top detail of Highland Railway No. 103 'Big Goods' at Glasgow Museum of Transport.



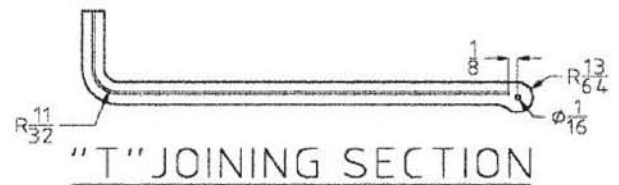
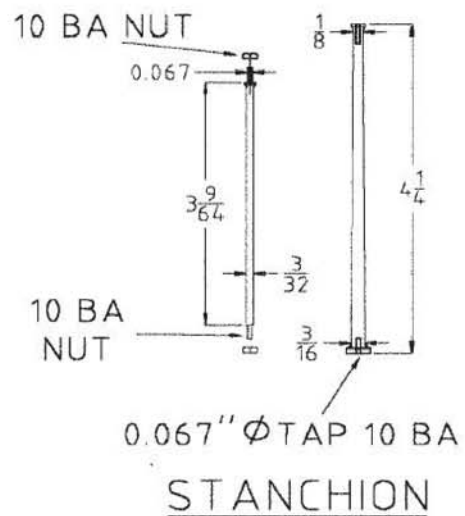
This view of the cab roof of H.R. No. 103 reveals its compound radius form. Painted matt grey, it is bolted to an angle iron surround.



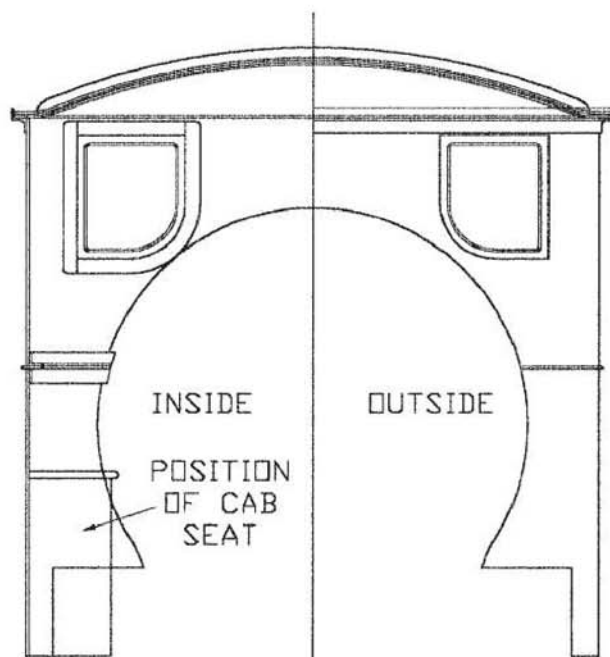
UPPER CAB SHEETS 2 OFF HANDED



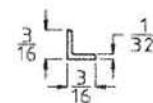
CAB SIDE ASSEMBLY



"T" JOINING SECTION



CAB FRONT ASSEMBLY



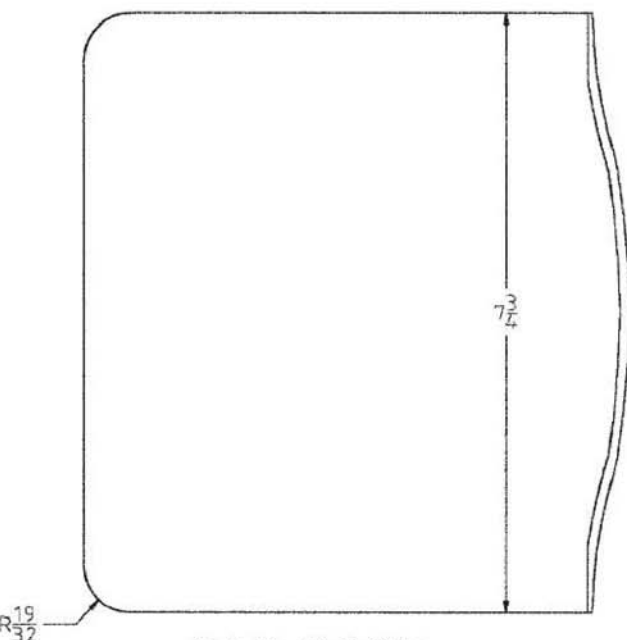
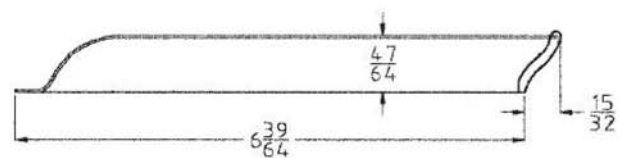
ANGLE SECTION



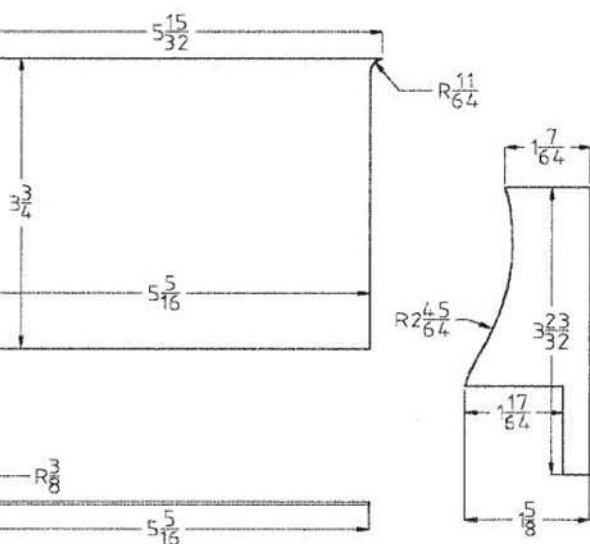
"T" SECTION

LOWER C

BIG C

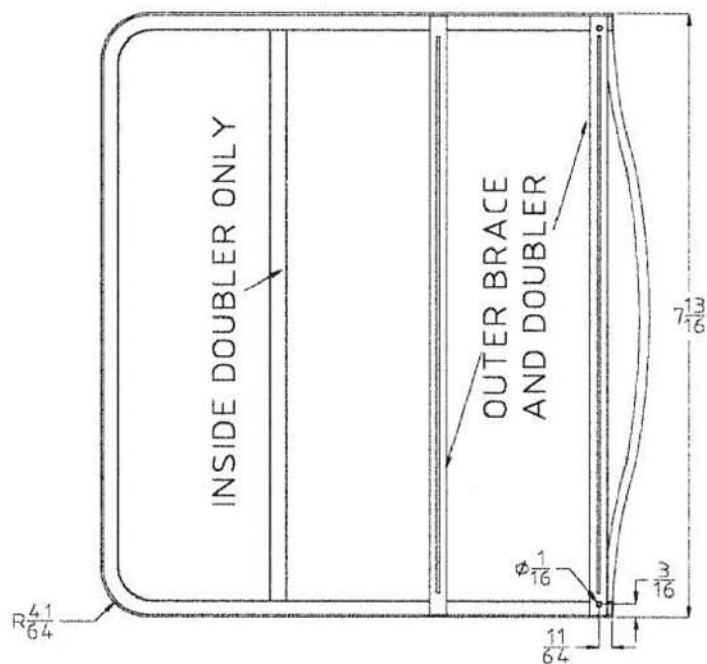


CAB ROOF

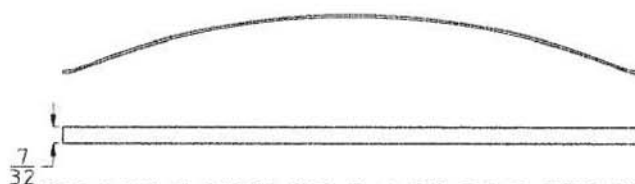


CAB SHEETS 2 OFF HANDED

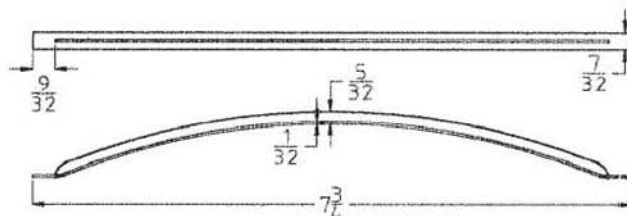
GOODS CAB



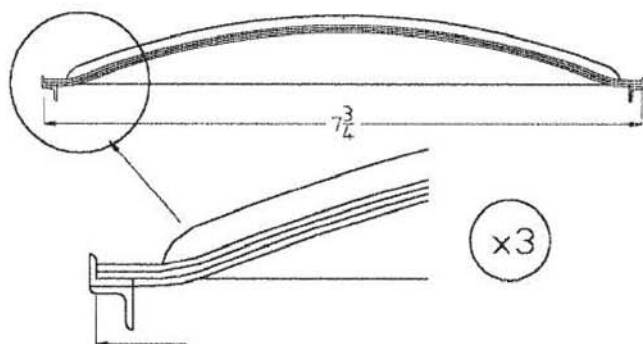
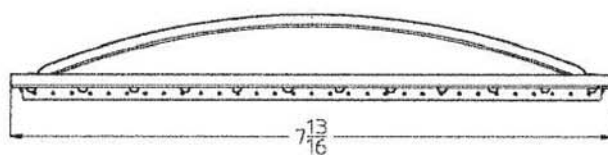
ROOF ASSEMBLY
1 OFF



BRACE DOUBLER 3 OFF 24G STRIP



OUTER ROOF BRACE
2 OFF 20G FABRICATION



ROOF SECTIONS

matter how well I anneal it.

I am using some 20swg copper for my own roof, and have beaten it over a simple, hardwood former. Anneal well, press the side edges onto the former and clamp them using two pieces of wood of appropriate radius.



Inside the cab of No. 103; note the bracing doubler inside the rear edge of the roof.

The front of the roof can then be beaten gently around the curved front of the former, annealing when necessary as you go. It's a flanging process really, so anyone who has ever built a boiler, or part thereof, should have no problems at all.

The back end is finished with a half round beading, which should be flattened a little with a file to give a more elliptical look. The roof is then bolted to the inside of the top angle as the photo and drawings show. The two outside stiffeners and the three inside braces are built up and sweated on, or in, as the case may be. In full size, of course, the inside pieces were doublers, to give a more substantial seat to the rivets that fixed it all together.

There are two cab seats, one on either side, and these, together with the various rails and handles, will come under the 'blobs and gadgets' section.



This interior cab view of No. 103 at Glasgow shows the spectacle plate and window latch.

Readers letters

An interesting letter appeared in Post Bag (*M.E.* 4182, 15 November 2002) under the heading *Swindon locomotives*. I'm sorry that Mr. Barton feels that he has been "lumbered with Penrhos Grange". The facts are a little different, however. I live in the west side of the country, and had Mr. Barton visited the recent Bristol show he would have seen the immense popularity of GWR locos in general and *Torquay Manor* in particular. I counted no less than 12 examples of the 'Manor' on show, ranging from half-completed chassis, to finished engines. It should be obvious that the Great Western 4-6-0 is by far the most desirable engine to a large majority of enthusiasts, and therefore I decided that the time was ripe for the rest of them to be described, in reasonable detail and with a closer attention to scale appearance than was thought necessary 30 years ago.

I don't understand the rest of the letter; is Mr. Barton talking about full size locos or our smaller versions? Does he honestly think that we need wide fireboxes to burn 'low grade' coal? There is no shortage that I have ever noticed, of top quality coal around the clubs, and a narrow firebox is more efficient than a wide one. The photo that he supplied is of a standard ALCO Mogul as used by most of the US railways. A super engine, but I wonder how many would actually be seen on British tracks in 10 years time? About as many as we see *Natals*, *Caribous*, *Maisies* and *Ayeshas* I suspect. My personal preference would be for something like a Midland Compound, a Chapelon Pacific, or the magnificent looking, but totally unsuccessful 3-cylinder Pickerskill class 956. Graham King keeps gently pushing the

Pickerskill 4-4-0s, and I have looked into the possibility of a 'Schools' class 4-4-0. An engine with which I am very taken, is the Smith 4-cylinder compound Atlantic of the North Eastern Railway. I did in fact draw a Sin.



Inside the cab of No. 103; note the polished trim and rivetted 'T' section.

version of this locomotive a few years ago, but was put off by the 7ft. 1in. diameter coupled wheels. The great snag with all of these projects, with the possible exception of the Caley 4-4-0 or possibly a Drummond D15, one of the best inside cylindered 4-4-0s ever made, is the enormous cost of pattern making. I have just been quoted a huge sum, three times what I would deem to be reasonable, for a pattern for a 'County' wheel. It would be impossible to amortise a capital outlay of that nature, in a run of even 50 wheels, at £45 each.

So, Mr. Barton, by all means produce your range of wide firebox American locos, learn how to use CAD, design the engines, get the patterns made, and write it up in *Model Engineer* and I for one wish you the best of luck.

●To be continued.



New Methfix® and Pressfix® transfers from HMRS

The Historical Model Railway Society is pleased to announce the release of a further 24 sheets of transfers to augment their

existing comprehensive range. These private owner wagon alphabets are suitable for all gauges, cover letter heights from 1.3 to 12.8mm in condensed and non-condensed fonts in white or white shaded black in either the Methfix® or Pressfix® styles. Part of sheet P5S (4mm and 1.3mm) is shown alongside. HMRS transfers range in price from £4.50 to £16.50 (plus P&P) according to size and style. They are available from model shops, exhibition traders and by mail order from HMRS Transfers, 8 Gilpin Green, Harpenden, Hertfordshire AL5 5NR. Please write for a complete list and further information.



