

MODEL ENGINEER

Vol. 189 No. 4182

15 - 28 November 2002 £2.20

INSIDE:
*SHELLEY CURTIS
JOHN ROCKEY
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Standard Equipment: Stand, Drip Tray, Splash Back, 4 Way Tool post, 3 Jaw Chuck, 4 Jaw Chuck, Face Plate, Fixed & Travelling Steadies, Tee Slotted Cross Slide, Sleeve, 2 x Dead Centres, Revolving Centre, Low Volt halogen Light, Guards.



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This attractive instrument is suitable for
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be made or marred by the quality of its
plateway as discussed and detailed in
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Responding to enquiries, a few words
about a simple boring and facing head
are followed by advice on making the
eccentric sheaves and straps. Part XXXI.
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On the cover ...

Corliss valve gear was used in the mill
engines which powered the cotton and
woollen industries, for winding engines in
the mining industry, for ventilation,
and for the generation of electricity.
This superb 1:16 scale model of a
tandem compound Pollitt & Wiggzell
Corliss engine by Peter Southworth was
awarded a well deserved Silver Medal
and the Tom Nevins Memorial Trophy at
last year's Model Engineer Exhibition
at Sandown Park Exhibition Centre.
May we have the pleasure of seeing your
work at this year's M.E. Exhibition?
Sandown Park 29-31 December 2002.

(Photograph by Mike Chrisp)

TRADE TOPICS:

A special offer from Motors Direct plus
a new product from Jetcal for home-made
waterslide transfers.
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A CWR LOCOMOTIVE for 7 1/4in. gauge

Introducing a new miniature rack railway
at Beamish plus details of vacuum brakes
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Careful work on the cylinders involving
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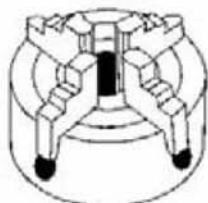
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SMOKE RINGS

With the Editors

Model Engineer Exhibition 2002

Group Sales Manager Colin Taylor and Sales Manager Tony Robertson have been hard at work planning, arranging, organising and preparing for the forthcoming Model Engineer Exhibition to be held 29-31 December 2002 at Sandown Exhibition Centre in Esher, Surrey where all refurbishment work has been completed, making this a superb and accessible exhibition venue.

Regular readers will have noticed the advertisements for the Model Engineer Exhibition and the Competition/Loan Model Entry Forms which have been published in recent issue and which will continue until M.E. 4185, due at your newsagent on 27 December. We hope that these provide all the necessary information required by prospective visitors and those whose models we shall all be able to enjoy at the exhibition. We would be pleased to supply further details if required; please call the Swanley office on 01322-660070 and Colin or Tony will do their best to provide you with the answer or direct you to someone else who can! Please call the Advance Ticket Hotline (01353-654422) or order on line at www.hhc.co.uk/mee to obtain discounted ticket prices; see the advertisement on pages 508-509 in this issue for further details.

We are delighted to report that Colin and Tony have been able to accommodate more model engineering society and club stands at this year's exhibition and have been particularly pleased with the response and take-up of stand space by our good friends in the trade.

We have made sure that plenty of display space is available for Competition and Loan Models and note with pleasure the arrival of a steady stream of entry forms. Readers are advised that all models of an engineered or engineering nature, whatever the subject matter, are welcome and we look forward to hearing from you if you have something which you would like to display.

M.E. 4175

We have received innumerable letters, 'phone calls and e-mails, mainly from regular overseas readers concerning the issue cover dated 9 August 2002. While the editorial remit includes no authority concerning distribution and/or delivery, we have nevertheless sought an explanation from those with this responsibility and have had the following response from Associate Publisher Jez. Walters at the Swanley office:

"Having investigated the situation I am told the problem with 4175 is distribution, not print. Apparently the USA instigated some sort of new security regime which has caused a massive backlog for these bulk mailed items. The upshot of this is that the magazines should turn up at their destination - albeit a little late."

Having been contacted by readers in Australia and Europe who have not received their copies of M.E. 4175, we are intrigued as to how the new USA regime has affected deliveries elsewhere.

Although very much concerned when readers do not receive their copies, the editorial team has no means by which to deal with delivery and/or distribution problems which are handled by other Highbury Nexus departments. To avoid inevitable further delay, readers are advised that enquiries concerning non-delivery of your regular copy should be directed to the Swanley office (tel: 01322-660070, fax 01322-616319).

Lost and found

Bruce Whalley has reported finding a pair of spectacles in a brown case following the recent very successful SEQLEC event at Weston Park.

Bruce notes that the lenses seem quite strong and suspects that the owner may be anxious to know where they were left and that they are safe and waiting to be claimed.

Please call 01952-850555 if they are yours and arrangements will be made to return them to you.



Remote madness!

A new ten part series *Remote Madness* airs on Discovery Home & Leisure during November (Sky Digital 133 and digital cable) and is presented by remote control enthusiast and Channel 4's *Driven* presenter Mike Brewer. The series premieres on Monday 18 November at 21:00.

Remote controlled vehicles are not just the trendy toys of the boardroom executive. There are around 2000 remote control enthusiasts' clubs up and down the UK, where gadget-mad controllers of all ages race cars, boats and planes. Although many enthusiasts take part in impromptu races with their mates, there has never been an opportunity for them to test their skills in a head to head competition. That was until now.

Man and machine will now unite in a bid to be number one and ultimately to claim the title of *Remote Control Champion of Great Britain*. This nation-wide competition is organised in regional heats. Structured around a basic knockout system of 16 teams, each episode features the best remote control experts from two clubs pitting their skills against each other.

This competition demands a high degree of handling skill from the remote control handlers. Speed is not the only factor, as contestants also have to carry out complex manoeuvres. These technical challenges vary from aerial, sub-aquatic and load-carrying tasks, including flying the vehicle through a loop of fire, to retrieving an object from a lake. The team with the highest score will progress through to the quarter finals with the series culminating in the Grand Final.

The winner will have demonstrated technical skill, superior driving technique and the competitive edge to realise their dream. Having pitted their skills against the *crème de la crème* of the Remote Control World, the victor will truly be Number One. So fasten your seat belt and prepare for some serious *Remote Madness*.

Siamese Bee i.c. engine

We have received a letter from Mr. B. G. Bell in Hertfordshire who is making the *Siamese Bee* horizontally opposed, 2-stroke twin engine. The description of this engine by Bill Reichart commenced in M.E. 4140, 23 February 2001.

Mr. Bell has discovered an error on the drawing of the crankshaft assembly. For some reason the crankshaft discs have been dimensioned as 1 1/2 in. diameter making it rather difficult to assemble them in the crankcase, whose internal diameter is shown as 1 5/16 inch. The crankshaft discs should, of course, be 1 1/4 in. dia. and we apologise to those readers who have attempted to build this engine and have been misled. Our thanks must also go to Mr. Bell for pointing out this error, which appears to have lain dormant for some considerable time.

CHUCK the MUDDLE ENGINEER

by B. TERRY ASPIN



POST BAG

'The Sentinel'

SIRS, - Having received back numbers of *M.E.* describing the construction of the quarter scale *Aquila* rotary engine, I came across John Haining's articles describing his 3in. to the foot, S3 Sentinel.

I worked at 'The Sentinel' (as it was known) from 1947 to 1950. Towards the end of that period, a contract to build 100 steam wagons to haul coal in the Argentine was won. Some coal was sent to Shrewsbury to verify that the Sentinel boiler could be fired with it. The boiler was reputed to be capable of burning slate, so poor quality coal presented no challenge!

Seven or eight old models were unearthed to be overhauled in advance of the main contract. Apparently they all differed in minor aspects and the 'old hands' proclaimed that they personally had never worked on that particular model!

Interestingly, Mr. Haining's article refers to aluminium alloy pistons; I can only remember fairly elaborate (with relief around gudgeon pins) cast iron pistons. What I found more remarkable was the three position (start, run, reverse) sliding cam shaft, which was so different to the usual i.c. engine camshafts.

At that time, 'The Sentinel' was remarkable, possibly even unique, in its range of activities. Apart from seriously specialist items including ball bearings, piston rings and the like, everything could be and was produced on site. A splendid foundry, a laboratory, a well equipped machine shop, a fitting shop capable of aligning and scraping lathe beds 20ft. or more in length were all there, together with expertise in welding and sheet metal work. This was backed up by a good-sized design and drawing office.

The firm existed, I suppose (I was on the shop floor) on contracts, and the attempt to introduce a Sentinel product in the form of the diesel lorry fell by the wayside. How good the management was, I cannot say, I only came into contact with foremen.

At the time I was there, the products included standard Swift and Edgwick lathes plus specials (long beds), a super precision miller (Thiel), the Cridan B high speed screw cutting machine (which used lead cams instead of a lead screw), 20 and 50 ton presses, Wadkin spindle moulders, coal cutting machinery and of course, the diesel engined lorry. The engine in this lorry was mounted as a flat-four in

the style of the old steamers. It was fitted with a cast iron crankshaft (composition unknown to me) and, as far as I could make out, had proved fragile in operational service. At any rate, I recall seeing a replacement machined from a solid steel billet. The red-hot chips from the 'heavy duty' metal removal by negative rake face milling cutters were very impressive.

There was one other special department known in the works as the DOCP where diesel engines used in the big excavators by the Directorate of Open Cast Mining were overhauled. These were genuinely big marine type diesels of, I suppose, 400-500mm bore. There were also smaller auxiliary engines and I used a set of scrapped valves from a Cummins to make a set for my Riley 9.

The Cummins valves were machined on the old round bed Drummond with the stems and seats finished in the works. This department also assembled some large five-stage, in-line compressors to produce, I believe, liquid oxygen for BOC. Another good example of versatility was the production of the spherical pressure vessels used at that time to transport liquid oxygen. These spheres were composed of six or eight copper segments beaten up on a welded former and assembled by brazing.

Towards the end of my time there, manufacture of a 2-cylinder, Ganz diesel engine was started. This was an Austrian or Czech design and I recall talk of it being accepted as part of some reparation deal. For us the problem (commoner, later I expect) was the conversion of metric measurements to be undertaken with imperial measuring equipment (tolerances with four figures after the decimal point).

Given the range of machines and trades it was perhaps not surprising that 'foreigners' could be fairly easily introduced. I lost the more or less essential starting handle from my 1932 Riley 9 and in two days had a new one turned and bent up. I still have the two pairs of hardened and ground parallels I had made up, but not everything went quite as intended. A cylinder block with three bores plus 0.020in. and one at plus 0.060in. is not ideal!

I managed to begin a career as a professional engineer (AMI Mech. E) as a turner at 'The Sentinel' entirely on the basis of what I had learned as a boy from *M.E.* and practice (unsupervised) in my father's fairly fundamental, treadle driven workshop. I can also say that the range of



Mr. Rhodes' simple lathe tool height setting device.

activities I was able to observe in the Sentinel works stood me in good stead in my subsequent career.

David R. Richards,
Ligueux, France.

Tool height gauge

SIRS, - I read with great interest Mr. Ellis' recent article (*Letters to a Grandson*, *M.E.* 4173, 12 July 2002) and especially his comments on tool height gauges and their usefulness for rapid tool setting.

Enclosed is a photograph of my own tool height gauge, which has been in constant use for many years. This design has the advantage of enabling rear mounted tools such as parting tools, which most people seem to find work better upside down, to be set at the correct height. Sam Rhodes, Lancashire.

Drummond lathes

SIRS, - In his series *Letters to a Grandson* (*M.E.* 4175, 9 August 2002) Mr. M. J. H. Ellis describes the Drummond 4in. lathe and returns with further details in *M.E.* 4177, 6 September 2002.

Grandpa Ellis is evidently a younger grandpa than the writer of this letter. He may be interested to know there must be many owners of Drummond round bed lathes still using them. I am one of them.

I bought my lathe new in March 1929. It cost £9-0s-0d for the lathe with faceplate and change wheels for screw cutting. A hollow mandrel was five shillings (5/-) extra, and a taper screw flange chuck for wood turning cost ten shillings and sixpence (10/6) more. The total price was £9-15s-6d and the lathe arrived in a stout returnable packing case. The cost was well beyond my pocket money but a massive subvention of five pounds birthday money made the purchase possible.

In 1993, by means of a letter in *Model Engineer*, Mr. R. A. Bird of Poole started a register of Drummond owners. I registered my machine under its serial number 05073 and he sent me much interesting information on the Drummond 4in. and 3½in. lathes, together with a history of the company. Regrettably he died some time later.

My Drummond succeeded my first lathe, which was a round bed Wade. I did quite good work on the Wade but the Drummond is much more versatile and stiffer. Mr. Ellis is right when he says that the round bed has the disadvantage that the tool is 7in. above the key which slides in the slot under the bed and prevents the saddle from turning around the bed. Any slack between the key and the slot is therefore magnified at the tool. There was correspondence in *Model Engineer* about this and one solution was to make a key with a longitudinal saw cut in it which could be expanded using a tapered screw.