FACEPLATE DOGS

Peter Spenlove-Spenlove describes these handy work holding devices with applications for a variety of machine tools used in the home workshop.

●Part II continued from page 605
(M.E. 4184, 13 December 2002)

Returning to the topic of faceplate dogs following the very brief introduction made in Part I of this short series, I referred to heavy duty dogs constructed with a sliding jaw configuration and normally sold in sets of four. Figure 1 here illustrates the type, which could be very large and used when machining heavy items.

These big faceplate dogs were used on large horizontal lathes for repetition work on large components, but they were more commonly used on vertical lathes. A vertical lathe is equipped with a huge faceplate but has no tailstock. It is up-ended so that the headstock can be sunk into a pit with the faceplate level with, or just above, the floor. A vertical bed carries the turning and boring tool slides. The work, which is often large, can be manhandled onto the faceplate for clamping and setting to run true. The faceplate dogs of the type described assist in the adjustment of the work.

Not far from my home I recall watching a huge casting being set, clamped and bored on a 25ft. diameter faceplate. With the faceplate rotating at 3rpm, the work was slow and tedious.

While working, the operator placed a stout fence around the machine to stop errant forklift truck drivers from straying on to his faceplate from the gangways alongside. In these days of relatively small high-speed engines you may wonder what products need bores and diameters of 20ft. or more. The answer is very few these days, except for low-speed, vertical shaft water turbine/alternator sets which are built into the base of large dams, and some special types of electric motor which are directly coupled to steel rolling mill stands. Even these are becoming scarce and I suggest that one large boring lathe could probably serve the world's needs in respect of work of this size.

Readers familiar with church bells may be aware, or if not, may be interested to know that bells are tuned by machining their internal profile with the bell mounted mouth upwards on the faceplate of a vertical lathe. The bell is tuned to sound a minor chord by carefully machining the profile at particular locations between the crown and the lip — a highly skilled operation.

An interesting variation on the basic type of lathe faceplate dog is shown here in photo 1. A low profile variety, an advantage of this type is that the workpiece is pulled downwards onto the working surface as it is gripped.

Most readers today accept that a 4-jaw chuck is part of the standard equipment for a lathe. However, back in 1913, a lathe chuck as we know it was a very expensive item. For this reason faceplates and dogs were extensively used, especially the stepped type. If you still work this way there is one thing that can make life easier. If you have some suitable Belleville disc springs (see p481, M.E. 4182, 15 November 2002), put one under each clamp nut with a stout plain washer on top when clamping work to the faceplate. This will provide sufficient friction to enable the nuts to be slackened for work adjustment without the whole thing running amok.

On looking at photo 1 in Part I of this brief series, which shows a Myford catch plate with the Wade dogs fitted, new readers may wonder why there is a loop of material around the drive peg. It is a piece of $1/8 \times 1/2$ in. leather strapping. When turning work between centres the drive carrier, which is fixed to the work piece or mandrel, is driven by the catch plate in the usual way. But sometimes, especially if the cut is intermittent, the hard metal carrier/peg drive can chatter or vibrate to give rise to poor cutting conditions. The piece of leather (rubber hose would also be suitable) damps the vibrations. However, it is wise to remove it before screw cutting and to tie the carrier to the peg with a twist or two of wire. This will hold the work in the correct relationship to the change gears and lead screw and help prevent 'splitting' the thread.



Figure 1 - Heavy Duty Faceplate Dogs with Reversible Jaws

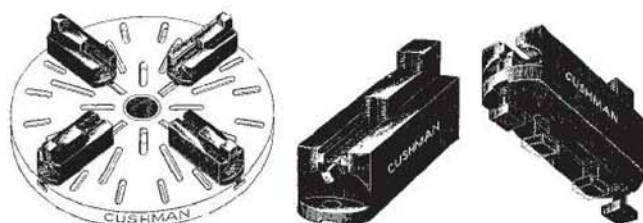


Figure 2 - A set of four faceplate dogs with faceplate. Dogs only, in sets of four, were sold for any faceplate.

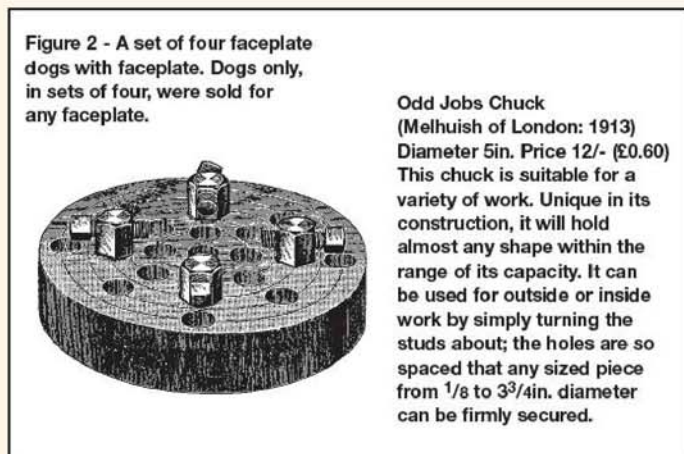
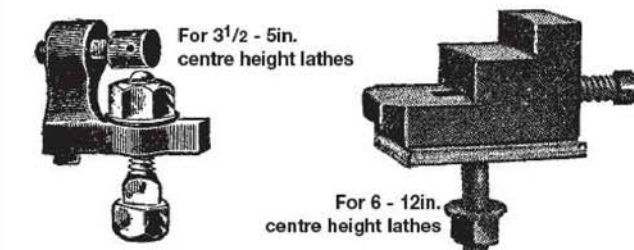


Figure 3 - Standard Pattern Faceplate Dogs



For $3\frac{1}{2}$ - 5in. centre height lathes

For 6 - 12in. centre height lathes

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

Martin Wallis

discusses some frequently asked questions and begins work on the 'motion'.

●Part XXXII continued from page 496
(M.E. 4182, 15 November 2002)

Frequently asked questions, or 'FAQs', are commonplace in the world of computers and other such electronic gadgets and gizmos. Many instruction manuals have comprehensive sections dealing with FAQs which I have found both useful and reassuring. At least I know that I am not the only one to have found the screen goes blank at a certain stage, or the program cannot find the printer!

The FAQ's that come in my direction are usually either "What scale should I build?" or "How do I set about buying a workshop?" The first question is easy: if you are building simply for the pleasure of making a model, do exactly what you fancy. However, if you are building a model to steam regularly, give children rides, and other such uses, I suggest you build as big as circumstances allow. The bigger the fire the less fiddling will be required. Small fires do need constant attention to keep them alight. Remember that a bigger model has the same number of bits to make as a smaller one and, within reason, will take much the same time to build.

In reply to the second FAQ on how to put a workshop together, there are two main routes. One is to buy new, which sadly these days often seems to mean buying 'Far Eastern' and the second is to buy second-hand British machinery. There is no doubt that the Far Eastern machinery is excellent value for money, which presumably

is why so many indigenous machine tool manufacturers have ceased to trade. However, as with all things, you do tend to get what you pay for and the down side is that such machines are put together in very large numbers and the quality control and attention to detail can occasionally be suspect. Second-hand British machine tools such as Colchester, Harrison, Boxford or Myford (to name but a few) can be often be bought at much the same sort of price as new Far Eastern equipment of a similar size.

In my opinion the best second-hand bargains are those purchased before a dealer has given it the 'once over' and a coat of paint. This usually means buying the equipment at an auction, and buying it as seen, which does not need to be too much of a problem for a beginner. If the price is right, only a few simple matters need investigation:

Does the headstock run sweetly? Do all the power feeds work? Does the bed look okay? Are there 3 and 4-jaw chucks plus a faceplate? Are there any extra goodies such as a taper turning attachment, steadies, or spare backplates?

A few years back I purchased a rather 'sad' looking lathe, which I revitalised in about two months of evenings and weekends. The lathe is illustrated in photos 1-3. As purchased, the lathe looked none too appetising, a fact which was reflected in its price. As no suitable power source was to hand, I had to buy it without first running it, but I was assured that it was 'okay'. Except for the headstock spindle, I completely stripped it down and fully refurbished it, including the fitting of a dry plate clutch. The lathe has since given every satisfaction and is often taken as a new machine. Value for money? Most certainly.

Concerning my original purchase, the lack of electrical power to try it out may well have been for the best because during the rebuild I discovered that a shear pin for the power feeds in the apron was broken, so none of the feeds would have worked. Not knowing that this shear pin was broken at the time of purchase I could well have thought twice about my prospective purchase and been put off. The shear pin is nothing more complicated than a 1in. length of 1/8in. brass rod.

Little Samson eccentric rods

Together with the connecting rod, these items make up the better part of what is called the 'motion'. The full size rods would have been forged from bar, an option not suited to model engineering. My preference



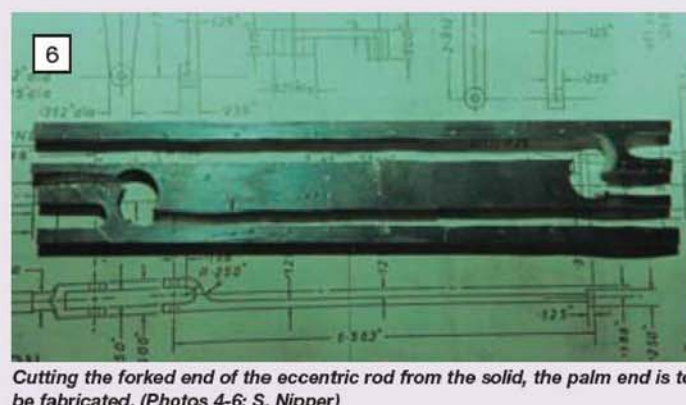
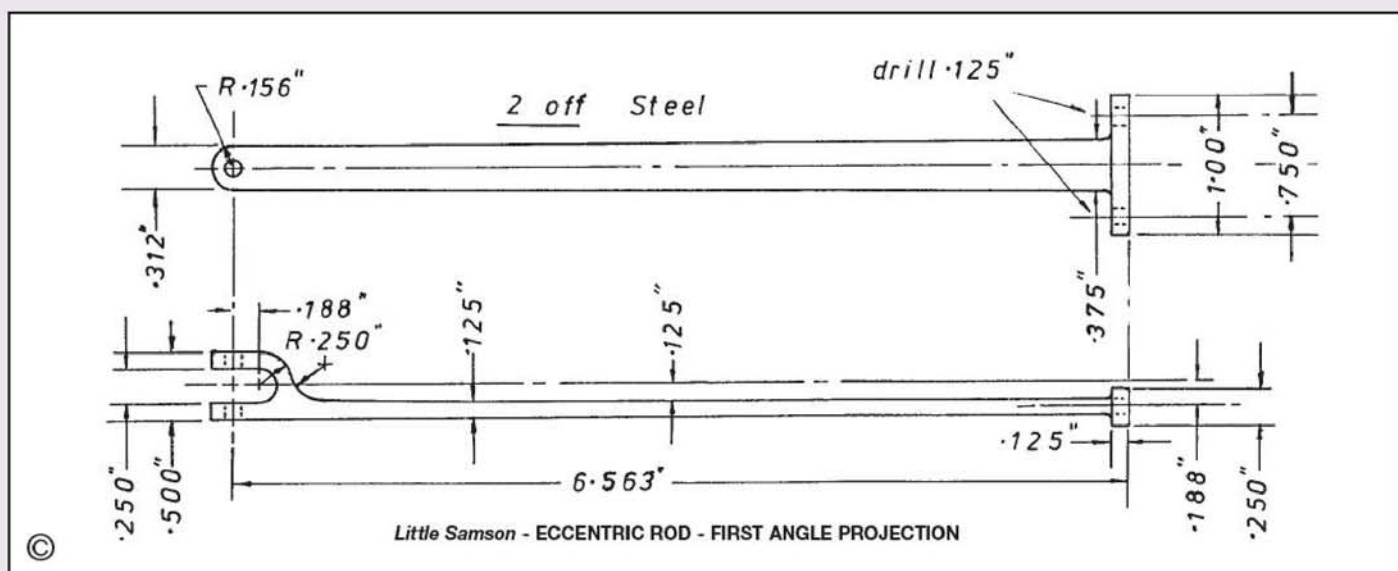
The 15in. swing 'M' series Omni Speed lathe as purchased by the Author. The pumped coolant gear was discarded as was the 3-phase electric, which were replaced by a single-phase motor and switchgear.



The machine was stripped down as far as possible and cleaned but the headstock drive train was left undisturbed.



The component parts were cleaned and inspected before reassembly with the result seen here: a completed clean, shiny lathe, as good as new.



Cutting the forked end of the eccentric rod from the solid, the palm end is to be fabricated. (Photos 4-6: S. Nipper)

would be to cut the eccentric rods from the solid but I am prepared to concede that it may be quicker to fabricate them.

Cutting them from the solid will mean a great deal of machining but, with a little cunning, this need not be as onerous as may at first be thought. A great deal of metal may be removed by chain drilling. My favourite drill size for this operation is $\frac{13}{64}$ in. which, at 0.203in., corresponds to one turn of a feedscrew handwheel on most milling machines calibrated in thous. I remember chain drilling the front axle profile for my 6in. Fowler from a billet of 4in. by 2in. steel bar, and did the job in an afternoon.