The tailstock key does not wear much but, in any case, both the saddle and the tailstock can be tightened onto the bed by screws which close slots in the bases which both surround the bed. Sometimes I miss a back gear especially as most of my lathe tools are carbon steel and suitable only for modest cutting speeds.

I am glad to see that the famous Drummond 4in. lathe is still interesting enough to appear in the magazine. I would have liked to be able to afford the 3½in. lathe in 1929, but it cost £30!

E. V. Mellor, Cheshire.

Tufnol springs

SIRS, - There has been correspondence concerning the suitability or otherwise of Tufnol sheet for leaf springs. As my next locomotive (when I eventually finish this one!) will have leaf springs, I looked up the constituents and properties of Tufnol in the manufacturer's data sheet and found that it is made using either a phenolic resin, or in the more exotic grades, an epoxy resin. Neither of these is a thermoforming plastic, i.e. one that can be moulded using heat, although since Tufnol has been so moulded, it is obviously possible, but not always successfully. I wonder whether the physical properties are affected.

I must emphasise that I have not tried the following for real, but what little work I have done suggests that if one were prepared to experiment a bit, success would be likely. Most model shops sell Plasticard, a rigid polystyrene sheet in thicknesses



Mogul (2-6-0) Locomotive for Freight Service. Built for the Lackawanna by the American Locomotive Company. Cylinders 20 1/2 in. x 26 in. Steam Pressure 200 lbs. Diameter of Drivers, 63 in. Tractive Effort, 2,948 lb. Heating Surface, Tubes 2,176 sq. ft.; Firebox, 161 sq. ft., Total, 2,337 sq. ft. Grate Area, 53.4 sq. ft. Rigid Wheel Base 15 ft. Total Engine Wheel Base, 23 ft. 10 in. Weight on Drivers, 150,500 lb. Total Weight of Engine 171,500 lb. Fuel, Soft Coal.

ranging from 0.01 in. to 0.08 in. by 0.01 in. increments. It is mainly available in black or white but other colours are also available.

My reference books state that polystyrene has a Young's modulus of 2.7-4.6 GPa. I have done some simple cantilever bend tests, which suggest Plasticard has a value at the bottom end of this range. I rang up the suppliers, but I don't think they understood my question. Steel has a value of 207 GPa, and Tufnol is quoted at 6.5 or 10.4 GPa depending whether Carp or Whale brand is used. Binding a piece of Plasticard to a steel former and then immersing in boiling water for a few minutes produced a permanent change of shape. Plasticard therefore looks like a viable alternative to Tufnol, and is much more readily available. Duncan A. Webster, Cheshire.

Swindon locomotives

SIRS, - When Neville Evans commenced his Jones Goods/Loch series I thought that at long last *Model Engineer* had learned that other towns apart from Doncaster, Derby, Crewe and Swindon could design locomotives. However, the Swindon fan club appears to be very active and we are now lumbered with *Penrhos Grange* which, as the author states, is nothing more than a beefed-up *Torquay Manor*.

Then we have Keith Wilson's, Great Western *Saint Christopher* and I am well aware that he is doing the *Logger/Slogger* series.

With its tapered boiler barrel, Belpaire firebox and inside valve gear, the Swindon locomotive is a very expensive locomotive to make and service. LBSC with *Ayesha* and *Maisie*, and Martin Evans with *Caribou* and *Natal* proved that a straight boiler barrel with a wide or Wooten firebox would produce all

the steam needed with low-grade coal. In full size the Wooten firebox allows easy replacement of all boiler stays without a boiler lift. This may explain the increasing number of American 5160 locomotives on private railways in this country.

I have pleasure in enclosing details of locomotives that would make excellent, easy to build models (*one of which is reproduced above — Ed.*)

Are readers aware that the SLM (Swiss Locomotive and Machine Works) are now producing modern steam locomotives? So far a rack locomotive and a mainline locomotive for hauling the Orient Express have been produced.

Clive Barton, Leeds.

Colour on drawings

SIRS, - Commenting on the letter from Harold Hall (*M.E.* 4175, 9 August 2002) I would object to colours in engineering drawings only from the point of view that it would put people who are colour blind at a disadvantage.

One of my favourite pictures is a print of the general assembly drawing for a Johnson 4-4-0 LMR locomotive (this print may still be available from the Science Museum at a very modest cost.) This drawing is coloured and, just from this, one is able to determine materials to be used as well as constructional details.

How does this impinge on model engineering? I take the view that the purpose of drawings is to clearly provide all the information necessary to produce the part or assembly to which it refers. Colours, with the caveat above, have no relevance provided the information is clear and complete. However, a great deal of thought has been applied in this area and has resulted in British Standards and ISO standards. These may be too onerous for general use

in our hobby but could form the basis of what should be accepted.

I notice an example of coloured drawings in *M.E.* 4176, produced by Keith Wilson. If one were very critical, the drawings for the components in this article would just about scrape in on the clarity front.

Having said that, I must also say that I understand Keith's approach to transferring drawings to the printed form. Over the recent years and months I have noticed that Keith has been searching for a way to show outlines in a wider line thickness. With his CAD program I would guess that at times he has used 'polylines' which have not been filled when they have finally reached the print stage and look like a set of miniature tram lines.

So I suggest to Keith *et al* that colours are okay, but that they should be used to give clarity, employing colours that have a high contrast with white — red is much better than yellow in this respect — and at least draw hatching where sections are shown.

David Tompkins, Surrey.

CAD Printout

SIRS, - To keep the workshop shack at the cutting edge of the white hot technological revolution I am teaching myself CAD but seem to have a little problem.

How can I get my A4 inkjet printer to produce half imperial drawings that I can read at a suitable distance while turning? Perhaps the printer's intestines could be liberated and used to make a flat bed plotter? I feel that taking floppies to a print shop would be admitting defeat.

In response to Harold Hall's letter concerning coloured drawings, perhaps we could compromise by using only one colour and calling them 'Blue Prints'.

Chris Smith, Somerset.

Ordnance Society

SIRS, - I have noticed over the years in the pages of *Model Engineer* a consistent interest in miniature ordnance, most recently the excellent series of articles by David Wilcox. It occurred to me that readers interested in ordnance might not be aware of the existence of the Ordnance Society.

The society, of which I am Chairman, was formed in 1986 to promote, encourage and co-ordinate all aspects of the history of ordnance and artillery. It is today an international society with members, including many experts in the field, from several countries. Its primary aim is to provide a means of communication for individuals and organisations in any aspect of ordnance and artillery of all periods. A number of members are committed modellers.

The society organises a number of events and produces a number of publications to further this aim: an annual *Journal* of about 90 pages which is produced to a high standard, well illustrated and containing authoritative articles; a quarterly *Newsletter* containing news, short articles, reviews, and occasional features such as *Ammo Box* and *Modeller's Corner*. Several visits are organised each year to appropriate places of interest and we run *Members' Days* for sharing and exchanging information.

If readers would like to find out more about the Ordnance Society then they can visit our website at: <http://freespace.virgin.net/ordnance.society/index.htm> or write to me c/o the Editor.

Robin Armstrong, Kent.

Royal Scot update

SIRS, - Following my recent letter, on Wednesday 4 September 2002 the *Scot* was finally separated into more manageable pieces. The boiler lift went well. There were slight problems with the smokebox, which was stuck to the saddle. This was resolved by driving wedges between them with a 14 lb sledgehammer while under tension and a bit of jiggling with the crane to get the firebox end to come squarely out from between the frames. It now sits on a well wagon awaiting cladding and asbestos removal. The frames were then lifted from the wheels and placed on two ex-London Underground accommodation bogies. The only problem was that the engine bogie didn't want to drop off until assisted by a large fork lift truck! I believe the lift was covered live by Anglia TV News.

On the same day the LBSCR Terrier *Martello* was also separated into similar bits so there will be plenty of things to do over the next couple of years.

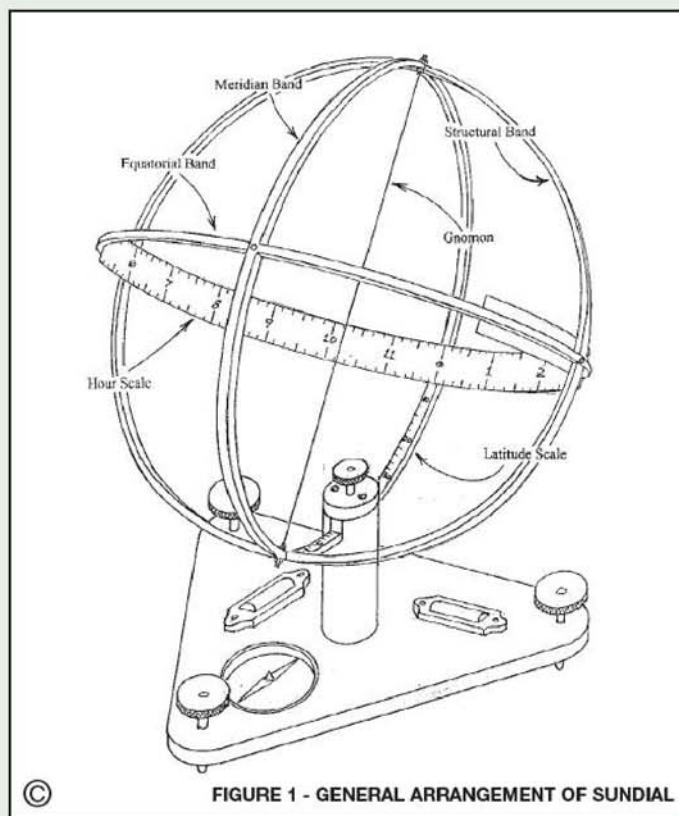
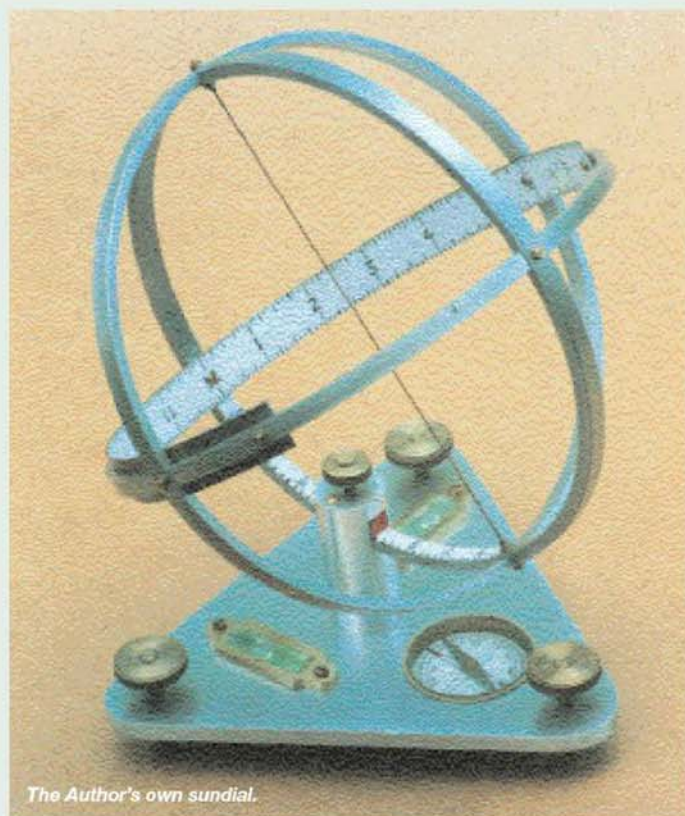
As mentioned before, if any readers are building models of either of these locomotives, this is probably the best chance to measure and photograph the bits, particularly as some parts will have to be remade before re-assembly.

Colin Ager, Norfolk.

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PORTABLE UNIVERSAL SUNDIAL

David Wilcox

describes the design and construction of an armillary sphere portable sundial which can be used anywhere in the world and can be set to show the time to an accuracy of 2 to 3 minutes.

Readers of *Model Engineer* may recall that I described the construction of a Portable Compass Sundial in *M.E.* 4134, (1 December 2000) small enough to slip into one's pocket. Like common-or-garden sundials, the hour scale was non-linear and could indicate time with reasonable accuracy for latitudes encompassing the British Isles.

The sundial described in this article is, on the other hand, Universal, in the sense that it can be used anywhere in the world. The hour scale is linear and the angle of the gnomon can be set for most latitudes. It takes the form of an armillary sphere which is, in effect, a skeletal model of the celestial sphere. This comprises, as a minimum, two circular bands plus a wire or rod through the poles equating to the Earth's axis and which acts as the gnomon. One band represents the equator and carries the hour scale and the other (in the vertical plane), the local meridian of longitude. A third band at right angles to the other

two merely provides structural rigidity.

To use the sundial, the base must be accurately levelled, the gnomon set to the local latitude angle and the whole pointed to true North. Corrections then have to be applied for Summer Time (if in force), displacement East or West of the relevant Time Zone meridian and finally the Equation of Time. More on all this later in the article.