If your milling machine has power feed it can then be left to get on with it while you do other little jobs, such as making the little brass oilers or filing up the next casting on the list.

A large cutter will be needed to produce the necessary internal radii, but given light cuts and a keen cutting edge this should not be difficult. Beware of climb milling, a process which has been discussed many times and one in which the cutting action pulls the cutter into the work. This can lead to a deeper than expected cut just when it is not needed. It is important for the curves to blend seamlessly into the flats without those annoying little steps or troughs.

Fabricating

In the smaller scales, silver-soldering is the best method. Being steel, the job needs to be heated quite quickly as the flux does not seem to last as long on steel as it does on copper. Where possible, the individual bits should have the larger radii machined on them as the silver-solder will not build up a fillet. Careful drawfiling and a rub

with emery cloth will be needed to clean up the joints and return the rod to its original 'bright' condition. Remember that when bright and clean, silver-solder on steel is not that easy to spot, but when tarnished it will be much more visible. If the motion is to be painted, as is often the case on showman's engines, this will not matter a scrap. With all the attendant grime and dirt, a working engine will soon disguise any traces of silver-solder but a clean exhibition model will not.

In the larger sizes: 4in. to the foot and above, the eccentric rods may be fabricated by means of electric welding. Since the metal deposited is steel it will be difficult to spot the method of construction. The key to a good strong weld is in the preparation. The two pieces to be joined must be properly prepared by grinding right back so that the weld can penetrate fully. A shallow surface weld, much of which might be ground or machined away in the cleaning up process, could subsequently become unstitched when running with horrible consequences.

Some folk may choose to electroplate their bright work (satin please) which will nicely mask any fabrication traces. If so, please plate *all* the bright work, not just parts of it.

Expansion link, the CNC way...

For those of us, and I guess this may not be too many, who either own or have access to a CNC machine, the expansion link is but a short program away. The CNC milling machine is just as happy to machine around a complex shape as it is to cut in a straight line, but for this particular component a small diameter cutter is necessary to get inside the slot and give acceptably small corner radii. Such cutters are renowned for 'whip'. It is worth

running the program several times to 'work out' the inevitable flex in the cutter.

An alternative to a CNC milling is CNC wire cutting. The principle of wire cutting is very similar to spark erosion but the electrode is a wire which does the cutting. This wire is fed continuously from a drum above the workpiece and is coiled onto another drum below it. The wire and/or work table is moved under computer numerical control to generate the required form. Wire erosion will cut right into a corner (the fillet radius equalling half the diameter of the wire) and is as accurate as we can ever hope for. An advantage of wire erosion is that the work can be glass hard if you want it to be. Last year I saw the teeth for a large starter motor pinion for a big diesel being wire cut onto an already fully heat-treated billet. The teeth had perfect shape and I was told the new one started the engine as sweetly as the original once did.

...or on a rotary table

Happily in our workshops a rotary table will suffice nicely. In the smaller scales, in combination with a large rotary table, it might be possible to mount the expansion link directly onto the machine table. It is more likely, however, that the expansion link will need to overhang the table considerably to achieve the radius needed. A sub-table will be required and such a set up is shown in photo 8. It should be noted that the cutting forces are now some distance from the rotary table and are magnified accordingly. With light cuts the manufacture of the link in photo 8 was easy enough, but do not push your luck!

Remember that the worm and wheel inside the rotary table are quite small, and a good deal is

being asked of them in these circumstances. I have a 6in. centre height universal dividing head which I use for gear cutting which, following the principles in photos 1-3 came completely to pieces. The 40:1 worm and wheel in the middle of it all was a sobering revelation; while the complete dividing head is seriously heavy, the worm and wheel were comparatively tiny and could be held in the palm of your hand.

Unless a very large rotary table is available for a 4in. scale model, the arrangement shown in fig 1 will offer a more robust set up. A sub-table will still be required, but it is pivoted at one end, and driven at the other by a peg on the rotary table. Don't forget that a means has to be devised to hold the sub-table down.

The index dials (or the digital readout) on the slides of the milling machine should be zeroed on the centre of the rotary table, and the table may then be moved across by the amount needed to give the desired radius. The two holes that receive the pins for the eccentric rods must be drilled on the same set up as that for the slot, i.e. they must be on an identical radius. This is easy enough: after drilling and reaming the first hole the expansion link is simply rotated to drill the second.

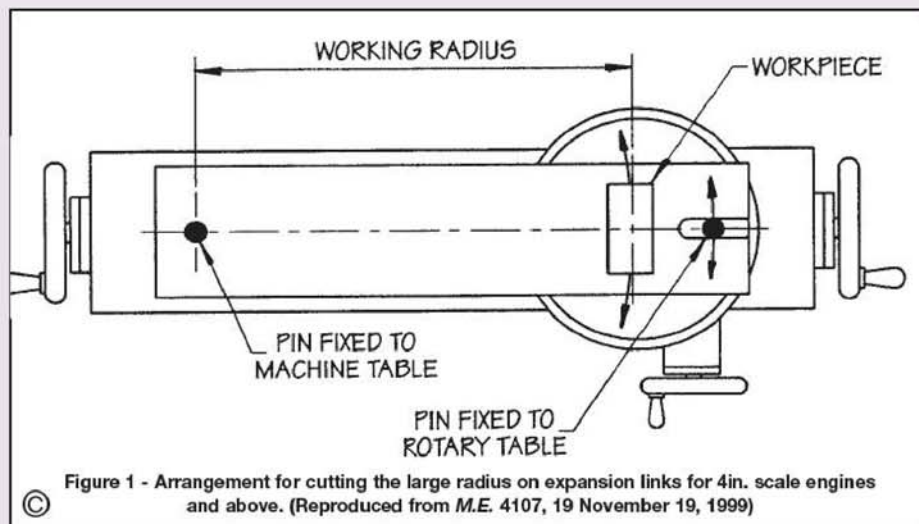


Figure 1 - Arrangement for cutting the large radius on expansion links for 4in. scale engines and above. (Reproduced from M.E. 4107, 19 November 19, 1999)

Die block

The die block should be made on the same jig, the expansion link being used as a plug gauge to determine its dimensions. At this stage, I would leave it a fraction on the tight side in the slot. When satisfied, the die block may be dismantled and hand fitting commenced. The inside corners of the slot will need to be tickled out with a file as per the drawings. Try the die block both ways round, it might fit better one way around than the other. Very light rubbing with fine wet and dry paper should then remove any minor high spots and the

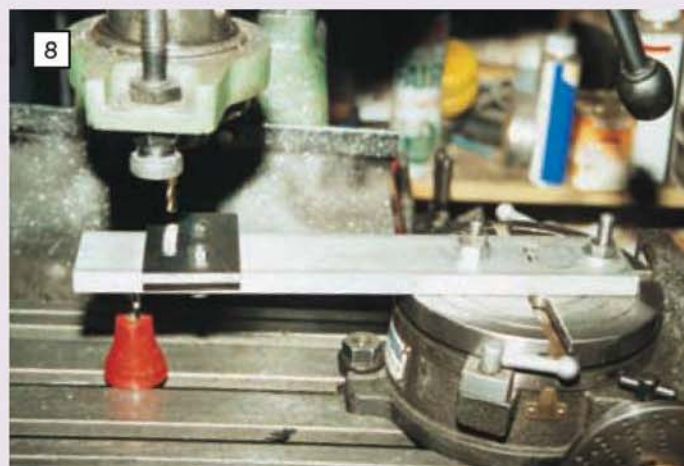
die will soon run sweetly in its slot. The drawings show a relief in the corners, as per full size, which may be added or not as the builder fancies.

Case hardening

Conventional wisdom is to case harden the expansion link, all the pins, and all the holes including the ends of the eccentric rods. This involves heating to red heat to absorb the carbon rich powder (Kasenit or equivalent), subsequent reheating, and then quenching. I have always figured that this is an open invitation for distortion and I



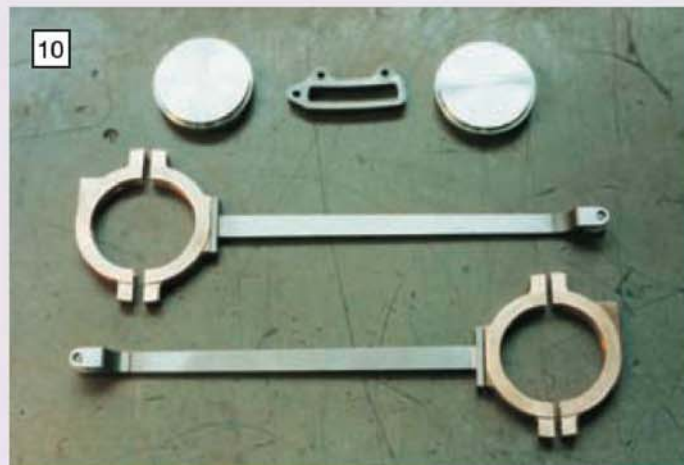
CNC machining a 3in. scale expansion link. Note the stop on the vice to allow the work and sub-table to be mounted and dismantled without losing location. (Photo: B. Camps)



Stan is machining his expansion link on an aluminium alloy fixture bolted to his rotary table. The red object underneath is a little bottle jack, which is supporting the fixture. (Photo: S. Nipper)

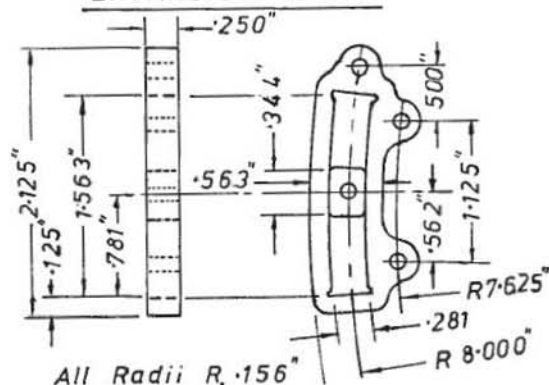


My own jigs for machining the expansion links; these are stored away safely in case the link requires any remedial work in the future.



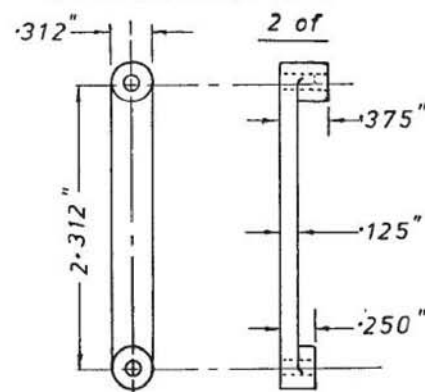
David Hall has laid out the valve gear components for a photograph. David preferred bronze to cast iron for the eccentric straps and has yet to bore the eccentrics. (Photo: B. Camps)

EXPANSION LINK

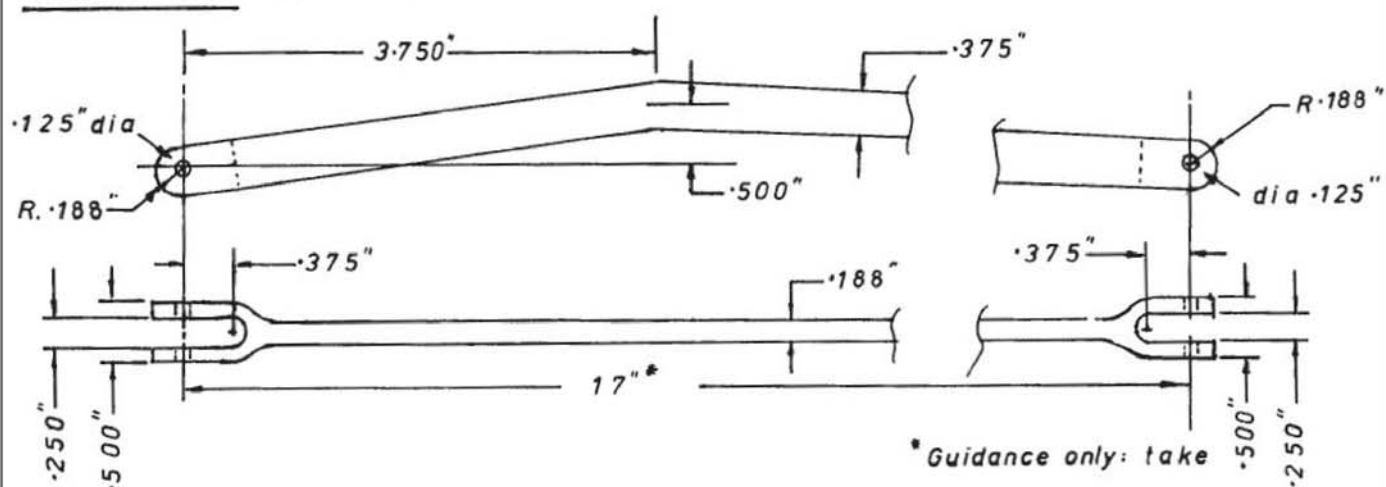


A Little Samson catalogue listing drawings, copies of Works Drawings, materials and castings in 3in. and 4in. scales is available for £2.50 post paid (UK) from Little Samson Models, 38 Wheatsheaf Way, Linton, Cambridge CB1 6XD
<http://homepages.tesco.net/~little.samson>

LIFTING LINKS Steel



REACH ROD MILD STEEL



have never had the inclination to subject my shiny new bits of motion to this process. Readers are, of course, perfectly welcome to case harden whatever they like.

My path, a compromise if you like, works fine for me. I leave the expansion link just as it is, I figure that if it does eventually wear, it is easy enough to tickle out the odd thou. later. The machining jig is therefore dutifully stored somewhere safe to be retrieved later should the need arise. The expansion link is made from just plain old steel. The die block and all the pins are made from silver-steel, which is hardened right out and tempered accordingly. The same principle applies to the eccentric rods: the holes are left soft and the pins fully hardened.

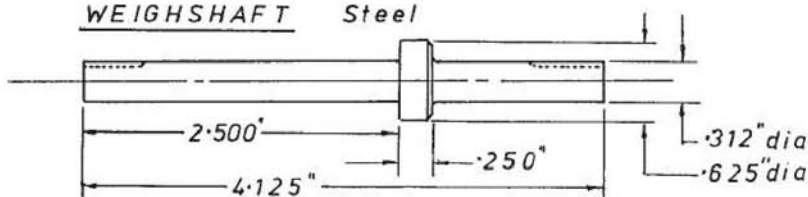
My 6in. Fowler follows the above practice of hard pins running in soft holes, and has been steamed for ten years, including a great deal of road work. While I could not claim there is no wear, there is certainly no wear I have noticed.

Next time

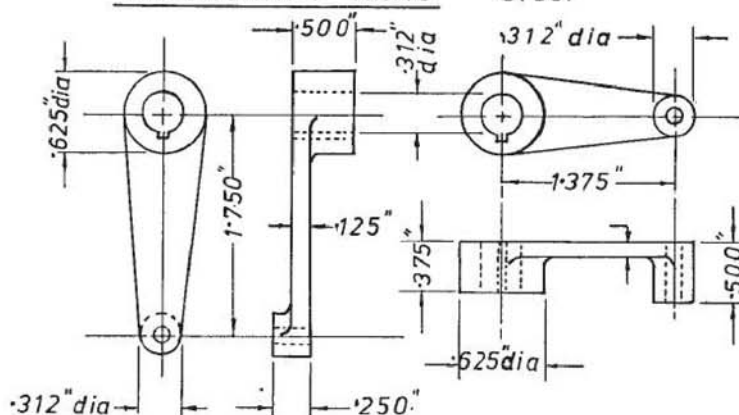
In order to keep within my allotted space, the text and illustrations describing the weighshaft, weighshaft arms, lifting links and reach rod will need to be held over to the next issue. However, the drawings of these items are included herewith.

●To be continued.

WEIGHSHAFT Steel



WEIGHSHAFT ARMS Steel



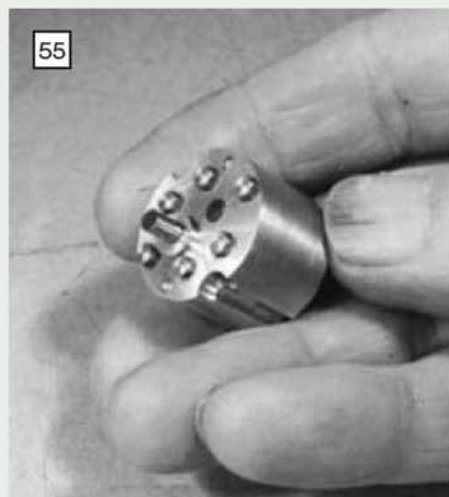
©



Inserting a finished piston into its cylinder bore; note that it has no top at this stage.



The piston has been attached to its con-rod and the stainless steel cap is about to be fitted.



The oil pump had to be made with very small internal clearances for it to perform correctly.

THE BURNT AIR ENGINE

Frank Taylor

discusses a few more features of the engine before moving on to the displacers.

●Part VI continued from page 605
(M.E. 4184, 13 December 2002)

There are a few things I would like to show you before moving on to the displacers. Photograph 53 shows a view of a completed piston being inserted into the cylinder. It can be seen that the piston is unusual in that it has no top. The reasons for this are that access is needed to bolt up the small end and the screw-on stainless steel cap reduces heat loss to the

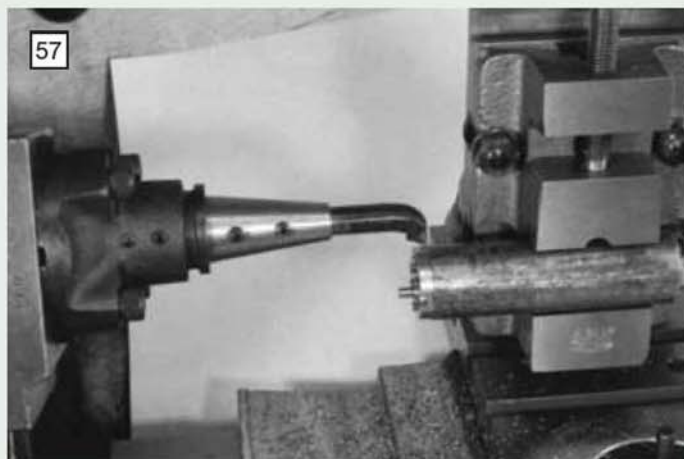
aluminium alloy piston body.

In photo 54 the piston is now shown fixed to the con-rod and the screw-on cap is being offered up to it. The cap makes a gas-tight, metal-to-metal seal with a shoulder in the piston.

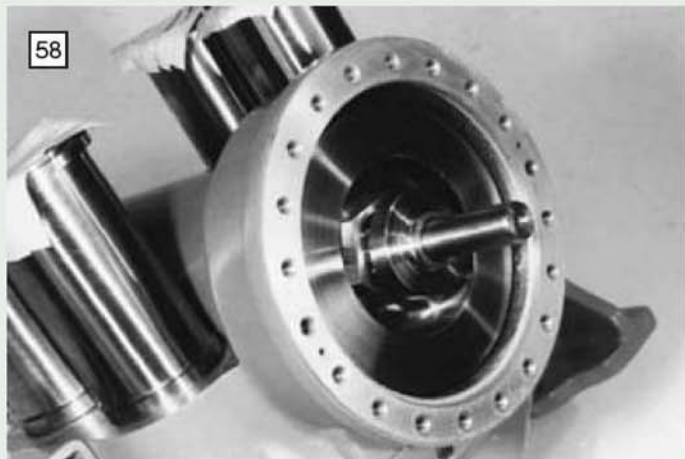
The piston rings required little design effort on my part. While I was still scratching my head an article by Mr. C. Trimble in the USA appeared in



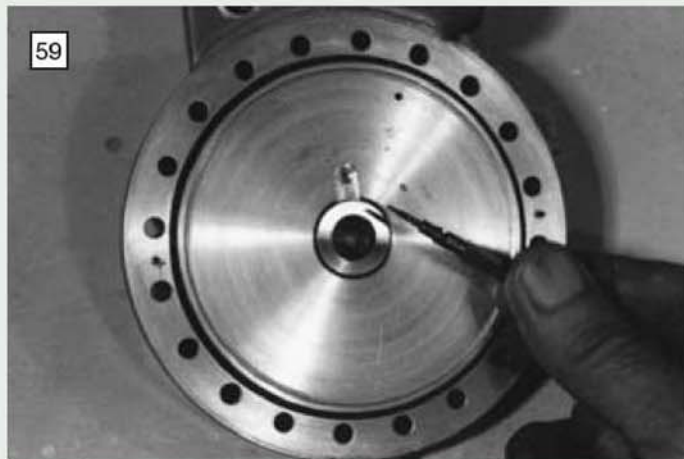
The method used to machine the oil pump. The necessary orifices could be machined using co-ordinates set by the cross-slide and the vertical slide.



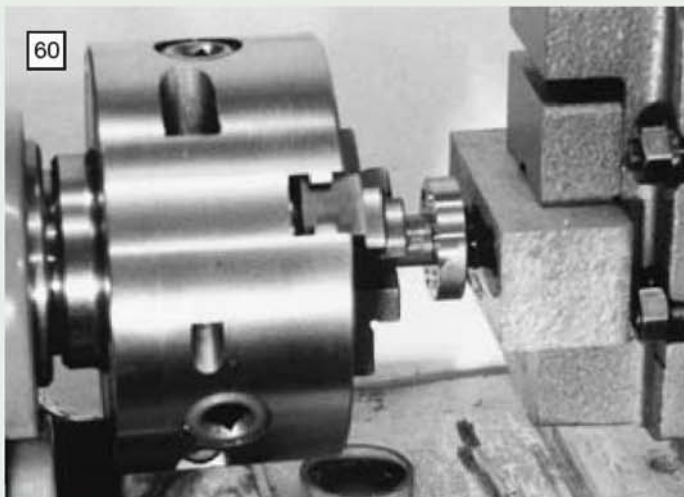
Another view of the set-up for machining the oil pump. Here an inverted boring tool is being used to bring the outer diameter to size.



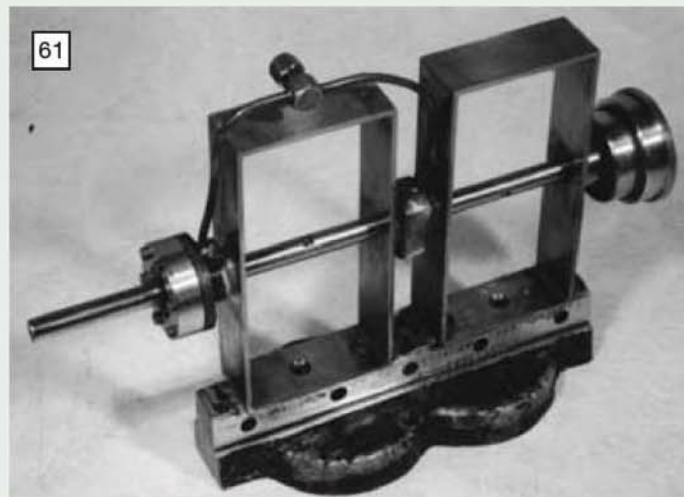
The engine stripped down to show the rotating part of the axial metal seal; the flywheel nut is recessed to accept compression springs.



The stationary part of the seal is being pointed out in this photograph; the highly polished, flat surface makes a good mirror for the screwdriver.



The method used to bring the oil seal surfaces to the required degree of flatness and surface finish. The lap is held in the machine vice.



A view of the heads for the two cylinders. The structures on top are fabricated from stainless steel and are brazed into position.

M.E. 3735, 17 August 1984. Briefly, his method was to machine the rings exactly to size, split them with a pair of tin snips, place them on a special mandrel to stretch them and put them in a furnace protected from oxygen. I followed his instructions implicitly and was rewarded with rings exactly to size and absolutely circular. I would recommend the method to anyone wanting to make rings. Thank you Mr. Trimble.

Photograph 55 shows the completed gear type oil pump which will deliver a good volume of oil at 90 pounds per square inch. Clearances were kept to 'tenths of a thou.' to get the performance.

After initially parting off the front cover plate, the whole pump was made on the end of the leaded gunmetal rod as shown in photos 56 and 57, using the cross-slide and vertical slide index dials to locate everything. Finally, the pump was parted off in the chuck.

Metal type axial seal

As the engine is pressurised, the drive shaft had to be sealed. I chose a metal type axial seal which has performed very well. The shaft part of the seal is shown in photo 58. Six holes are drilled in the flywheel nut which hold springs that press on this part of the seal to keep it in contact with the stationary part shown later. The part in this photo is rubber bonded to the shaft in such a way that it has a limited axial movement.

The stationary part of the seal is shown in photo 59. As can be seen by the reflection of the screwdriver, it has been brought to a mirror finish and, at the same time, it is dead flat. It is made of

silver-steel hardened in oil and left hard. This type of seal must be bathed in oil and the spill-way oil entry hole can be seen above the seal.

My method of getting both parts flat and to a very fine finish is seen in photo 60. A block of cast aluminium alloy was set up in the machine vice, as seen, and fly-cut true. A small amount of metal polish and oil was applied to the block.

Removal of the cross-slide feed screw allowed the slide to be pushed back and forth with the block very lightly touching the seal with the lathe running at medium speed. It took very little time to complete the job. The hard, static part of

the seal received similar treatment; the only problem here was, in the initial stages, getting it flat. After trying different abrasives it was found that Zirtex (the stuff with which you coat the ladles, etc. when casting) makes a lovely sharp abrasive, almost like very fine diamond dust. It is definitely not suitable for the softer metals, but is ideal in this case.

Displacers

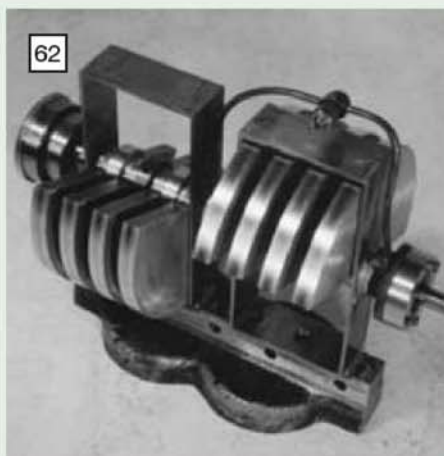
As before we will look at the completed parts first and the interesting bits of machinery afterwards. In photo 61 can be seen the cylinder head catering for two cylinders which are 180deg. out of phase. Brazed to the head are two stainless steel cages made up with dovetailed corners for strength. The rotor shaft has ball races each end and a solid bearing in the centre. O-rings are used for sealing.