Skeletal sphere

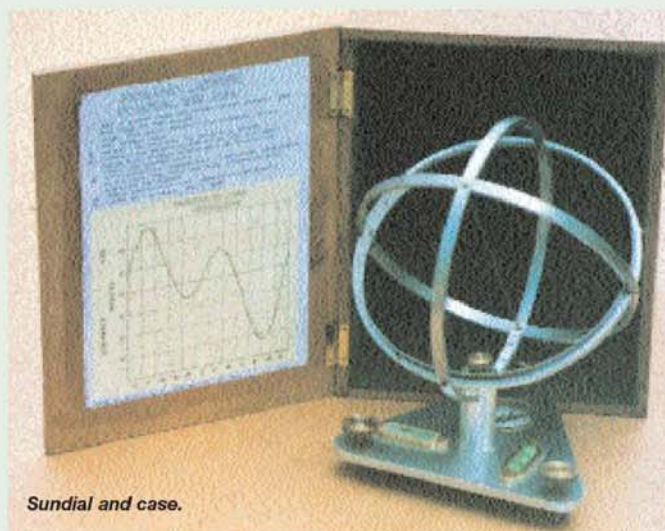
The construction and the dimensions of this sundial depend very much on what materials are available, in particular the fabrication of the three bands or rings which should ideally be exactly the same size. For this reason, I have not provided detailed

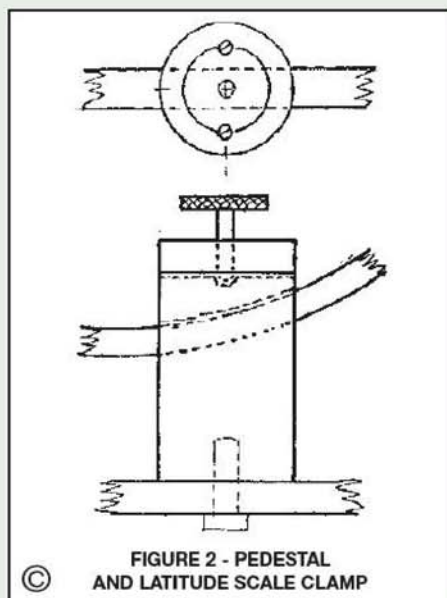
drawings but instead, diagrams to indicate the general idea which other model engineers may wish to adapt to what they have at hand. In my magpie chest, I found a cast aluminium alloy fan housing from an old washing machine motor which had a useful cross-section just under 6in. dia., 1in. wide and 1/4in. thick.

With some difficulty, I mounted this on the faceplate of my Myford ML 10 and managed to machine from it three identical rings 5.7in. dia., 1/8in. thick and 1/4in. wide. The three bands were interlocked together using carpenter's housed joints precisely 90deg. apart on each ring. The six joints were drilled through to accept 12BA bolts to secure the bands rigidly.

The two joints joining the meridian band to the structural band have to support the gnomon wire which was made from a length of 22 gauge bronze wire cut to the diameter of the bands. The heads were removed from two 12BA bolts which were then drilled through to accept the wire. These lengths of 12BA screw were then silver-soldered with a tiny dab of Easyflo paste to each end of the wire. Nuts on the outer ends of the screws tensioned the wire and nuts on the inner ends locked the screwed sections in place.

The hour scale is mounted on the inner surface of the equatorial band with noon at the centre and in line with the meridian band. Since this is an equatorial type of sundial, the hour/minute scale has equal divisions





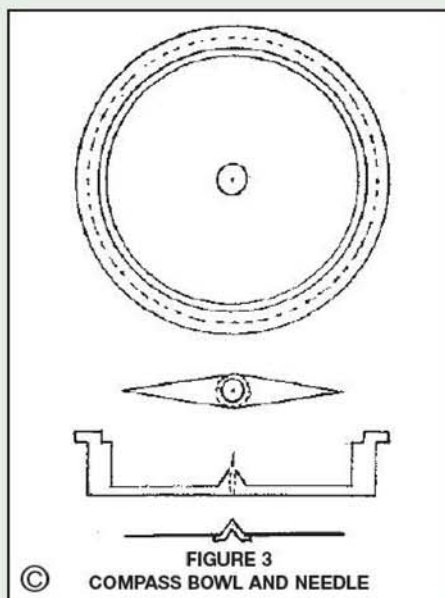
and traditionally runs clockwise from 5am to 7pm. The 6am and 6pm marks are exactly 90deg. from the noon mark and should coincide with the joints made by the hour band with the third band. The hour scale was made from springy steel strip, 1/2in. wide as used for baling crates. Good quality white paper was glued to the inside surface of the strip. The strip was then sprung into place for a trial fit and the 6am, noon and 6pm points marked. After removing and flattening it, the scale was subdivided using a geometrical projection and inscribed with hour, half-hour and 5 minute marks. The scale was extended either side to 5am and 7pm. The scale was then bolted to the hour band at the 6am, noon and 6pm points using the 12BA bolts at the three joints. Finally, the scale was given two coats of transparent lacquer.

Pedestal

The skeletal sphere is attached to a pedestal which in turn is mounted on the base plate. The attachment to the pedestal has to allow for the gnomon to be able to be set to the local angle of latitude and yet at the same time accurately maintain the fixed orientation of the meridian band to the base plate. Doubtless there are a number of ways of doing this, for example the sphere could be gimballed about an axis running through the 6am-6pm hour marks, however, I chose a pedestal approach since it was perhaps simpler and more compact.

The pedestal is made from a length of 1/4in. dia. round Dural bar. It could equally have been square or rectangular in cross-section. As fig 2 shows, a channel is machined in the top of the bar, its width providing a close sliding fit to the meridian band. The idea is to be able to clamp it rigidly in the channel at the selected latitude angle. The depth of the channel is such as to accommodate the thickness of the band plus a securing wedge made of brass.

The pedestal is surmounted by a matching cap bolted to it by two 8BA screws. A small knurl-headed brass screw operates through the centre of the cap so as to bear down on and clamp the wedge and meridian band against the lower surface of the channel in the pedestal. A dimple was drilled in the top centre of the wedge for the clamp screw to locate in. By loosening the knurled screw, the meridian band can slide through an arc of about 70deg., limited by the diameter of the pedestal. In fact I chose to cant the sphere forward by about 20deg. so as to better



centralise the sphere over the triangular base.

This was done by machining the channel at an angle of 20deg. to the horizontal. As a result, the gnomon on my sundial can be set for latitudes between 20deg. and 90 degrees. This is certainly not to suggest that the sundial cannot be used between the equator and 20 degrees. For these latitudes, a 20deg. setting should provide undiminished accuracy.

In my design, a paper latitude scale was glued to the inner surface of the bottom rear quadrant of the meridian band. The latitude scale is marked from 0 to 90deg. and is read against the front edge of the wedge which is flush with the front of the pedestal. The scale was calibrated using a protractor to measure the angle between gnomon and the horizontal base. Once again the paper scale was given two coats of transparent lacquer.

In retrospect, it might have been simpler not to cant the meridian band forward in the pedestal but to clamp it with a wedge so that the centre of the sphere is vertically above the centre of the pedestal. But in this case the angle read on the latitude scale against the front of the wedge would then need to be compensated for the offset from the vertical caused by half the diameter of the pedestal. I leave it to readers to conceive of a more elegant way of setting and reading latitude.

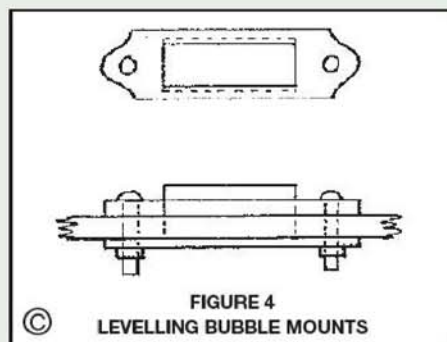
The bottom of the pedestal was screwed to the base using a 2BA cap-headed bolt.

Base

This was constructed from 3/16in. thick Dural plate, cut triangular in shape with corners rounded. The base plate has to accommodate the pedestal, magnetic compass, two levelling bubbles at right angles to each other and three levelling screws. The pedestal is set back from the centre of the base so as to allow space for a reasonable size compass and hence the reason for canting the sphere forward by 20 degrees.

Compass

For the sundial to be set accurately to true North, the compass card should be large enough to be read to better than 5 degrees. The compass bowl was turned from brass plate approximately 1/4in. thick with an internal diameter of 1 1/4 inch. The essential features, shown in fig 3, include an external lip for mounting the bowl, a recess for the transparent plastic cover, and a central pip drilled to accept the compass needle pivot. The pivot is the sharp end of a sewing needle about



3/16in. long, secured in the hole with Loctite 601. A 0.5mm dia. drilled hole was found to suit the needle. Surplus needle length was sawn off using a mini-drill cutting disc. If possible use hard clockmakers brass for the compass bowl, you will be less likely to break a tiny drill!

The compass needle itself was cut from mild steel shim 2-3 thou. thick, which sits on a cone shaped brass thimble which in turn balances on the needle point. Some trial and error is to be expected to get the compass needle and thimble to balance perfectly and turn freely on the pivot. I ultimately achieved success using a diamond sharpener to grind up a spade drill about 1/16in. wide and with an angle of 60deg. to bore out the thimble.

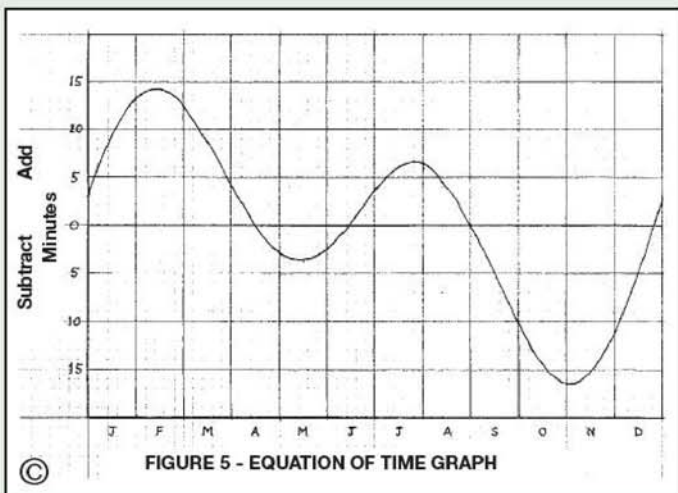
The compass needle was adequately magnetised by stroking it across the pole of a strong magnet. The North end was given a tiny dab of red paint and the South end, blue. The compass card was drawn in black ink with a mapping pen on white card and shows the cardinal points of the compass, but equally important, it needs to be marked, at least close to North, with 5deg. intervals so that adjustment may be made for magnetic variation. Finally, the compass bowl was capped with a thin disc of transparent plastic. The thimble and compass pivot have to be dimensioned so that the top of the thimble does not foul the transparent cover but equally, if the compass is inverted, it still remains captive on the pivot.

Levelling

To indicate the time accurately, the base must be absolutely level. The three brass levelling screws began life as 1in. long 2BA screws. The heads of each were turned off in the lathe leaving just a small spigot. This was inserted and then silver-soldered into a matching hole in a knurled brass disc about 3/4in. dia. and 1/8in. thick. 2BA holes for the levelling screws were drilled and tapped at each corner of the base plate 1/2in. in from the edge.

The plastic levelling bubbles may be obtained from Greenweld, Unit 24, Horndon Business Park, West Horndon, Brentwood CM13 3XD, (5 for £1). They each measure 1 inch long and 1/4in. dia. and they rest in troughs cut in the base plate. As shown in fig 4, each is secured by a thin plain bottom plate and a quasi-decorative top plate, this latter cut from brass sheet about 1/16in. thick. The top plates have cut-outs with the internal long edges bevelled so as to provide the capsules with a snug fit. Each pair of plates was fastened through the base with two 8BA bolts. The bubbles were arranged on the base either side of the pedestal at right to each other.

For alignment purposes, it may be wise to lightly inscribe the top surface of the base plate with a centre line running from the front levelling screw to the bisect of the rear side. The compass and pedestal were positioned on the centre line with the compass North/South and the meridian band aligned along it. So much for the construction of the sundial.



location is West of Greenwich, local time lags that at Greenwich and 4 minutes per degree must be added. Conversely if East of Greenwich, then 4 minutes per degree must be subtracted.

3: Summer Time
When this is in force, one hour must be added.

Use

In order to use the sundial and convert local apparent (or solar) time to Standard (or mean) time at the central meridian for a given time zone, a number of corrections have to be made, having first levelled the sundial.

1: Magnetic Variation

The sundial has to be set to true North, using the compass. In the British Isles, Magnetic North currently lies about 5deg. West of True North (or Pole Star), but varies a little across the country. An accurate figure may be found in the margins of your local Ordnance Survey 1/50,000 scale map.

Let us say it is 5deg. West, then the sundial must be turned 5deg. clockwise so that the compass reads 355 degrees.