Photograph 62 shows the situation after the rotors have been assembled on the shaft. The construction of these will be shown later.

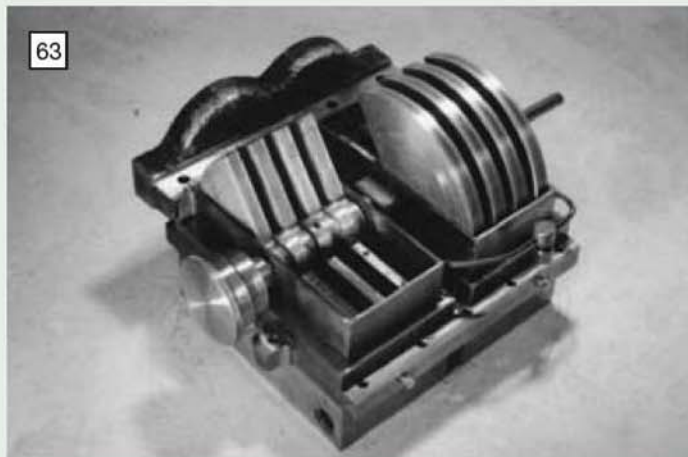
In photo 63 the cages and rotors have been assembled into the cooler casting with the rotors moving in machined slots in the casting. Space between rotor and casting is around 0.015 inch. Gaskets are placed between the cages and the casting. A cooling water entry hole can be seen close to the corner of the casting nearest to you.

To complete the assembly, photo 64 shows the heater casting placed in position and propped up with a bit of rod for the photograph. With the heater closed down, the two castings are bolted together with a multitude of stainless steel bolts.

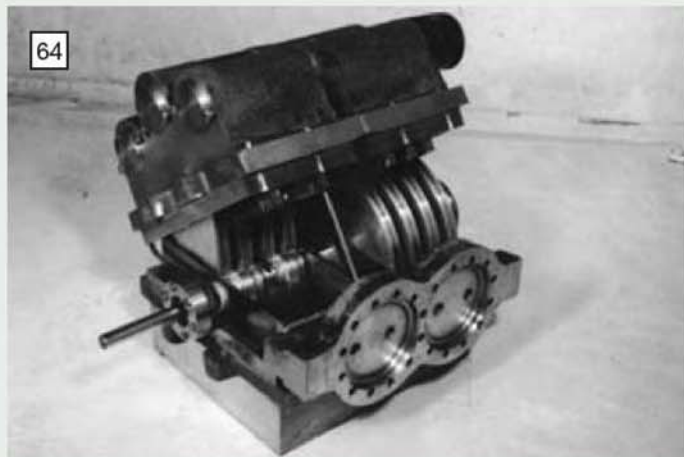
●To be continued.



Cylinder heads with rotors fitted to the shaft; the cylinders operate 180deg. out of phase.



The rotor assembly housed in the cooler casting; the rotors rotate in slots machined into the casting.



The assembly is completed by the heater casting seen here propped up to reveal the rotors. The heated and cooled castings are bolted together.

Keith Wilson

continues with the construction of the cab for this elegant engine.

●Part XXXIII continued from page 603 (M.E. 4184, 13 December 2002)

SAINT CHRISTOPHER

A GWR LOCOMOTIVE for 7¹/₄in. gauge

I recently received a simply splendid e-mail; I won't say from whom, but the contents are worth a chuckle or two. "Hi Keith. Many thanks for your most prompt and reassuring reply. I was in the company of 'the pundits' yesterday evening and just happened to raise the issue of the valve gear error (my 5in. King design had been queried). I let them make their usual remarks before playing my trump card: an e-mail from Keith Wilson himself! The effect was electric; the sound of back pedalling could be heard for miles around. "Maybe it was some other engine, etc., etc." They were so knocked back they didn't even accuse me of entrapment!"

I have also been gently corrected (Hooray!) regarding A4s and double chimneys. It seems that only 4 were actually built 'double-potted', these being Mallard (4468) and also 4901/2/3, things lasting that way until 1957 when they all got the draughting boost.

These e-mails raise the time-old question to which I have referred before — more than twice. If you have, or think you may have found an error

in one of my designs, please let me know, so that I can issue a correction. It could save others some naughty words when they have spent their valuable time making a part wrongly.

Saint cab

The Great Western Railway was never over-generous in the comfort of its cabs. For example, although seats were provided they did not compare with the comfortable 'bucket seats' provided by Gresley or Stanier, although just how much time was available for the fireman to park his rear has not been vouchsafed. Gresley undoubtedly learnt much locomotive lore from Swindon, but clearly went on ahead in many respects. However, the fabulous *esprit de corps* of the Great Western, which later helped in the undoing of the railways on that imbecilic and disastrous event of nationalisation, prevented any great complaints.

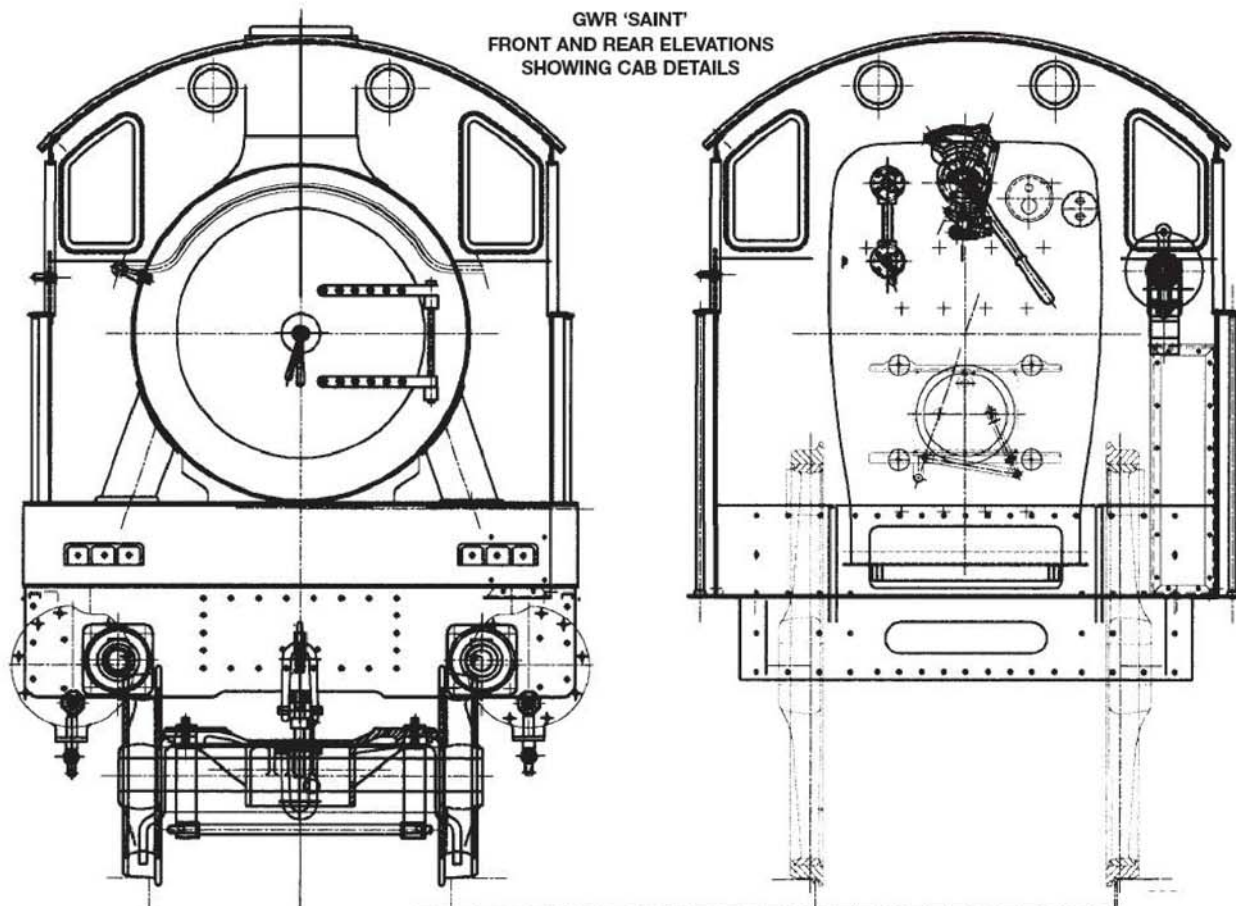
For the People of the Railways, who had done an incredible job throughout the war in keeping them running without being allowed to spend anything on their upkeep, were told that they had

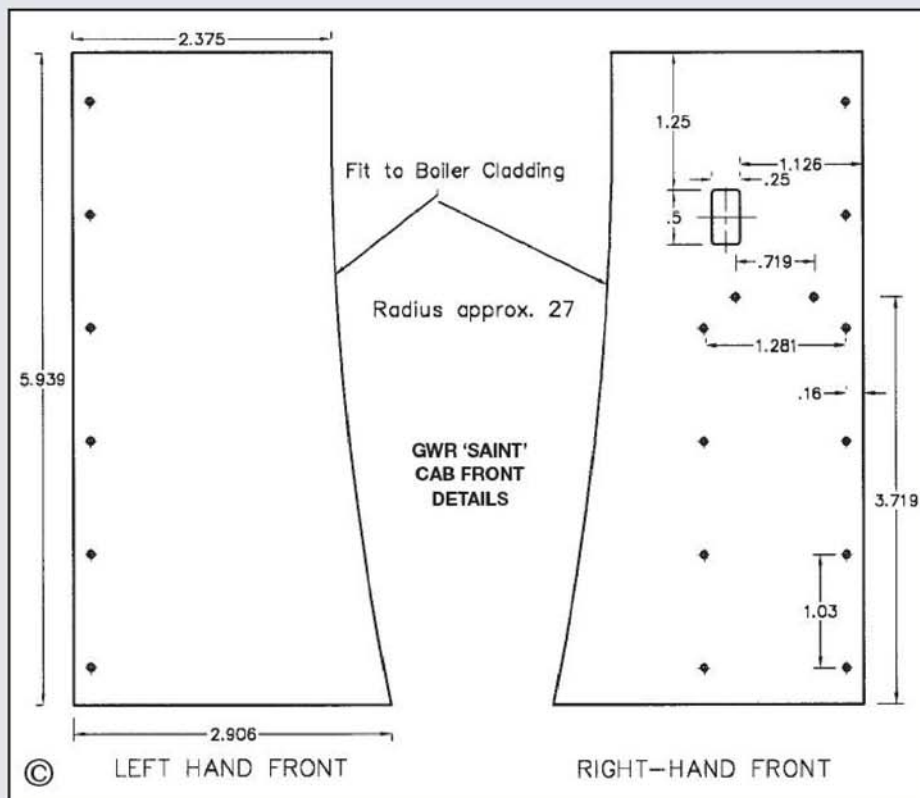
made a complete mess of the job and it was time somebody else had a go. This political insult was enough to get any reasonable person's back up, so when some fairly high level jobs were offered to the true railwaymen (a classic qualification that *cannot* be taught) they understandably declined. Hence, although there were some notable persons in charge now and again, lawyers, politicians and accountants got the jobs, thereby sealing the eventual fate of railways.

It will come as no surprise to learn that I have one or two railway friends in high places; some of the stories I hear from them (strict secrecy of identities) make hairs curl and turn grey, doubtless ensuring that Brunel, Churchward, Stanier, Gresley, Bulleid, Holcroft, dear old Curly himself, and many others revolve in their graves at surprisingly high speeds.

The Saint cab had one big drawback. To get the screw reversing gear set-up inside the cab, the handles were right back at the door. (Later, on other designs, not only was the cab longer but the said gear had its own little 'dog-kennel' forward

GWR 'SAINT'
FRONT AND REAR ELEVATIONS
SHOWING CAB DETAILS





of the cab front so only the handles were inside the cab. For working models, this in itself produces access problems — they are so-and-sos to reverse and notch up. Since most self-respecting drivers would rather lean over the side of the cab than look out through the front windows, it follows that such drivers tended to get a certain curvature of the spine, an 'S' bend in fact. This was known as the 'twenty-nine bend' and I understand that it

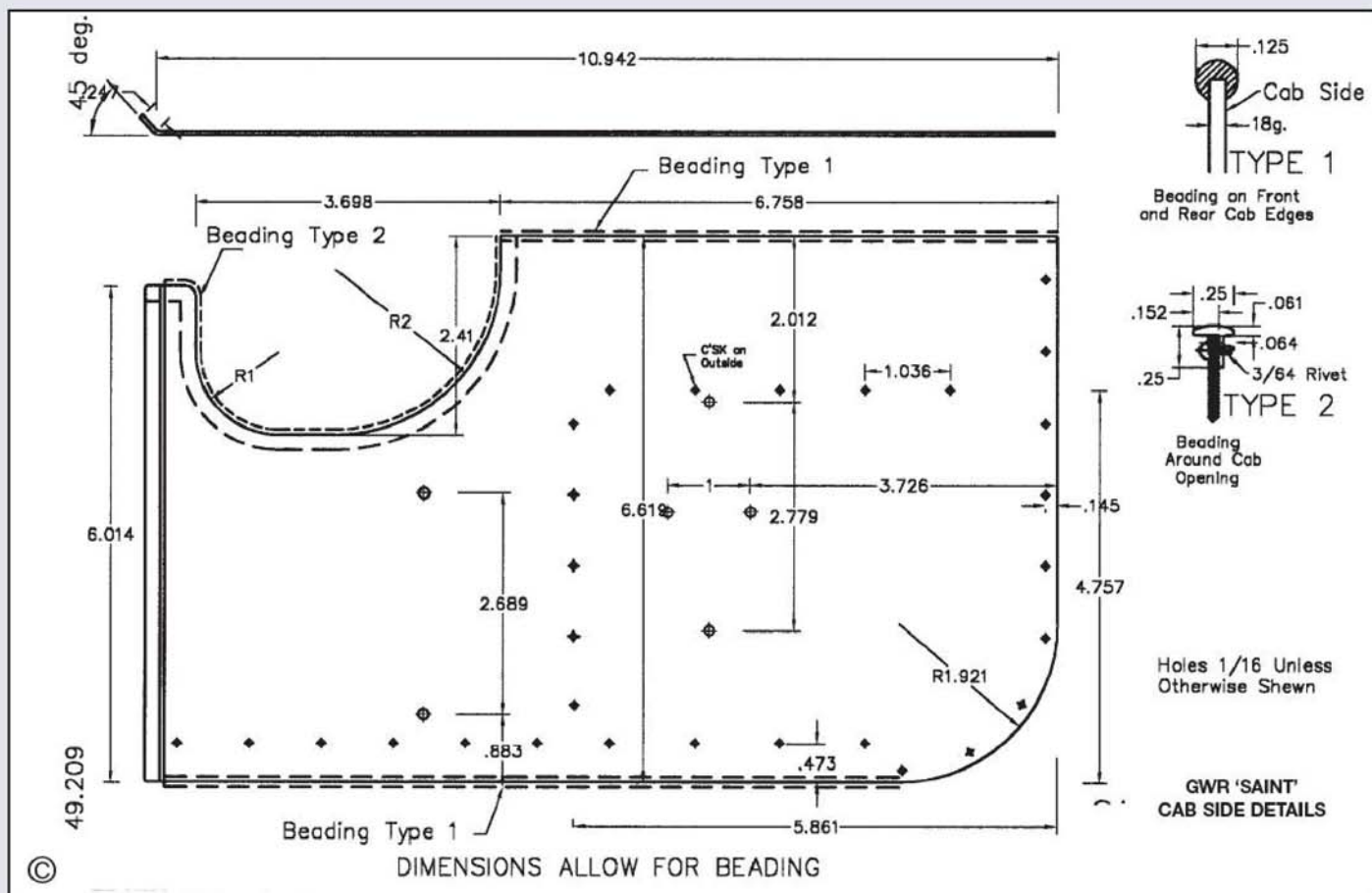
was by no means rare among Saint drivers.

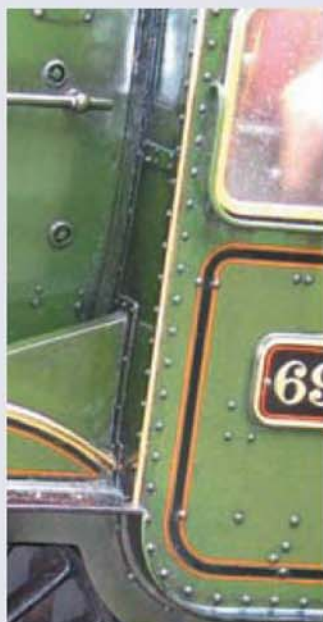
The assembly of the cab was shown last time with a few reference dimensions given to aid comprehension. To save lots of looking-up of previous issues, here is another. The actual cab is made up from several smaller bits, and I have tried to copy the prototype as well as I can. Swindon drawings are so much better than some others I could name, but in fairness it should be

remembered that the locomotive concerned was almost certainly composed of lots of standard bits bolted together, and complete assembly drawings would not be required.

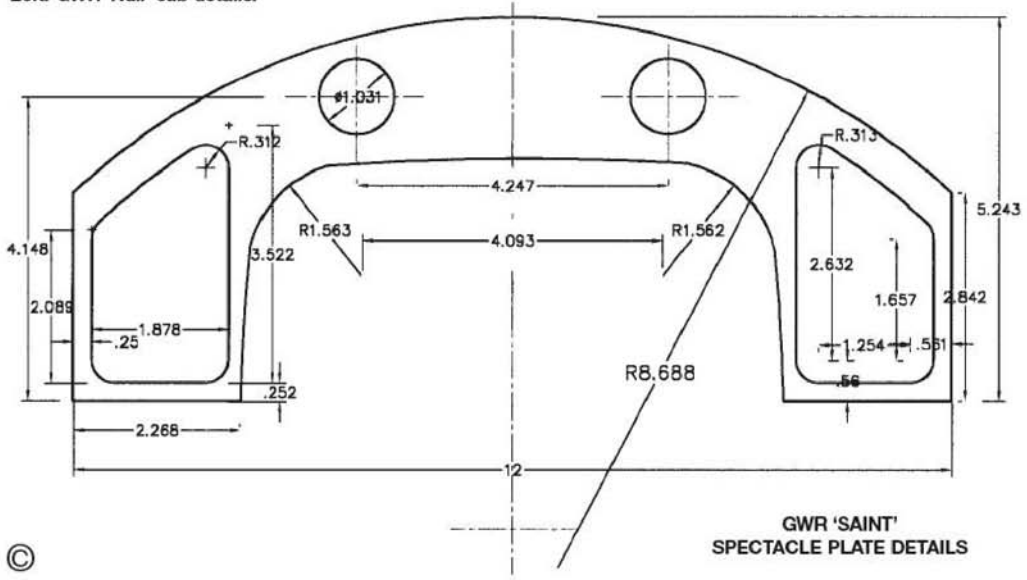
The front plate is in 3 main sections, two at the sides and one on top; this is better described as a spectacle plate, as if it wasn't obvious. There is no joint in the middle at the top. It took me some time to realise this, building quite a number of locomotives meanwhile. Note that the joint 'twixt lower and upper is at the widest point of the boiler cladding, thus the two lower portions can be built into the cab assembly and more or less made permanent. These two parts are shown as accurately as I can manage — yours must be individually profiled to match your boiler cladding — this invariably takes some time. The task, however, is easier than with more modern locomotives for, owing to the 'dog-kennel' previously mentioned, the right-hand one would be pretty flimsy.

Rivet holes are fairly accurate, do not omit. I take the view that we must use rivets to hold the thing together, therefore they might as well be in the right places. It can take me some time to get the places right, for they are seldom if ever dimensioned. I fear many of my predecessors have omitted these things, and while fully agreeing that they won't make the pesky thing work any better, I defy anyone to put his hand on his heart and deny their appearance. As a rough guide, you will need about 2,500 of 1/16in. dia. x 1/4 or 3/16in. copper rivets for the tender alone, probably another 200 plus for the cab. Sorry to put you off, but the last time I bought 1/16 x 3/16in. round head (snap head) rivets I bought them wholesale;





Left: GWR 'Hall' cab details.



I think it was 10 kilograms. At about 4,500 per kg. I still have enough left for my present batch of locomotives, after 8 Prairies at 3000 each, 4 Kings at about the same, and 2 Dean Goods plus 2 Bulldogs at about the same. Figures approximate!

These plates are fixed to the cab sides via angles, and are *not* flush with the front of the sides. If the angles are mounted first on the sides, then the top spectacle plate may be slid into place in due course. The two round holes in this item are optional depending on the age of your loco. I do not know the date when they were omitted, some engines having them replaced by steel plates; but I would think it was probably about the same time that somebody realised that for driving wheels larger than 6ft. diameter, cylinders could be on the same centre-line as main axles. Prior to this they were parallel to, but 2 1/4in. above that center to get a bit of platform clearance.

The front edge of the cab is protected on full-size by a length of tube, split with a chisel; exactly how the tube was held during this operation escapes me; maybe several vices in a straight line. It was placed over the edge of the plates making up the cab sides. This raises a minor problem for us, for it is hardly practical for us to use scale thickness platework; although those who wish to use 16 thou. sheet are welcome so to do. I cannot recall seeing plate thickness shown on any drawings, so I am guessing at 1/8in. thick for which 18swg. (0.048in.) is a reasonable compromise. I do not know the diameter of the tube used, but 1/8in. with a bare 1/16in. slot milled in it looks about right; if attached with some soft solder all seems to be well.

If you are intending your Saint for lots of really tough work, it might be as well to stick the ends of the tube onto the plate with some silver-brazing, 'tis far stronger. The rivets holding the angle onto the plates should be backed up by soft-solder.

Some time ago I made a very small jet for the oxy-acetylene kit, with jet size half the area of the finest jet normally supplied (No. 2). It gives a flame about the size of a thin knitting needle which is very useful for fine work. It tends to be a bit unstable, the gas pressures involved are perforce very low and the pressure regulators therefore have difficulty regulating. With a little practice, however, this can be dealt with and the resulting jet is extremely useful. Small fittings need very little heat to stick them together, this alone makes it worthwhile — and how!



A view into a GWR 'Saint' cab.

Strange words seem to flow automatically as a weeny brass fitting that has taken some time and care to get just right melts away beneath the benevolent heating needed to assemble them on a permanent basis.

Drilling and riveting is greatly facilitated when certain parts are stuck together by soft-solder, for clamps can slip, which of course they do at precisely the wrong moment. I wonder how they know; but the soldering process is much more rigid. After riveting is complete, heat it all up again to get the rivets soldered in too; every little helps, as the old lady said.

I mentioned fluxes in the last part; I have found nothing better than a greasy-looking flux called Lo-Co. Obtainable from tool shops and plumber's supply shops, it is quite cheap, far cheaper than Baker's fluid. I put it on with a small paintbrush, just like the application of Easiflo flux. Okay, so

the paintbrushes only last a few weeks, but they are 'dirt cheap'. Water soluble, it cleans off nicely with a bit of scrubbing using an old washing-up brush to leave a clean surface.

The fancy beading around the edge of the cab is easier to make than at first appears. A bit of elbow-grease with a file will produce the required rounded surface on one edge of a piece of 1/4in. thick brass or a belt sander may be called into use. A version of the traditional belt sander is made by Black & Decker and is sold as a 'profiler'. It has a fast-moving abrasive belt sticking out at the front which acts like a high-speed file, and the belts are available in several grades. It makes light work of many filing tasks and can reach parts that ordinary files cannot reach. Using medium belts, it cleans off surfaces for soft-soldering or silver-brazing in the proverbial trice. There is a resilient pressure-pad underneath for doing flat jobs, but using the belt between this and the front roller produces rounded edges.

Having got our rounded surface, clamp the sheet to the milling table parallel to its longitudinal axis, set up a suitably sized serviceable slitting saw, and starting just under 1/8in. from the rounded edge, cut a slot 5/32in. deep by 1/4in. wide. Turn the brass sheet over, re-setting parallel, etc. once more. This time, cut a slot 3/32in. deep by 1/4in. wide. Part off with a fine saw, clean up the sawn-off edge and Robert is your aunt's brother, for you have a length of posh beading.

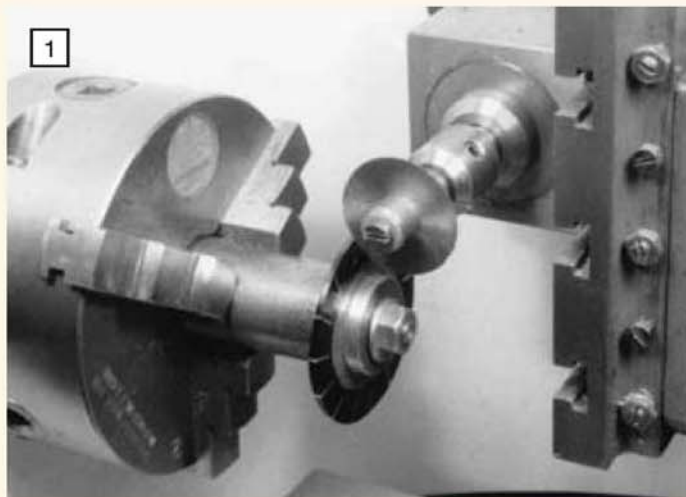
You will want a piece of the round for the lower rear edge each side, and a piece for the cab cutout where the driver customarily leans out. These latter will need bending, a tricky task at first, but a little heating will aid matters quite remarkably. When it is correctly shaped, fix it into place with soft solder and use 3/64in. brass rivets to fix and look snob.

The broken lines around parts of the cab side show where beading is to be applied, double broken lines indicating the round type, and single lines show the other type.

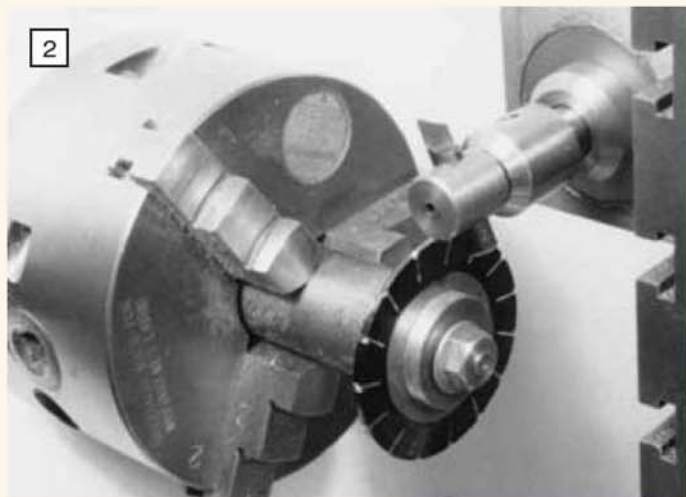
With the exception of the reverse stand, to be shown and described later, the difference between 29 and 47 cabs is a matter of dimension.