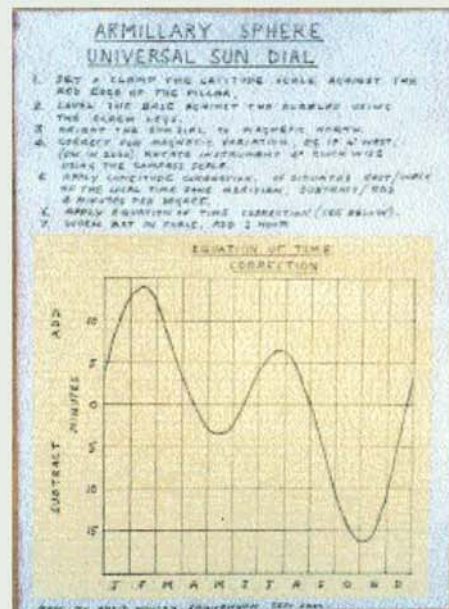
2: Longitude

Time zones throughout the world are generally centred on a local meridian and these are often multiples of 15deg. since 15deg. of longitude is equivalent to 1 hour. Each degree is therefore worth 4 minutes. For the UK, a good map will show for any place the number of degrees it is East or West of the Greenwich Meridian. So, if a

4: Equation of Time

Because the Earth is inclined at 23.5deg. to the ecliptic, and also because the Earth goes round the sun in an elliptical orbit, during the course of the year, the length of the solar day can differ from the 24 hour mean day by up to 16 minutes. The necessary correction is read from a simple graph drawn on card pasted to the inside lid of the sundial case. The precise equation of time may be found in *Whitaker's Almanac*, available in any public library, and although it varies slightly due to the leap year over a 4 year cycle, the year-to-year variation may be ignored with sundials. An approximate Equation of Time graph, sufficiently exact for the purpose, is shown in fig 5.

It may be worth noting that round about mid-day, the front half of the meridian band obscures the shadow cast by the gnomon on the hour scale. Hence with many equatorial type sundials, the front half of the meridian band is omitted. Likewise, depending on the time of the year, the front half of the equatorial band will partially obscure the hour scale and this is the reason why the hour scale is made much wider than the equatorial band. Omitting the front halves of these bands will of course affect the rigidity of



Instructions for using the sundial are mounted conveniently inside the lid of its carry box.

the structure and possibly the accuracy but this problem could be overcome by beefing up the main elements. Clearly the general idea lends itself to any number of mechanical interpretations and I leave it to readers to think about this.

Conclusion

If this sundial is well made and the corrections applied, it should be capable of indicating the time to within 2 or 3 minutes.

Finally, to round off this project, I would suggest that a travelling case is made. I made mine from MDF sheet, pinned and glued at the edges and then varnished. The inside was lined with self-adhesive green baize and the Equation of Time graph and a simple *aide-memoire* to the use of the sundial were pasted inside the case door.

May the sun always shine when you need to tell the time.



Peter Spenlove-Spenlove
comments on some important design features.

These notes are prompted by Chris Leggo's adjustable faceplate design which was published in *M.E.* 4170, 31 May 2002. First, let me say what a good idea it is — so simple that one wonders why it hasn't been done before. Since the standard cast iron faceplate supplied with the typical 3 1/2 - 4 in. centre height lathe is usually rather small, this new design is ideal. The use of Belleville spring washers makes adjustment of the heaviest work easy too — an excellent idea.

ADJUSTABLE FACEPLATES

Back plate

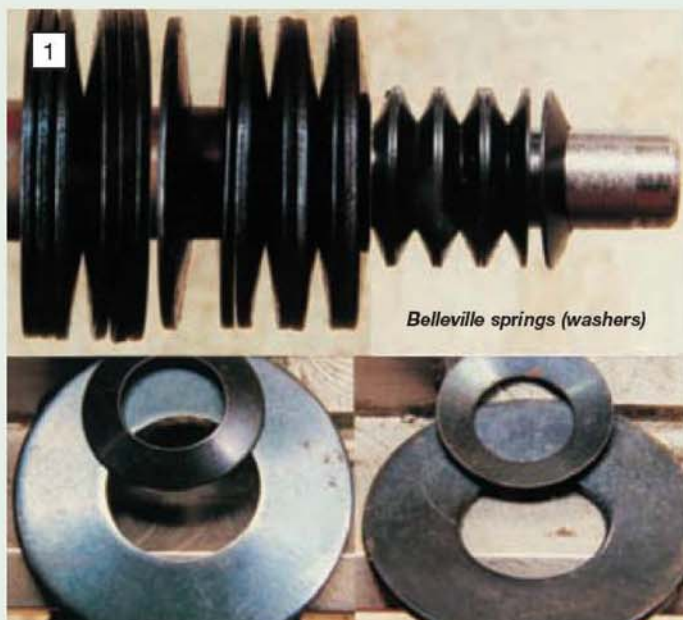
I have a few comments for those readers who are new to engineering. This should help to avoid tool chatter when turning a large flywheel or traction engine road wheels on this adjustable plate. Mr. Leggo used stout proportions for the parts but mild steel, if struck, can 'ring' whereas cast iron does not. Cast iron tends to be dead and absorbs vibration — that's one of the reasons it's used for the structure of machine tools. If the back plate is small and the steel plate too thin then tool chatter may occur due to vibrations in the plate. Incidentally, the existence of the four dogs on the back will help to lessen the ringing effect and hence chatter.

My advice would be to buy the biggest back plate you can find. Several advertisers offer back plate blanks threaded to suit several popular lathes. The unmachined face and outside diameter is left as cast or rough machined so that it can be machined

to suit your chuck which might be 3 in., 4 in., or even 6 in. dia. for a 3 1/2 in. (7 in. dia. swing) lathe. To do so, simply make sure the thread is clean and fit it to your lathe. Skim the face of the back plate without taking too much off and clean up the rim.

The steel disc could be bought as a sawn billet, or piece which has been flame cut from plate. Steel is springy, so try to avoid material less than 1/2 in. thick unless the faceplate is intended only for very light work such as clock faces, wooden bowls and the like.

If you have a flame cut disc, it will almost certainly be from an off-cut left over from another job. It is as well to check that it is flat by testing it with a rule before you take it away. A slight bend may not be visible but will be tedious to machine out from both sides. Your 1/2 in. plate could easily end up only 3/8 in. thick, or even less. If in doubt, aim for thicker material, but not to



the extent that it uses up valuable bed gap space.

It may not be possible to obtain a mild steel disc, so give consideration to making a wooden pattern and asking a foundry to make a casting. Several advertisers in these pages supply iron castings and may be able to help. Make the pattern about $\frac{5}{8}$ in. thick to allow for machining. If this isn't possible give some thought to casting a disc yourself in aluminium alloy. Simply make a circular shape in a level bed of *clean, dry* sand. Line the rim with a ring of cardboard or tinplate to stop the edge of the sand from falling in. Make the depression a bit deeper than the finished disc thickness.

Melt some clean, dry, oil free, surplus castings in an old cast iron saucepan and pour it into your mould. Face and body protection must obviously be worn, and a barrier placed between your legs and feet and the mould in case of spillages and splutters. If the exposed top surface is uneven, play the blowtorch over it to re-melt it so that it can flow out evenly. A finished, aluminium alloy disc of 10in. dia. and $\frac{5}{8}$ in. thick should be satisfactory for lathes like a Myford or Southbend and will put less weight on the headstock bearings than an iron or steel disc.

Tapping the holes

Once the disc has been machined, you'll need to consider how you will tap the 100 or so holes so that each one is square to the surface of the faceplate. To do this relatively quickly, first drill all the tapping holes and lightly countersink each side. Put the plate on the drilling machine table and grip the tapered tap from a standard set of three in the chuck. Make sure that the hole, or a T-bolt slot in the table is under the tap. Anoint the holes with tapping lubricant. If your drilling machine has a reversing switch and you have a helpful friend, you may wish to use the following technique:

- 1: Line up the first hole using the tap. The spindle should be stationary.
- 2: Your helpful friend now switches the spindle on and off again as you lower the tap into the hole to start the thread.
- 3: When spindle has stopped, your assistant selects reverse and switches on and off again.
- 4: The tap withdraws while you support the feed lever against its spring.

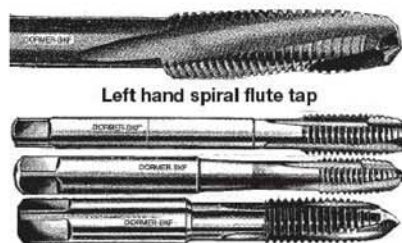
After all the holes have been dealt with, fit the tap into a tap wrench and 'feel' the tap into each of the holes to complete the tapping. It should pick up the already started thread in each hole and provided

before following up with the second tap you shouldn't need the plug tap.

Some single-phase motors will get hot if repeatedly stopped and started as described. If this happens to you, stop every so often to allow things to cool down. Note also that single-phase motors must come to a complete stop before switching to reverse. If your machine has no reverse, once the chuck has stopped, get your friend to grab it and wind the tap out while you hold the plate and lever. If all your friends desert you in your hour of need then you will have to clamp the plate down for each hole and work the lever and reversing switch yourself. A large plate is not easy to clamp down as it probably covers most of the surface of the drilling machine table leaving little space to fit clamps properly *so please be sure to take care*.

It is possible to tap the hole right through in a single pass on the drilling machine, but first drill a slightly larger tapping size hole to give 85 to 90% thread. Buy a spiral flute machine tap whose spiral runs in the opposite direction to the flutes on a twist drill. Use a paste type tapping compound in each hole and set the drilling machine to its lowest speed. Clamp the work for each hole. Switch off just as the tap breaks through. If you delay, the momentum in the machine may cause the shank of the tap to spoil the first few entry

FIGURE 1 - MACHINE TAPS FOR THROUGH HOLES



Left hand spiral flute tap

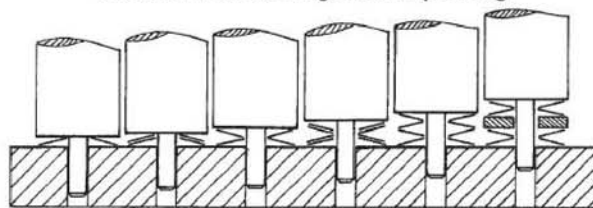
Three spiral point taps

Spiral point taps may have straight flutes; note similarity of the cutting end with that of the spiral fluted tap. Machine taps are power driven through the hole in a single pass, swarf being pushed forward. Reversing partway through the hole is not recommended. The hole to be tapped is often drilled slightly oversize to reduce the power requirement and breakage.

A tap wrench and three taps (taper, second and plug or bottoming) used in sequence is required when tapping by hand.

FIGURE 2 - BELLEVILLE SPRINGS (Washers)

Upper and lower pressure faces should be hardened. Interpose hardened steel washer(s) for maximum life. Centralise on a free fitting hardened pin or leg.



Use these as short stroke springs where space is limited, ie press tools, shock absorbing buffers, adding stiffness to lever pivots, etc. One or two may be added to firm up tin snips/garden shear joints, etc. Dealers may supply experimenters' packs containing an assortment of diameters and thicknesses to facilitate selection for a particular job.

you are careful not to exert any side pressure on the tap, the finished threads will be perfectly square to the surface of the plate. If the taper tap is taken right through

threads. These spiral fluted taps are designed to push the swarf forward and out of the bottom of the hole, so make sure its exit from the hole is not obstructed. Make sure the tap is for through holes and not for blind holes. Figure 1 shows some machine taps. All four are designed to cut right hand threads in a single pass without stopping.

Disc springs

A word now about Belleville washers or, more correctly, disc springs (photo 1). It must be about 40 years ago that they were introduced to press toolmakers. Certain parts of press tools need strong, reliable springs with a short stroke. There is usually no room for normal coil springs or rubber springs and the Belleville disc springs came to the rescue.

Manufacturers usually supply data sheets which give spring rates for a large range of sizes, together with methods of installation and use. Each diameter is available in a variety of thicknesses and hence spring rates. They are made by blanking and piercing annealed spring steel sheet. After pressing to a slight cone shape they are heat treated to give them the required design parameters (springiness, etc). To increase the force two or more spring washers can be combined, each the same way round. To increase the deflection two or more spring washers can be combined, each in alternately directions. By combining the two layouts, both force and deflection can be increased (fig 2). Properly installed, Belleville washers are very useful indeed.

Later, fitters acquired Belleville washers and used them as washers to place under nuts, usually self-locking nuts of the Nyloc or similar variety. In this way a pivot can be made rattle free but not so tight that it is stiff. It is this effect that Chris Leggo has used to such good effect to centre his faceplate before locking it up tight.

Studding

Newcomers to the hobby may not have a collection of clamping bolts so should consider buying a couple of lengths of studding. This is mild steel rod with a thread rolled along its entire length of, typically, 300mm or 1 metre. It can be bought at engineer's merchants and is available in a range of diameters and threads. While you are there, buy a handful of stout washers and nuts to suit the studding.