Close-up photographs of Saint details are understandably scarce, but I have a black and white shot of a Saint cab, plus close-up of a cab of a closely allied locomotive — a Hall.

●To be continued.



The set-up in the lathe for cutting the front face of the teeth.



Flycutting the notch at the tip of each tooth.

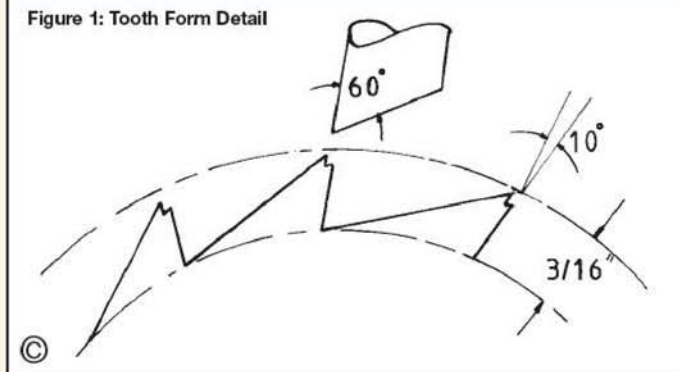
M.E. JUBILEE CLOCK UPDATE

John Wilding FBHI

describes his method for forming the teeth on the count wheel of the *M.E. Jubilee Clock* suitable for users of small lathes.

Ratchet shaped teeth are frequently used in clockmaking. Examples include barrel ratchet teeth, date wheels and recoil escape wheels which have this shape but of course are not used in the role of ratchet teeth. Count wheels as used on the Synchronome and *M.E. Jubilee Clock* (ref 1) employ this tooth form as well but can cause difficulty in cutting because of the large size of the tooth. In both these clocks there are only 15 teeth resulting in a large amount of metal to be removed if a form cutter is used. In the original description of the *M.E. Jubilee Clock* by E. T. Westbury he suggested making a special cutter to be mounted in a milling spindle in order to cut the teeth in the lathe. This method is satisfactory if the lathe is fairly robust such as the Myford, but in the case of smaller lathes the long sloping back to the teeth may cause chatter due to a lack of rigidity.

Figure 1: Tooth Form Detail



An alternative way of forming large ratchet type teeth is by sawing them out in the lathe using a slitting saw. This is a method I have often used for cutting out dead beat escape wheel teeth on small tower clock movements (ref 2). A general view of the procedure is shown in **photo 1**. Here the wheel blank is truly mounted on a mandrel and the slitting saw is rotated in the milling spindle on the vertical slide (ref 3). In the original drawing of this wheel the depth of the teeth is excessive. In **fig 1** I show a drawing in which the tooth depth is $\frac{3}{16}$ in. which is perfectly satisfactory. In many cases the radial face of the tooth is in fact not radial but inclined at some 10 degrees. In ratchet wheels this ensures a clean 'drop off' when the ratchet is released. This practice is usually followed in count wheels such as those used in the Synchronome and Jubilee Clock. In this particular case with a wheel of 2in. diameter, the slitting saw should be offset from the centre position by 0.173in. in order to produce an undercut of 10 degrees. The slitting saw should be run at a moderate speed and no cutting oil is necessary if the correct type of brass is being used.

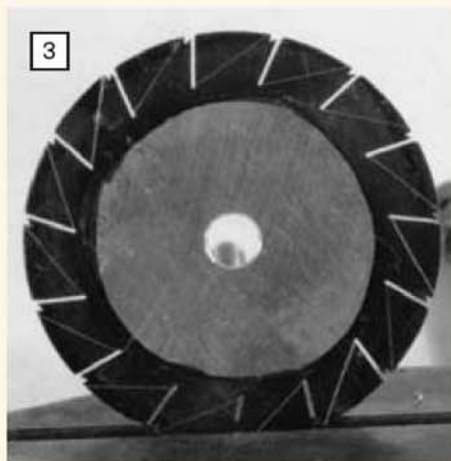
After the 15 saw cuts have been made, the saw is changed for a 60deg. fly cutter and the small notch is formed at the tip of each tooth. This is illustrated in both **fig 1** and **photo 2**. The sloping backs to the teeth could also be formed with a slitting saw in the lathe but the small $\frac{1}{4}$ in. diameter saw shown in **fig 1** will not be large enough to perform this second cut. I removed the blank from the lathe and drew the

sloping face with a scribe as shown in **photo 3**. I then cut this out with the piercing saw and filed it to the line with a fine (No. 6 cut) needle file. The completed wheel is illustrated in **photo 4**. As I have already pointed out, the depth of this tooth is excessive and the $\frac{3}{16}$ in. shown on the drawing would be better.

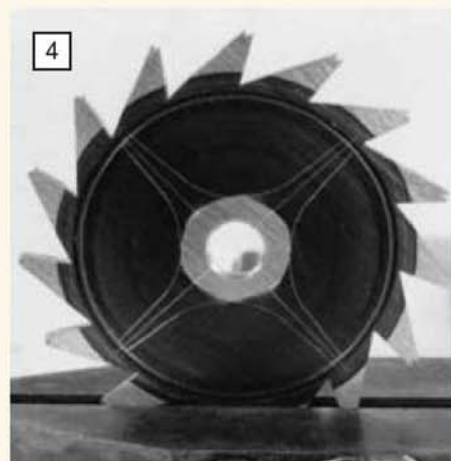
The advantage of this procedure is that the dividing facilities on the lathe will provide the accuracy of the wheel when forming the front face of the tooth.

References

- 1: The book on the construction of this clock, updated and with colour pictures on the cover is available from RiteTime Publishing, 18 Woolmer Way, Bordon GU35 9QF; tel: 01420-487747.
- 2: A description of the cutting of a dead beat escape wheel for a tower clock is in my book *The Construction of a Small Weight Driven Tower Clock Movement* also available from RiteTime Publishing.
- 3: Slitting saws $1\frac{3}{16}$ in. dia. with a $\frac{1}{4}$ in. centre hole in varying thicknesses can be obtained from H. S. Walsh.



The wheel with the front face of the tooth cut and the notch formed.



With the teeth now completed, the wheel awaits finishing by crossing-out.

CLUB CHAT

With Stan Bray

UK News

One of the annual **Bradford MES** highlights is the Otley Victorian Fair which sadly this year had to be cancelled due to the strike by fire-fighters. The organisers considered that their absence would make it too dangerous to go ahead. During a club meeting at Saltaire Methodist Church, some youngsters slipped into the kitchen and stole the petty cash as well as the tea and biscuits, so in future the society will have to secure the premises during meetings. It seems that full-size railways are not the only ones which suffer with leaves on the line. We understand that the ground level track at Northcliffe has been completely hidden by leaves!

Car parking during wet weather has long been a problem at **Wigan MES** and, as we are all well aware, recent months have been *very* wet. The manager of the park in which the track is situated has now approved the laying of hardcore in the areas used by the club, work which is proposed for the winter, provided sufficient volunteers can be found. Low attendance at two themed rallies organised by the society meant that considerable quantities of refreshments were left over, and this was after the ladies had made special efforts to provide an extensive supply. Ordinary catering arrangements will be made for future events together with a good supply of tea. Tea has also featured on the agenda at normal club meetings, particularly when there is a guest speaker. Mid-meeting tea breaks have been taking up too much time, which is considered to be discourteous to the speaker. Pre-meeting tea was considered but it was noted that the mid-meeting break is useful when a projector or other equipment has to be set up. It has therefore been decided to continue with the mid-meeting break, but to restrict it to a maximum of ten minutes.

Despite the bad weather, work on the new **Bournemouth DSME** track site is making steady progress. The local council cut a trench to the position of the proposed new clubhouse and laid water pipe and an electric cable; unfortunately the latter was 6 metres short and there was a delay while it was extended. The site has also been connected to the main sewer, although what the local cricket club will have to say about the trench which went right through their pitch, is anyone's

guess! What with the engine shed completed and by now connected to the electricity and water supply, and toilet facilities, there will no doubt be an increase in the number of members turning out for working parties, although as is always the case in any society the load will probably fall mainly upon a few stalwarts.

The latest edition of *Lionsheart* from the **Old Locomotive Committee (OLCO)** gives a full account of *Lionsmeet 2002*, hosted by **Bromsgrove SME**, with an entire page and colour photographs allocated to each of the five competitors. The competition took place in the afternoon, following informal running, and was won by Andrew Neish. The publication also deals with the AGM which was held, as usual, at the Manchester Museum of Science and Technology where members get the opportunity to clean *Lion* as well as enjoying the meeting. Items under discussion included the possibility of a new museum building at Liverpool to which, no doubt, *Lion* would be transferred. Due to pressure of work John Brandrick has been obliged to relinquish the position of *Lionsheart* editor and the job has passed to Bill Stubbs. *Lionsmeet 2003* will be hosted by **Erewash Valley MES**.

An inaugural meeting of the **Basildon & District Model and Experimental Engineering Group** took place on 31 October in Basildon and was chaired by Councillor Geoff Williams. The meeting was organised by Malcolm Barrell and eight other people attended. Discussion centred upon the idea of forming a society and it was agreed to meet monthly in the new year at No. 1 The Gore, Basildon Town Centre, on an informal basis, and to defer setting up a formal society with officers and committee until a later date. Discussions also included the possibility of building a miniature railway in Basildon's Gloucester Park, and a possible group visit to the Deutsches Museum and other attractions of industrial archaeological interest in Munich in 2003. Group leader Malcolm Barrell of 8 The Avenue, Billericay, Essex CM12 9HH would be pleased to hear from anyone living in the area and interested in joining the group. He would also like to hear from any model engineers in the Munich area with a view to possibly arranging exchange visits.

Over 50 members attended the **Cardiff MES AGM** which we understand is not unusual, as all

club meetings are well attended. Although there were a couple of changes to the make-up of the committee, the officers remain the same. Some years ago, visits to other societies were popular but in recent times there have been none. It is believed that a reason for this trend is that model locomotives are somewhat larger nowadays and more difficult to transport by coach. Nevertheless, it is intended to schedule some visits in 2003 and hope that members will respond with some support. The new club locomotive, a 5in. gauge InterCity HST, is rapidly nearing completion and is expected to be running in the 2003 season. A request to members to supply drawings for a proposed extension to the ground level railway brought a very good response; all are being considered with a view to submitting a final plan to the local authority as soon as possible.

The annual **Stockholes Farm MRS** locomotive trials is as much a fun day as a serious trial, although with juniors allowed to participate, it also serves as a training exercise. Even though the event is light-hearted, all participants must strictly observe the rules governing the operation of trains. There are two separate sections, passenger and freight and, unlike most locomotive trials, the loads consist of model coaches and wagons, rather than passengers or dead weight as used by many other societies. The winners were Melvyn Bailey and Ivan Smith. Following the event, a young lady of six years was given the opportunity to have her first drive of a locomotive. A somewhat unusual event took place in late August with the organisation of a brass band social and barbecue. The two bands involved were South Milford Brass and Markham Main Colliery Band. The day started with both bands playing together for about an hour and a half followed by the barbecue, and then trains ran for another four hours or so. Many club members brought along locomotives and the day proved to be highly successful. If anyone is wondering where they can get two brass bands to come to a track meeting free of charge, we had better let it be known that Chairman Ivan Smith and his wife Barbara, who is Secretary, just happen to each play for both bands. A possible project for the future is the construction of an 00-gauge model railway that will provide extra entertainment for both visitors and members.

All the many sections of the **North London SME** appear to

have had a busy time during the late summer. The marine section open day attracted visitors from local societies, despite an unfortunate clash with the Bedfordshire County Show. The slot car racing enthusiasts decided to try life abroad and went to Belgium to enter a 24 hour race, the journey there and back providing as much excitement as the race itself, which they won by a handsome margin. Not to be outdone, the locomotive enthusiasts had an invitation day, invitations having been sent to several societies, some of which could hardly be described as local. A total of 14 visiting engines from 7 different societies were seen on the tracks at various times. This was a particularly encouraging attendance since in the days leading up to the event the weather had been awful and on the actual morning the access road was flooded to a depth sufficient to stop the proceedings altogether, the water being too deep to drive through. However, once the nearby stream was able to carry the water away, the level rapidly subsided and the rest of the day turned out to be fine and warm, giving everyone the opportunity to enjoy themselves.

Wharf Station on the Tallyllyn Railway continues to be improved with the assistance of the **Tallyllyn Railway Preservation Society**. Attention is now being focused on a reconstruction of the Reverend Wilbert Awdry's study which is to form part of the museum complex. It will not be possible to reproduce the study exactly but the result will be a close copy of the original. A new childrens' playground has been built at Abergynolwyn and, having been officially opened by Lord Faulkner of Worcester, is proving to be a very popular attraction.

World News

Canada

Not only in Britain is officialdom taking an interest in our hobby; it appears to be happening around the world and **British Columbia SME** has had to register as an amusement contractor to operate the portable track, and with the Railway Inspectors for the permanent track. The club's new battery electric locomotive is taking shape and, having been towed around the track to ensure that it will clear everything and cope with the pointwork, all has been found to be in order. It was expected to be ready in time for an annual event in a local shopping mall which has become a regular part of the club programme.