When setting up a job a length of studding can be cut off to suit. Be sure to round off the cut ends to remove all traces of burrs so that you do not cut your hands. When setting up the job screw the studding into an appropriate hole and lock it lightly with a nut. It will then behave itself while you sort out finger clamps, packing, washers and nuts to clamp the work to the faceplate.

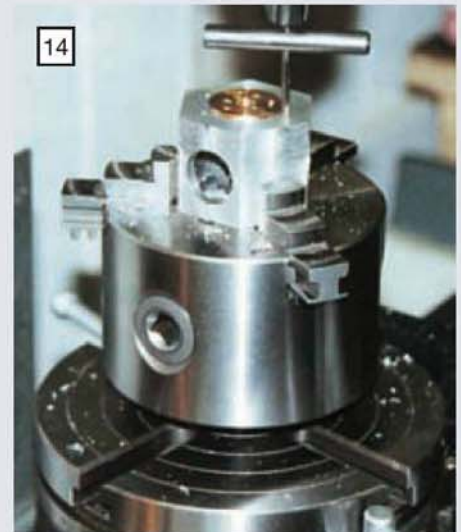




12 Milling the ports in the port flange using the rotary table with the part secured in a 3-jaw chuck.



13 The 8BA tap is supported in the drill chuck to ensure it is held perpendicular to the work when tapping for the port flange retaining screws.



14 With the port flange fitted to provide positive location, the holes are then spotted through, drilled and tapped 6BA for the steam chest.

BUILDING THE CYGNET ROYAL

S. J. Curtis

describes a 3-cylinder radial steam engine designed by E. T. Westbury.

●Part II continued from page 376
(M.E. 4180, 18 October 2002)

The crankcase breather is a straightforward turning operation and its simplicity could be regarded as a welcome respite!

Steam chest

I turned mine from aluminium alloy bar. Drill the 6BA clearance holes on the rotary table. Drill and tap the $\frac{1}{4}$ in. x 32TPI steam inlet.

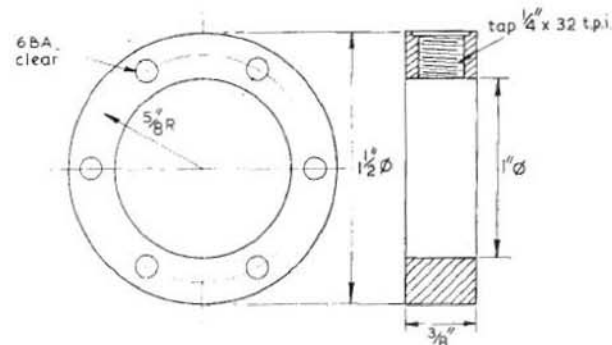
Steam chest cover

Again I used aluminium alloy bar. Turn to $1\frac{1}{2}$ in. dia. for approximately $\frac{1}{2}$ in. length. Turn the 1in. dia. x $\frac{1}{16}$ in. spigot. Drill and tap $\frac{1}{4}$ in. x 32TPI for the exhaust and part off. Drill the 6BA clearance holes on the rotary table.

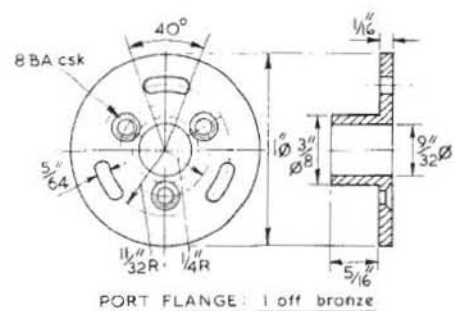
Port flange

Turn a piece of phosphor bronze bar to 1in. diameter. Turn the spigot to $\frac{3}{8}$ in. dia. and drill and ream $\frac{9}{32}$ inch. Part off to leave the flange a little over $\frac{1}{16}$ in. thick. Measure the flange thickness, protect the spigot with an aluminium alloy bush, chuck and face off to the required $\frac{1}{16}$ in. thickness.

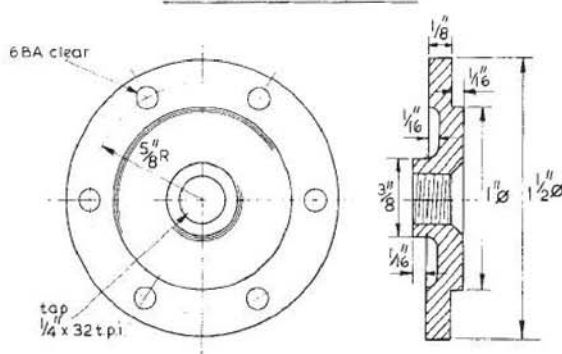
Using your milling machine and rotary table, mill out the ports (photo 12). At $\frac{11}{32}$ in. radius, a $\frac{5}{64}$ in. slot drill requires 28 deg. rotary table movement. Drill clearance holes and countersink



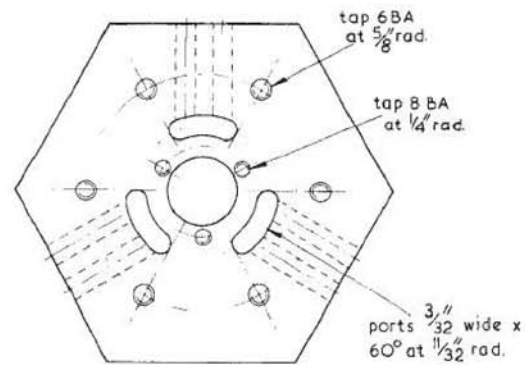
STEAM CHEST 1 off L/A



PORT FLANGE: 1 off bronze

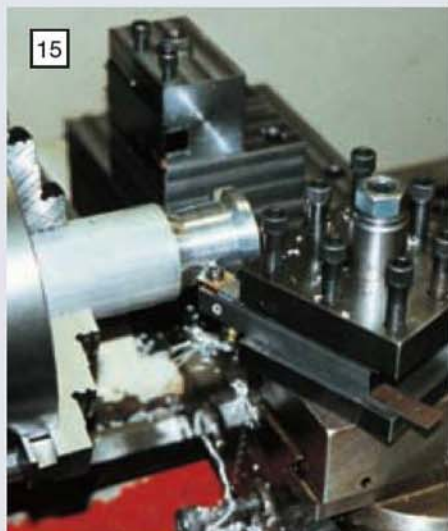


STEAM CHEST COVER: 1 off L/A

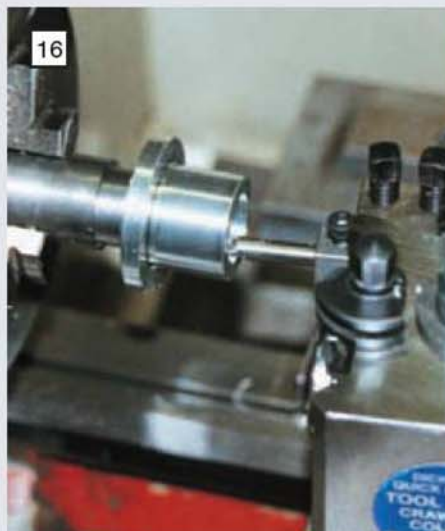


REAR FACE OF CRANKCASE

©



The bearing housing is bored $\frac{3}{4}$ in. dia. and the rear bearing seat machined before the external profile of the front section is turned.



The front bearing seat is bored and the outer diameter finished with the bearing housing secured onto a mandrel using Loctite 243.



The bearing housing is taken to the milling machine and rotary table for drilling the 6BA clearance holes in the bearing housing flange.

for the 8BA screws. Fit the port flange to the crankcase, spot through, drill and tap the three 8BA holes (**photo 13**).

Insert the screws and tighten the flange to the crankcase. Using the port flange to locate the steam chest, spot through, drill and tap the six 6BA holes in the crankcase (**photo 14**).

Crankshaft bearing housing

Face and turn a piece of aluminium alloy bar to $1\frac{3}{4}$ in. dia. for approximately $1\frac{1}{2}$ in. length. Drill and bore $\frac{3}{4}$ in. dia. x $1\frac{1}{2}$ in. depth. Turn the $1\frac{1}{4}$ in. x $\frac{3}{32}$ in. spigot using the crankcase register as a gauge. Bore out the rear bearing seating to 0.874in. dia.; a plug gauge is useful for this operation. Rough turn what will be the front section of the housing before parting off to length plus a 'cleaning up allowance' (photo 15).

Now take the stepped mandrel prepared earlier (see **fig 1**, *M.E.* 4180, 18 October 2002). The $\frac{3}{4}$ in. dia. section must be a push fit in the bearing housing — use it as a gauge. Do not remove it from the chuck. Smear a thin film of Loctite 243 Nutlock onto the mandrel and inside the housing and slide it on. Leave to cure for about an hour. Face to length and finish turn to 1.160in. dia. x $\frac{15}{16}$ in. long (**photo 16**).

I ignored the taper to facilitate chucking when drilling the fixing holes. Bore the bearing seating as before, using the 0.874in. plug gauge for final sizing. Holding the mandrel, dip the housing in boiling water for about a minute, it will then slide off easily. Don't forget to wear kitchen gloves for protection! Re-chuck on the rotary table and drill the six 6BA clearance holes (**photo 17**). Finally, drill and tap the $\frac{3}{16}$ in. x 40TPI oil inlet.

Orbital valve

Turn a piece of cast iron bar to $13/16$ in. dia.; drill and ream the $1/8$ in. central hole. Using a small boring tool, just touch the periphery of the bar on the far side. Zero the dial and wind out the cross-slide to give the required recess diameter of $9/16$ inch. This dimension is obviously critical for correct timing. Zero the dial to provide an easily recognised limit. Start from the centre and, as if using a facing tool, produce a recess $1/32$ in. deep. Take out a further $1/32$ in. depth to leave a $1/4$ in. dia. boss as shown on the drawing. This should present no problem, provided that the boring tool is no wider than a parting tool, say 2mm.

Part off to length plus a few thou. for lapping. Carefully re-chuck, check with a DTI to ensure there is no 'wobble' and face to 1/4in. thick.

Repeat operations as for the first side. Drill the six $\frac{1}{8}$ in. dia. exhaust holes on a rotary table. The drawing shows this valve as being $\frac{1}{4}$ in. thick, but any dimensional inaccuracies in the port flange, steam chest and steam chest cover must be taken into account before facing it off to thickness. So, check your individual components: Valve thickness = Steamchest thickness
- (port flange thickness + cover spigot length)

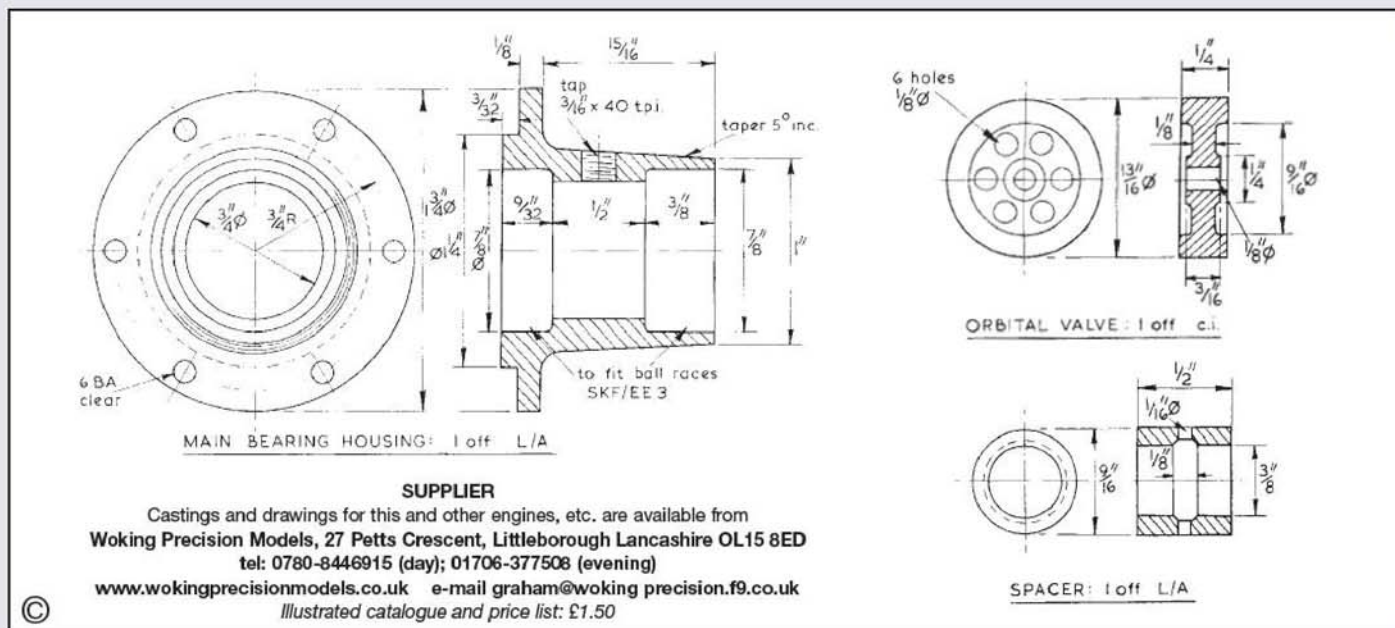
Spacer

Turn a piece of aluminium alloy bar to $9/16$ in. dia. Drill and ream $3/8$ in. diameter. Only one oil hole is shown on the drawing. In the interests of improved lubrication, I put in six. Undercut the internal groove making certain that the holes and the groove are positioned to coincide with the oil hole in the crankshaft journal when the components are assembled.

Part off to length, no less than the actual measured distance between the bearing seats, or an end load will be applied when the flywheel is fitted.

The bearings and spacer may now be fitted into the bearing housing. Use a short piece of $\frac{3}{8}$ in. dia. bar to locate the spacer when pressing in the bearings.

●*To be continued.*





THE JUNIOR

A STATIONARY INTERNAL COMBUSTION ENGINE

Stan Bray

sets about machining the cylinder and describes how he gets holes in separate components to line up.

●Part IV continued from page 381

(M.E. 4180, 18 October 2002)

The aluminium alloy cylinder which is bolted to the top of the crankcase and forms part of the water jacket will eventually be fitted with a steel liner. A lip cast on the small end has no apparent function; maybe it was once intended as a chucking piece, or perhaps the crankcase was counterbored to accept it (photos 21 and 22).

After due consideration, the casting was gripped in the 4-jaw chuck by the larger end and set to run as true as possible, using a surface gauge for reference (photo 23). Aluminium alloy shims were used to protect the casting from damage by the chuck jaws and a facing cut taken which removed the redundant lip. The bore to accept the cylinder liner was machined at the same setting (photo 24).

These preliminaries provided a datum and a nice flat surface from which to work and to facilitate subsequent operations. The casting was reversed (photo 25), checked with a square (photo 26), and the surface gauge again used to set the bore to run true as accurately as possible. The top was faced and the hole for the liner counterbored.

Several sets of matching holes are required in various components and while in some cases it is possible to use as a jig a part that has been already drilled (the crankcase covers, for example), this is not possible when it comes to fitting the cylinder to the crankcase and the cylinder head to the cylinder.

There are ways to deal with this, but by far the best solution is to drill all the holes in the correct position in the first place. This is best done with reference to the graduated slideway index dials of a mill/drill or milling machine.

Co-ordinate drilling

Starting with the four clearance holes for studs to hold the cylinder in position which match those on the top of the crankcase, these are shown on the drawing as being on a $1\frac{9}{16}$ in. pitch circle diameter. Begin by locating the exact centre of the hole in the top of the casting which is clamped to the table, and then with a small centre drill in the chuck or collet, move the casting through half of $1\frac{9}{16}$ in. (= 0.78125in.) rounding this off to 0.781in. for obvious practical reasons.

This job is made easier with the use of a digital readout (DRO). These are now available at very reasonable prices but could be home-made by clamping a cheap digital caliper to the machine by means of a couple of brackets. Secure the fixed jaw to the main machine casting and the moving jaw to the table, and there's your digital read out. A DRO is much easier to use than hand-wheel graduations and the effects of backlash are eliminated. As described here it will only read the movement along one axis, but a little thought given to the fixings could mean that it is a matter of only a few moments' work to move the digital

21



Inverted cylinder casting showing the redundant ring or boss mentioned in the text.

caliper from one axis to another.

Having moved the casting by the prescribed distance, the centre drill will be exactly on the correct pitch circle diameter. To drill the four holes, all we now need to know is the 'chord of four' for that diameter. A chord is a straight line across two points on the circumference of a circle, in our case the straight line distance between each pair of holes. The chord of four is a fixed number which can be found in reference tables. Others, e.g. the chord of six, etc., can also be found. To use this information, simply multiply the number given by the pitch circle diameter.

In our case, tables tell us that the chord of four is 0.7071. Since our circle is $1\frac{9}{16}$ in. (1.5625in.)

22



Top view of the cylinder casting showing how the water passages are cast in.

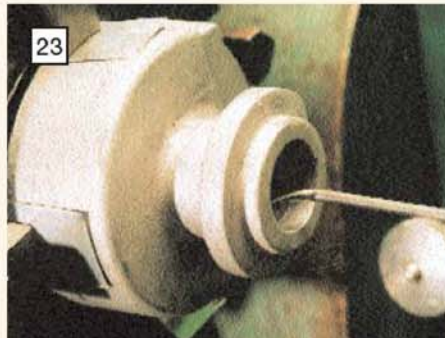
dia., our chord of four is calculated from:

$$0.7071 \times 1.5625 = 1.1048543\text{in.}$$

which we need to round off to 1.105 inch.

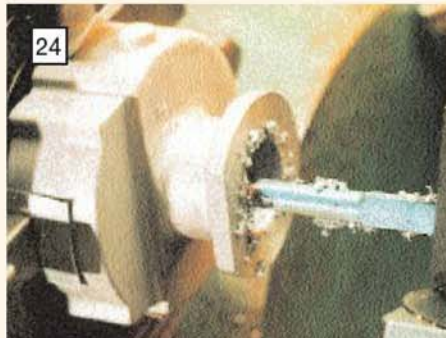
We left the centre drill in line with the end of the casting, which isn't where we want it. We shall have to shift it sideways through half our 1.105 (= 0.553in.) which is half the chord amount and is the position of the first hole. The full chord of four amount (1.104in.) can now be used to move things around in a square to locate the holes exactly. All of this has taken much longer to explain than to do and if the process is repeated on the cylinder casting, all eight holes will match closely. Any small discrepancy can be accounted for by a slight increase in the size of the clearance holes.

23



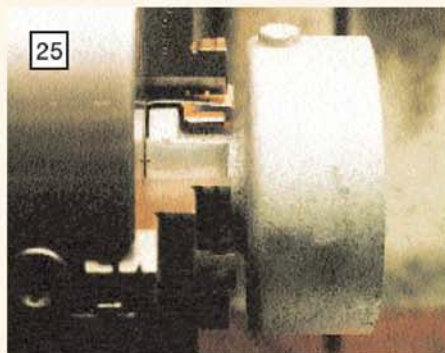
Setting the cylinder casting to run true. Note the protective shims under the chuck jaws..

24



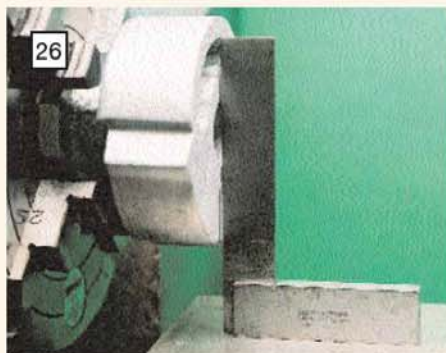
Boring the cylinder for its steel liner having removed the redundant boss.

25



The casting is reversed in the chuck and the newly machined surface protected with shims.

26



The casting is set true using a square, as here, and a surface gauge as in photo 23 above.

Alternatively ...

Readers who are unable or perhaps reluctant to use the co-ordinate drilling method, can 'match the holes'. Since it isn't possible to simply pass a drill through the crankcase holes into the cylinder we must use a bit of cunning. Make up four short pieces of silver-steel with a 45deg. point on one end and a 5BA thread on the other (photo 27). These will be our centre punches and should be hardened and tempered to a medium blue.

Screw them into the tapped holes in the crankcase (photo 28) so that they all protrude to the same height. Check this using a depth gauge (photo 29). Fit a length of 1in. dia. material in the crankcase hole and pass it through the cylinder. Almost anything with a true 1in. dia. will do for this; I used a piece of steel, but brass or even wood or plastic would suit the purpose — just use what you happen to have to hand. At this stage do not put any pressure on the cylinder.



Specially prepared punches are used to transfer hole positions as described in the text.



The four hardened silver-steel punches are screwed into the crankcase.



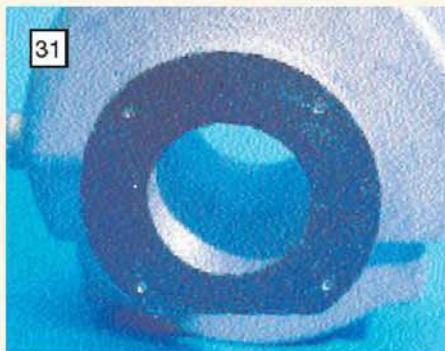
Aligning the cylinder with the crankcase using a length of 1in. dia. steel bar.

You now need a piece of tube with a 1in. minimum bore to fit over the piece of 1in. dia. bar protruding above the cylinder. I used a piece of lead piping but anything which fits will serve the purpose. However, if it is harder than the casting, something soft will have to be interposed between it and the casting. Wood, plastic, or even cardboard can be used, but it is essential to stop the cylinder suffering damage.

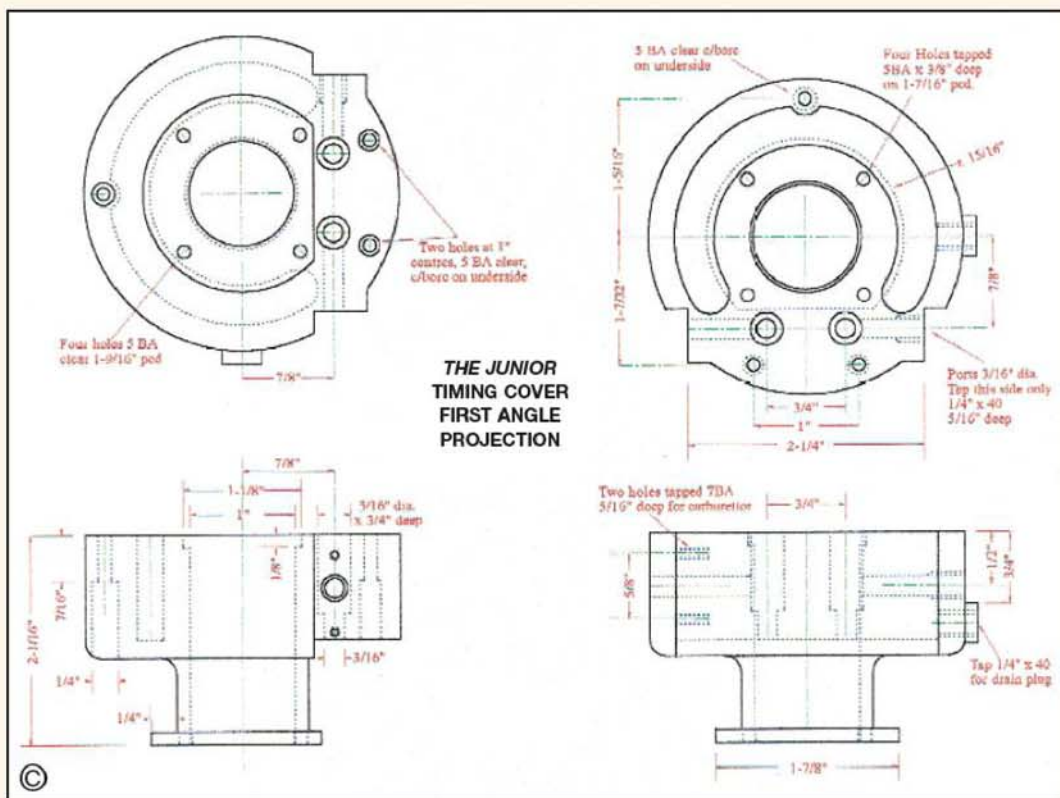
If you haven't a piece of tube for this job, use a piece of wood with a suitable hole. Align the cylinder carefully to the crankcase, put the tube



The four punches are all set to the same height and checked with a simple depth gauge.



After a sharp rap with a hammer, the locations of the holes are transferred to the cylinder.



over the lining-up piece and give a single sharp tap to the tube. It is essential that this blow is central to the tube, so a block of wood should be put on top prior to striking. After all this, which has again taken much longer to describe than to do, you should have four nice centre punch marks that will allow the cylinder to be accurately drilled (photo 31).

Valve guide holes

Two 3/16in. dia. holes are required for the valve guides and here too, the builder can adopt either method just described. In this case a single punch only is required (photo 27) and it can be made from a piece of 3/16in. dia. silver-steel hardened and tempered as before.

Bolt the cylinder to the crankcase and push the punch into one of the holes from inside the timing mechanism recess. It can be struck to mark the cylinder and the action repeated for the second hole. Interpose a short piece of wood between the punch and hammer to avoid damaging the cylinder, very little force is needed to make the mark so the fact that the wood will absorb some of the shock is of no consequence.

Finishing the cylinder

Three more holes remain to be drilled and counterbored in the cylinder from underneath; these can easily be marked out on the top face and the initial drilling done there.

Four holes on a 1 7/16in. pitch circle diameter are also required; these are used to bolt the cylinder head to the cylinder. They can be marked out and drilled, but may be left to a later stage when the cylinder head can be used as a drilling jig.