With Our Sympathy

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

Ernest Langdale
Roger Parsons
Brian Potter

Bradford MES
Crawley Model Engineers
Bournemouth DSME

New Zealand

After believing their plans to build a new track had been approved, members of **Canterbury SMEE** were disappointed to discover that the Landscape Department of the local City Council had decided that the matter must first of all be put before local residents to determine if there were any objections. Nevertheless, members are still hoping for the best and were pleased to receive a donation of a tonne of steel for the track. The land on which it is proposed to site the engine shed has been surveyed and tested and found to be suitable. Various organisations are providing financial support for the project and donations of about \$10,000 have been received so far from Pub Charities.

To provide members with the opportunity to take a rest from their duties during their Easter Weekend meeting **Auckland SME** has decided to hire a marquee from which refreshments will also be served to

the visiting public. The traditional Easter Saturday dinner will, however, still take place in the more comfortable surroundings of the clubhouse. All members were invited to attend the 21st birthday party of the **Scale Marine Modellers** at Panmure on 18 December and to enjoy the professionally organised barbecue and other attractions.

An irksome task for members of **Hutt Valley MES** is that of moving passenger carrying vehicles into the storage shed and is usually done by manhandling a large steel plate. Help is on the way as Gavin McCabe has designed and is making a dual-gauge double-slip point to do the job. Installing the point will require on site welding and to this end the electrical circuits in the clubhouse have been upgraded to take the heavier demand. Wet

weather has resulted in limited running, this in turn has caused a reduction in club finances from their usual healthy level.

South Africa

Centurion SME has appointed a Safety Officer, a position that has not previously been part of the club set up. A safety manual is to be printed so that all can become conversant with safety matters. Once more we are witnessing how modern attitudes to both safety and compensation claims for the most trivial of incidents are affecting the way in which societies are run. On a more relaxing note, a large quantity of shelving has been obtained and is to be used for the new library — at least it will be when volunteers have been found to erect it. A second-hand computer has been purchased and

will be installed in the library to monitor the movement of the books.

Discussion as to whether or not a new ground level track should be built by **Durban SME** is still ongoing. The opportunity to acquire an area of land suitable for the project is available but there are doubts as to whether there is sufficient manpower to go ahead with the project. Most clubs are well aware that the average age of their membership is steadily increasing, but there are generally sufficient younger people able and willing to undertake these tasks. For some reason this younger intake does not seem to be evident at Durban and could severely affect the project. Also, at present nobody has a locomotive in 7¹/₄in. gauge, which is the proposed gauge for the ground level track! It will be a shame if, with the opportunity there, advantage of it is not taken, as it may not occur again and in later years may well be seen as an opportunity sadly missed.

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.

JANUARY

- 10 **Colchester SMEE**. *Photographic Competition*. Contact L. G. Hammond: 01376-511666.
- 10 **Hereford SME**. *Bits & Pieces*. Contact John Arrowsmith: 01432-265151.
- 10 **Kinver & West Midlands SME**. *John Hurley: 2003 Footplate Reminiscences Part II*. Contact John Campbell: 01384-891244.
- 10-12 **Messe Sinsheim GmbH**. *Indoor Steam Meeting at the Exhibition Centre Sinsheim, Germany (on the A6 motorway near Heidelberg)*. Worldwide largest indoor steam meeting for functional models up to scale 1:2. Opening 12-8pm Friday, 9am-6pm Saturday, 9am-5pm Sunday. Contact Andrea Schmerbeck ++49 (0) 7261 689128.
- 11 **Reading SME**. *Club Running*. Contact Graham Bustin: 01189-615450.
- 12 **Bradford MES**. *British Horological Society Meeting*. Contact Gordon Eddison: 01943-864217.
- 12 **Sutton MEC**. *Track Day*. Contact Mike Dean: 0208-657-5401.
- 13 **Bedford MES**. *I. Heys: Antique Locomotive Films*. Contact Ted Jolliffe: 01234-327791.
- 13 **Erewash Valley MES**. *David Veal: Railway Talk*. Contact Jim Matthews: 01332-705259.
- 13 **Frimley & Ascot LC**. *Bits & Pieces*. Contact Bob Dowman: 01252-835042.
- 13 **Melton Mowbray DMES**. *Bill & Ben The Steel Men: Steels and Heat Treatment*. Contact Phil Tansley: 0116-2673646.
- 14 **Dockland & E. London MES**. *K. Norgrove: Docklands Light Railway*. Contact P. M. Jonas: 01708-228510.
- 14 **Sutton Coldfield MES**. *Brett Rogers: 7¹/₄in. Gauge Onwards*. Contact Roger Timings: 0121-308-5875.
- 14 **Taunton ME**. *Meeting*. Contact Don Martin: 01460-63162.
- 15 **Birmingham SME**. *Video Evening*. Contact John Walker: 01789-266065.
- 15 **Bournemouth DSME**. *David Booth: Fixtures & Fittings & Film*. Contact Mike Baker: 01202-383653.
- 15 **Bristol SMEE**. *Club Auction*. Contact Trevor Chambers: 01454-415085.
- 15 **Chingford DMEC**. *Doug Houchen: The Universe - Illustrated Talk*. Contact Martin Masterson: 0208-989-5552.
- 15 **Leeds SMEE**. *President's Night*. Contact Colin Abrey: 01132-649630.
- 15 **MELSA**. *Meeting*. Contact Graham Chadbone: 07-4121-4341.
- 16 **Cardiff MES**. *Len Rees: Railway Driver Recollections*. Contact Trevor Jenkins: 029-2075-5568.
- 16 **Isle of Wight MES**. *Bits & Pieces*. Contact Ken Stratton: 01983-760762.
- 16 **Reading SME**. *Eric Aspdin: The Thames Valley*. Contact Graham Bustin: 01189-615450.
- 16 **Sutton MEC**. *Toy Steam-up Night*. Contact Mike Dean: 0208-657-5401.
- 17 **Rochdale SMEE**. *Steve Whittaker: Restoring a GWR 2-8-0*. Contact Mike Foster: 01706-360849.
- 17 **Romney Marsh MES**. *Video Evening*. Contact John Wimble: 01797-362295.
- 18 **Erewash Valley MES**. *Steaming Day*. Contact Jim Matthews: 01332-705259.
- 18 **SM&EE**. *Problem Solving Forum & Bring & Buy Sale*. Contact David Boote: 01202-745862.
- 18-20 **Maidstone MES**. *Ground Level Track Opening*. Contact Bob Begnie: 528-9114.

- 19 **Frimley & Ascot LC**. *Club Run*. Contact Bob Dowman: 01252-835042.
- 19 **N. W. Leicester SME**. *Running Sunday*. Contact John Elliott: 01455-847040.
- 20 **Leicester SME**. *Member's Items of Interest*. Contact Raymond Wallis: 0116-285-8824.
- 21 **Chesterfield MES**. *Les Henshaw: Railway Films*. Contact Mike Rhodes: 01623-648676.
- 21 **Nottingham SMEE**. *Henry Balen: The Secret War, Bletchley Park (Station X) Code Breaking in WW2*. Contact Graham Davenport: 0115-8496703.
- 21 **Romney Marsh MES**. *Eric Palmer: In Search of Steam*. Contact John Wimble: 01797-362295.
- 21 **West Wiltshire SME**. *UK Transport Slides*. Contact R. Nev. Boulton: 01380-828101.
- 22 **Birmingham SME**. *Gauge 1/SM32 and Stationary Engines*. Contact John Walker: 01789-266065.
- 15 **Chingford DMEC**. *Alan Williams: Trams of London*. Contact Martin Masterson: 0208-989-5552.
- 22 **Guildford MES**. *Bits & Pieces*. Contact Dave Longhurst: 01428-605424.
- 22 **Hull DSME**. *Auction*. Contact Brian Rylance: 01482-647032.
- 23 **Basildon DMEG**. *Meeting*. Contact Malcolm Burrell: 8 The Avenue, Billericay, Essex, CM12 9HH.
- 23 **Cardiff MES**. *Club Chat*. Contact Trevor Jenkins: 029-20755568.
- 23 **Sutton MEC**. *Gauge 1 Round-Up*. Contact Mike Dean: 0208-657-5401.
- 24 **Colchester SMEE**. *A. Grose: History of Hertford Locomotive Depot 1843-1960*. Contact L. G. Hammond: 01376-511666.
- 24 **Hereford SME**. *AGM*. Contact John Arrowsmith: 01432-265151.
- 24-26 **Meridienne Exhibitions**. *The London Model Engineering Exhibition at the Wembley Exhibition Centre*. 10.30am-6pm (Fri/Sat) 10.30am-5pm (Sun). Adults £8, Senior Citizens £7, Children £5, Family (2+3) £21. Enquiries: 01926-614101.
- 25 **Chesterfield MES**. *Running Day*. Contact Mike Rhodes: 01623-648676.
- 26 **MELSA**. *Australia Day Run*. Contact Graham Chadbone: 07-4121-4341.
- 27 **Bedford MES**. *Oddball Tooling*. Contact Ted Jolliffe: 01234-327791.
- 28 **Chelmsford SME**. *Video Night*. Contact D. Blake: 01376-324205.
- 28 **Sutton Coldfield MES**. *Meeting*. Contact Roger Timings: 0121-308-5875.
- 28 **Wigan DMES**. *AGM*. Contact John Chamberlain: 01744-882255.
- 29 **Birmingham SME**. *Peter Jackson & Friends*. Contact John Walker: 01789-266065.
- 15 **Chingford DMEC**. *Small Working Models*. Contact Martin Masterson: 0208-989-5552.
- 29 **Teesside Small Gauge Rly**. *Meeting*. Contact Bill Foster: 01642-710198.
- 30 **Cardiff MES**. *Bits & Pieces*. Contact Trevor Jenkins: 029-20755568.
- 30 **Sutton MEC**. *Natter Night*. Contact Mike Dean: 0208-657-5401.

FEBRUARY

- 1 **Isle of Wight MES**. *Track & Pond*. Contact Ken Stratton: 01983-760762.
- 1 **SM&EE**. *Brian Andrews: The Sandbanks Chain Ferry*. Contact David Boote: 01202-745862.
- 2 **South Durham SME**. *Running*. Contact B. Owens: 01325-721503.
- 2 **Southland SME**. *Running Day*. Contact Peter Stark: 03-21-89702.
- 2 **Teesside Small Gauge Rly**. *Meeting*. Contact Bill Foster: 01642-710198.

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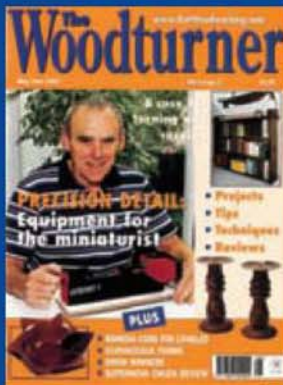
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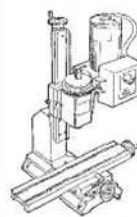
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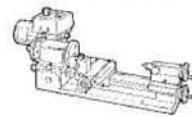


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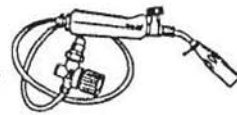
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SET No.

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3. BA TAP SET (2 Taps each size), & B A Die Set 0-1-2-3-4-5-6-7-8-9-10 BA	(TAPPING DRILL SET £5)	TAPS £18 DIES £20
4. 26 TPI TAP SET (2 Taps each size), 26 TPI Die Set, (BSB or CEI) 1/4" x 26, 5/16" x 26, 3/8" x 26, 1/2" x 26, 5/8" x 26, 3/4" x 26	(TAPPING DRILL SET £5)	TAPS £18 DIES £18
5. BSF TAP SET (2 Taps each size), & BSF Die Set 3/16", 1/4", 5/16", 3/8", 1/2", 5/8", 3/4", 1" BSF	(TAPPING DRILL SET £5)	TAPS £18 DIES £18
6. BSW TAP SET (2 Taps each size) & BSW Die Set 3/16", 1/4", 5/16", 3/8", 1/2", 5/8", 3/4", 1" BSW	(TAPPING DRILL SET £5)	TAPS £18 DIES £20
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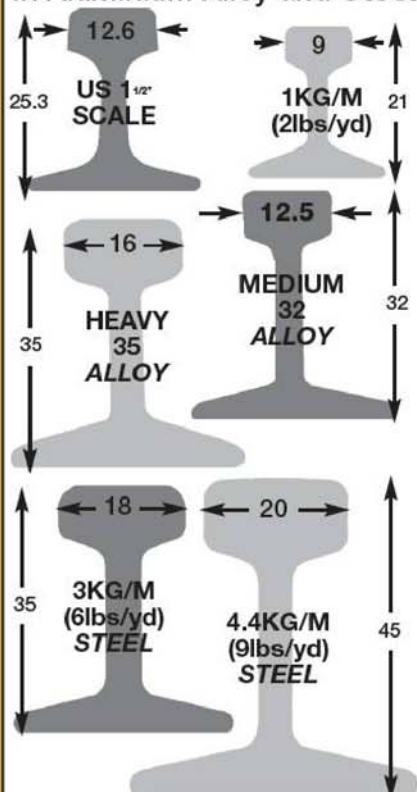
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