Two ports will be drilled across the casting to break into the holes used for the valve guides. These too are best left until later and matched to the job. Finally, two 7BA tapped holes are specified on the side of the casting, these will be used to secure the carburettor to the cylinder. Yet again it will be far better to spot through from the carburettor than to attempt to match the holes.

● To be continued



The finished ball lift mechanism showing the lifting tube, cover and entrance bracket. The non-return catch, to be described in a future article in this series, is also shown.

Richard Stephen

discusses the evolution of the ball lift mechanism and begins work on its construction.

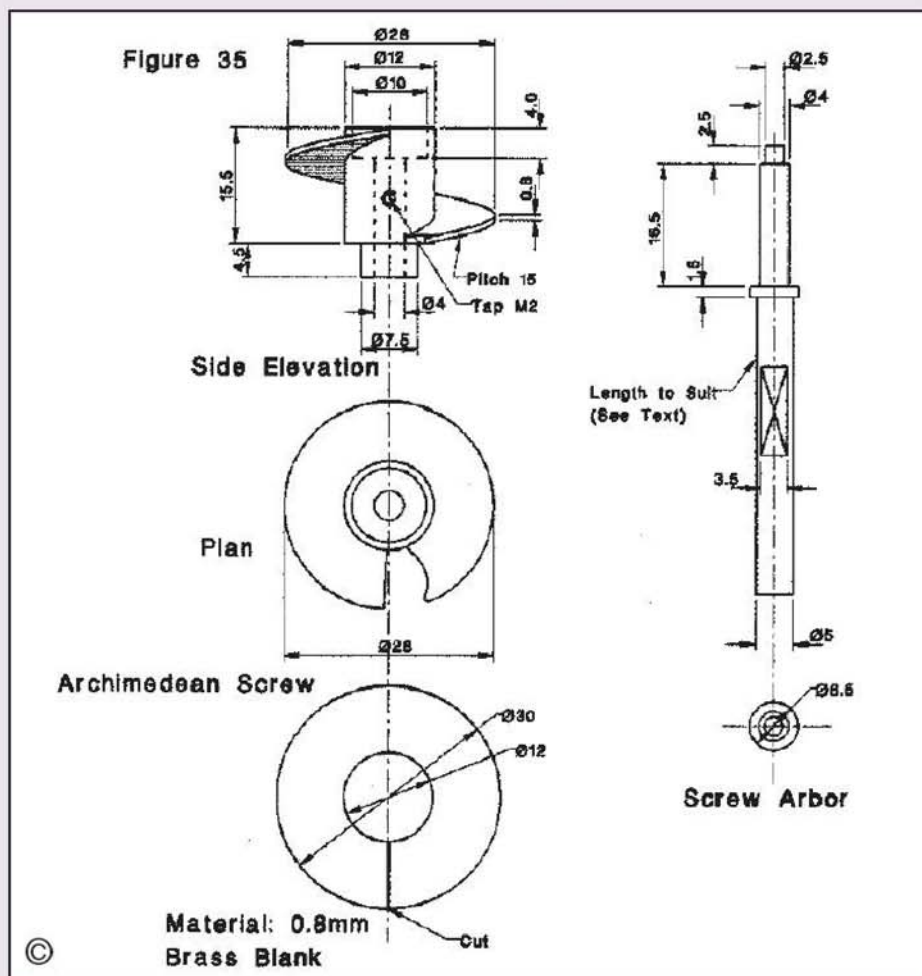
●Part IX continued from page 384
(M.E. 4180, 18 October 2002)

The next phase of the project, the ball lift, was by far and away the most difficult to design and construct. There even were times I thought it would never work!

I had initially wanted the clock to be entirely mechanical, with the ball re-cycling mechanism powered by a spring. To run the clock for a period of seven days, with one ball dropping off the Ferris wheel every 15 minutes, 672 balls were required to be lifted. I planned to use an Archimedes screw to lift the balls. With a screw having a pitch equal to the diameter of a ball this meant that the screw had to rotate 672 times each week. A typical clock spring requires about 10 turns to fully wind it. To obtain 672 ball movements then required the spring to be geared up by a factor of 67.2 with a consequent reduction in the torque of precisely the same factor if friction in the gear train was ignored.

A further negative factor was the fact that the torque of a spring increases almost linearly from zero when the spring is fully unwound to its maximum value when fully wound. This meant that the gearing factor would have to be significantly larger than 67.2. The more I thought about a spring the more impractical it became. To fit a really large spring storing sufficient energy to lift all the balls was really not an option. If any part of the drive mechanism failed at some time in the future with all the stored energy in a large spring being suddenly released I could see bits of clock being scattered over a large area!

The alternative was to use an electric motor powered by batteries to drive the Archimedes screw. The advantage of electric motors is that they run at high speed and to obtain a rotational speed of about 0.5 rev. per second, the motor has to be geared down. Most suitable battery powered small motors run at several thousand revs per



minute. Geared down by a factor of several thousand also results in an increase in the torque by the same factor. This means that even a very modest motor geared down to the required speed would have adequate torque for the job in hand.

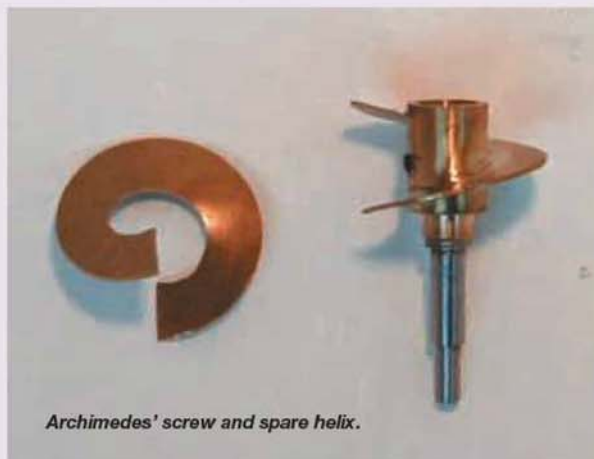
The next question was how long would a set of batteries last? I calculated from the characteristics of the recommended motor that four alkaline D cells giving a total of 6 volts, should last about two months. The clock has now run for over four months on one set of batteries. I did toy with the idea of using solar recharging. With over four months on a set of alkaline cells the complexity of fitting solar panels, which do not deliver much power at the light levels found in most front rooms, became a definite non-starter.

The principal aim in the design of the ball lift was to use the minimum number of parts and to keep everything as simple as possible. As the Ferris wheel rotates, the wheel reaches a point when a ball rolls out of the recess. The ball drops between a pair of contacts, closing a circuit

and generating a voltage pulse, which turns on the motor and drives the Archimedes screw. A detent attached to the shaft of the screw operates a micro switch, which cuts off the power to the motor after a single revolution.

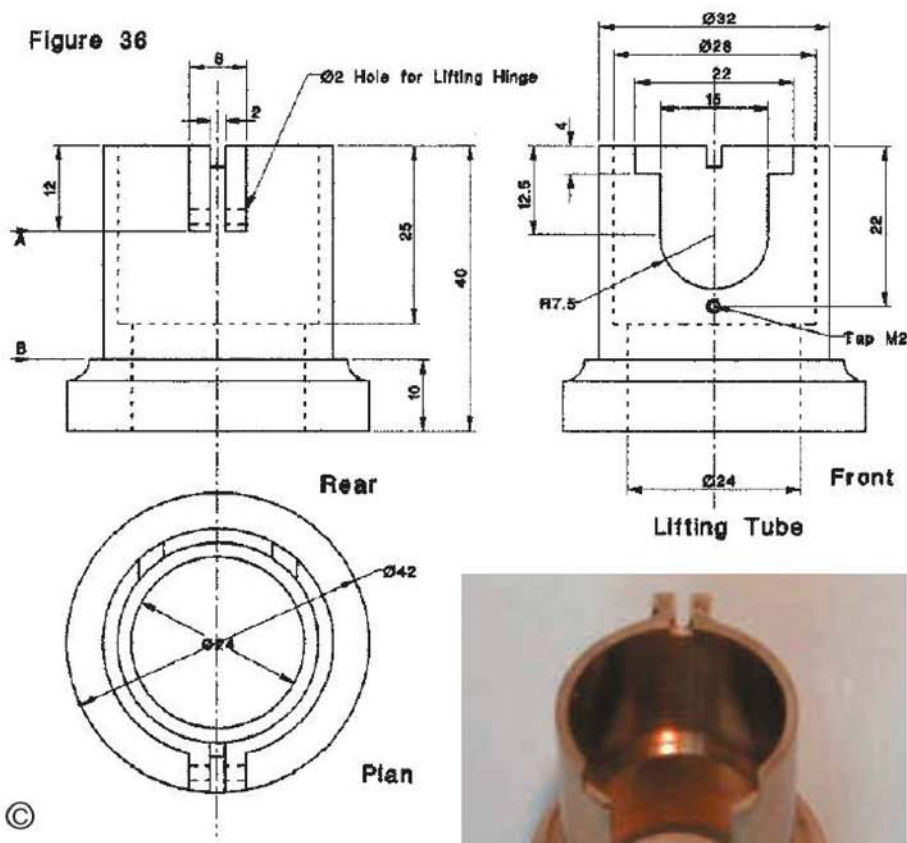
Archimedes screw

The components of the Archimedes screw and housing are illustrated in the accompanying photograph. The dimensions and details of the



Archimedes' screw and spare helix.

Figure 36



various components are illustrated in fig 35. The simplest way to make the screw is to fabricate the thread. As the screw is used to raise the balls it is not necessary for it to be 'engineering perfect'; it is only necessary for the pitch to be 15mm to match the diameter of the balls. It will not matter if the pitch is slightly greater than 15mm but it must not be less.

Begin by cutting about three brass discs, 30mm dia., out of 0.80mm thick brass sheet. You only need one disc, however it is always useful to have spares. Drill a 12mm dia. hole in each of the discs. Cut along a radius as shown in fig 35. Using your fingers, and where necessary a pair of smooth jawed pliers, pull the two cut edges apart to form the single turn thread as illustrated in the photograph. The effect of pulling the two edges apart will distort the central hole and reduce its diameter. When I made my screw the diameter reduced to just under 11.5mm. Using a fine round file enlarge the hole to fit onto a shaft with a diameter of 12.0mm. Slide the thread onto the 12.0mm shaft, which at this stage should be at least 20mm longer than the finished length shown in fig 35. The sides of the thread should be at right angles to the central shaft and the pitch equal to 15mm. The thread is now silver-soldered to the shaft using as little silver-solder as possible.

Grip the shaft in a collet or true 3-jaw chuck and taking only the very lightest of cuts, true up the thread and reduce its diameter to 28mm. The depth of the thread at this diameter is 0.50mm greater than the radius of the balls. At this thread depth all the force exerted on the balls will be directed vertically. If the thread depth is made less than the ball radius a component of force will be developed which will tend to push the balls out of the entrance to the lifting tube. Finally drill and ream a 4mm dia. hole through the centre of the shaft.

No further work can be done on the screw until the lifting tube is constructed.



The lifting tube is machined from solid brass, including the hinge lugs, evident in this view.

Lifting tube

The dimensions and details of the lifting tube are given in fig 36. The body of the tube is best made from a length of 50mm dia. solid brass bar. The hinge for the non-return ball catch is best made as an integral part of the tube and not silver-soldered to the side of the tube. To make it you will need to have a rotary table on which a 3-jaw chuck can be centrally mounted.

Begin by facing both ends and reducing the length to 40mm and the diameter to 42mm. Now turn the rod down to a diameter of 32mm over the section A-B shown in fig 36. Grip the lower end of the tube in the 3-jaw chuck on the rotary table mounted on the milling machine. Using a 3mm dia. slot drill, and only taking very light cuts, remove the excess material. This will leave a radius of 1.5mm in the corners where the hinge joins the tube. The slot for the non-return catch can now be milled out using a 2mm dia. slot drill.

Hold the tube in a vice taking care that the axis of the slot is precisely radial. Again taking only very light cuts, mill out the slot to depth of 5mm i.e. down to the outside of the tube. The 1.5mm radius corners can now be milled away.

The tube can now be bored out. Grip the tube in a 3-jaw chuck and check that it runs true. Start by boring a 24mm dia. hole right through the tube. Now expand the hole to a diameter of 28mm down to a depth of 25mm. The tube can be set aside for the present until the top and the entrance bracket are made.

Lifting tube cover

The cover of the lifting tube is a rather complicated shape and needs to be made carefully if the screw is to work and lift the balls reliably. The cover is made from a 35 x 45mm piece of engraving brass 9.5mm (3/8in.) thick. If you cannot find a piece of engraving brass a piece of plate will do. If you use a piece of brass plate it would be as well to check that it machines easily before you start.

Begin by facing both sides of the plate and reducing the thickness to 8mm. This is most easily done in the lathe with the plate held in a 4-jaw chuck. Smooth both sides by rubbing on 500 grit, wet and dry abrasive paper placed on a true flat surface. Mark the positions of the two holes A and B, 13.5mm apart as shown in fig 37. Using a pair of dividers, scribe the following circles:

- centre A of radius 14 and 16mm, and
- centre B radius of 11.5mm.

Drill and ream two 3mm holes through the plate at the positions A and B. The positions of these holes must be drilled as accurately as possible.

The cover can really only be machined using a rotary table and a 3-jaw chuck on the milling machine. Before starting work on the cover, you will need to make a brass holder to secure it during machining. The holder is made from a 25mm length of 25mm dia. brass bar. Reduce the end to 3mm dia. for a length of 6mm. The cover is attached to the holder with soft solder, which is easily removed after machining is completed. Solder the plate to the holder with the 3mm peg inserted into hole A.

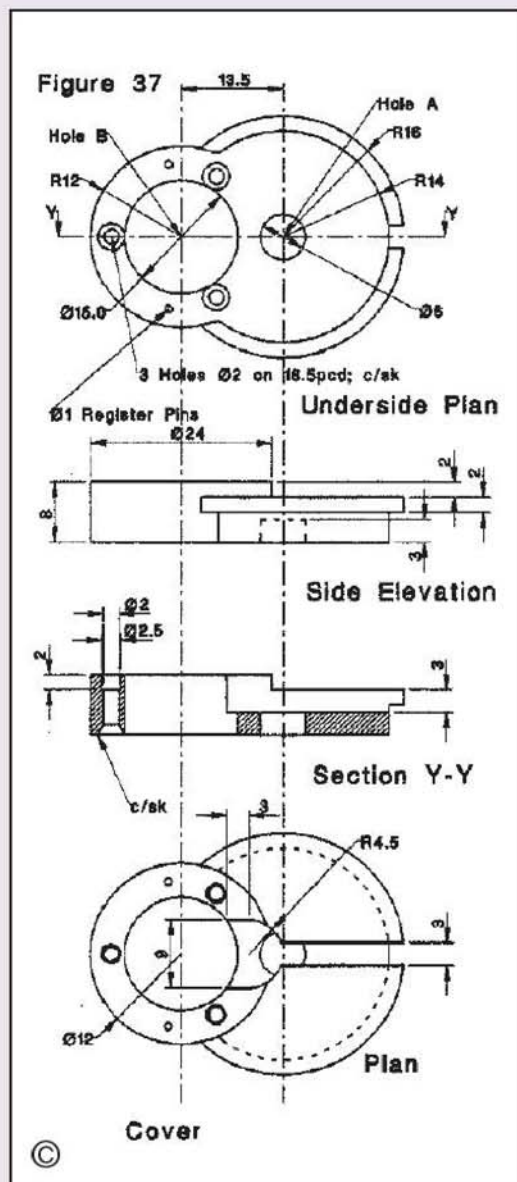
Use a 3mm slot drill and taking light cuts machine the recess (diameter 28mm) which inserts into the lifting tube to a depth of 4mm. Use the scribed circles as a guide for the limits of the machining. The rim of the top can then be machined. Unsolder the top from the holder and re-solder the cover to the holder with the 3mm peg inserted into hole B. Now mill the outside of the delivery tube and the 15mm dia. hole for the balls to pass through. The three 2mm dia. countersunk screw holes and the two 1mm dia. register pin holes should be drilled now. The centres of the screw holes must be positioned exactly 1.75mm from the edge of the 15mm hole. The edges of the vertical 3.5mm (9/64in.) guide rods will then be flush with the edge of the hole through which the balls lift.

Unsolder the top from the holder. Reduce the holder to 15mm diameter for about 4mm. Insert the holder into the 15mm hole and solder in place. The top of the cover can now be finished in the lathe. Unsolder the cover and clean off all traces of solder.

The 2mm dia. holes for the screws that secure the track rods should be enlarged to 2.5mm dia. to a depth of 2mm for the ends of the track rods.

Fitting the cover in place

The cover can now be fitted into the lifting tube. Referring to the previous drawings you will see that the centre of the slot for the non-return catch, the centre of the lifting tube and the centre of the hole through which the balls lift are all aligned. Position the cover on the lifting tube and mark the position of the recess that needs to be cut in the side of the tube.



Using a slot drill mill out the recess down to 4mm. Leave the width of the recess slightly undersize. The cover is best finally fitted with the aid of a file. Drill and tap the two holes for securing the cover to the lifting tube. With the cover fitted in place, the ball entrance in the lifting tube can now be cut out.

Fit the cover in place and use the sides of the 15mm hole to position the sides of the entrance hole for the balls. Using a slot drill, mill out the entrance to a depth of 12.5mm leaving the width slightly undersize. The circular bottom of the entrance will be cut out once the bracket for the entrance track is made and fitted in place.

Track bracket entrance

The dimensions of the entrance track bracket are shown in **fig 38**. The bracket is made from a 25 x 25 x 1mm piece of free machining brass plate. Clamp the piece of brass in the vice on the milling machine and square off the sides.

Begin by drilling and reaming a 15mm hole on the centre line 8.5mm from one edge. If you do not have a reamer and cannot borrow one but have a boring head, use this to cut a good clean hole. The sides of the entrance can now be machined using a slot drill. Drill the holes for the two 2mm dia. screws for attaching the track rods right through as shown in fig 38. These holes are then enlarged to 2.5mm dia. to a depth of 2mm

for the ends of the 3.5mm track rods. Take care to position these holes so that the edges of the track rods are flush with the sides of the opening in the bracket. Drill the hole for the 2mm dia. screw that secures the bracket to the side of the lifting tube.

Turn the bracket over and drill the countersunk holes to a depth of 5mm for the heads of the 2mm dia. screws. The circular back of the bracket now needs to be machined to fit flush with the outside of the lifting tube. The easiest way to machine the back of the bracket is to use a boring head if you have one. Set the radius of the cutter in the boring head to 16mm, the radius of the outside of the lifting tube. Clamp the bracket vertically in the milling machine vice. Take light cuts and machine the back of the bracket to its final shape. Before taking the final cuts check that the bracket will fit flush with the side of the lifting tube.

If you do not have a boring head the circular back can be machined in the lathe. The bracket will have to be soft-soldered to a suitable piece of brass so that it can be held in a 4-jaw chuck. The chuck will allow you to position the bracket so that its circular back can be turned out with a boring bar.

Fitting the entrance track bracket

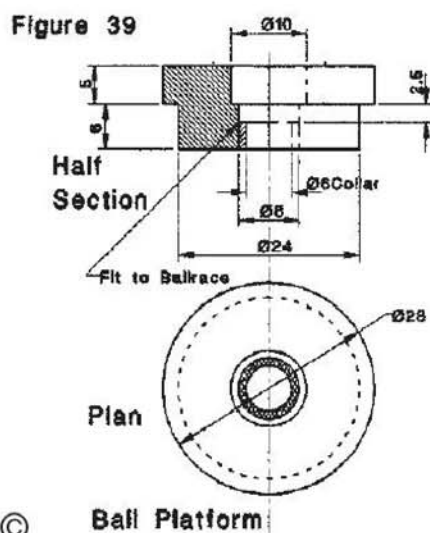
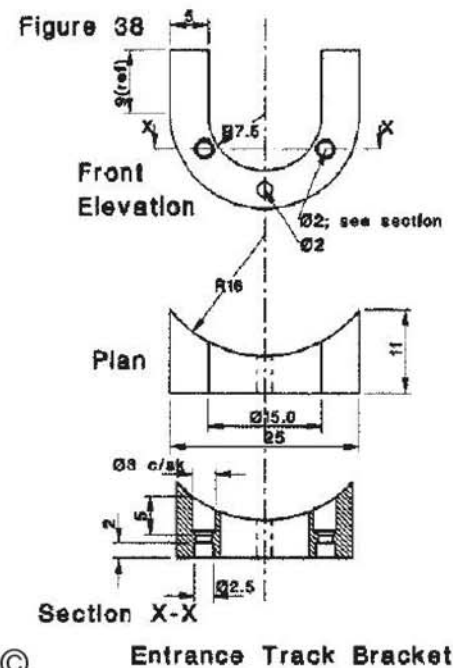
The entrance track bracket can now be fixed in position. Fix a cover in place and secure with the 1/8" dia. screws. Now position the bracket against the side of the lifting cover and press firmly against the underside of the cover. The sides of the entrance track should be flush with the hole in the cover. You may find that the bracket is 1/8" wider than hole. If so, set the bracket symmetrically relative to the hole. Clamp the bracket firmly in place. Using the register pins in the cover as a guide, drill the holes in the bracket for the register pins. Release the bracket and insert the register pins into the holes drilled in the bracket.

Re-position the bracket using the register pins and check that the bracket still fits snugly in the correct position. Using a sharp scriber mark the outline of the inside of the bracket on the lifting tube. Remove all the excess metal. The inside edges of the bracket and the lifting tube must be flush and smooth. Remove the bracket and the cover from the lifting tube. The platform, on which the balls rest before being lifted, will be the next thing to be made.

Ball platform

The dimensions of the ball platform are given in fig 39. The platform is machined from a length of 30mm dia. brass bar.

Turn the platform to size but leave the 28mm



diameter section slightly overlength. The top of the platform has to be flush with the bottom of the entrance track bracket. Slide the platform into the lifting tube and press it firmly down against the shoulder in the tube. Mark with a scribe the bottom of the ball entrance. Remove the platform and face to its final length.

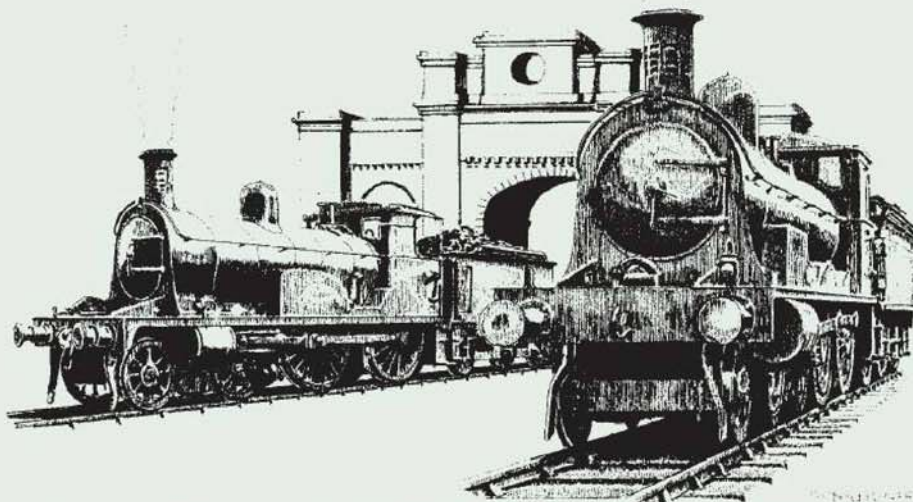
Drill and ream an 8mm dia. hole in the platform for the 5mm I/D ball race. The ball race should be an easy sliding fit. To prevent the race from dropping out of the bottom of the platform, a collar (see fig 39) is fitted into the bottom and secured in place with Loctite high strength retainer. Fit the platform into the lifting tube, screw the cover in place and fit the bracket in position using the register pins.

Clamp the bracket firmly in place and, pressing the platform down, drill a tapping hole for the 2mm dia. screw through the side of the tube and into the platform for a depth of about 6mm. Dis-assemble and tap the hole in the platform for the 2mm dia. screw. Open up the hole in the side of the tube to 2mm diameter.

●*To be continued.*



Left hand side view of H.R. No. 103 at Glasgow Museum of Transport. Note the front splash cutaway to accommodate the boiler cladding.



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

Neville Evans

describes the platework

●Part XX continued from page 284
(M.E. 4178, 20 September 2002)

The next item on the agenda is the platework: running boards (platforms?), splashers, cab and the like. The tender tank is, however, a different kettle of fish and I think is best made of brass plate. I find that these parts take more time than the rest of the loco put together, and of course represent the 'value added' bit that everyone notices first.

Materials

The platework on the full-sized Jones locos is fairly substantial in that it is made from $\frac{7}{16}$ in. steel plate. The valancing is $\frac{1}{2}$ in. thick, and 10mm angle, which is about 0.390in. deep, is almost spot on for our purposes, another example of forward thinking on the part of David Jones,

who obviously had 5in. gauge loco modellers in mind when he specified the valance depth. Or perhaps not. What is true, however, is that $\frac{7}{16}$ in. in our scale thickness works out at just about 1mm, which is jolly handy, because you can buy or otherwise obtain 1mm sheet steel anywhere.

I believe that the plate work on the Jones engines as built was bolted together, which made for accessibility and ease of maintenance. In fact, the cab is made in two pieces with the obvious advantage that the backhead can be assembled with comparative ease. The assembly with 18 or so 10BA round headed bolts is a bit of a fiddle, but I'm sure that for the sake of originality it is well worth doing. Due to the complexity of both platforms and cab, we shall have to leave them (the cabs that is) for the near future.

Note that I specify steel. This is because 1mm steel is much stronger than the $\frac{1}{16}$ in. brass that we commonly use for small loco plating, even in the smaller scales. The two things that I hate most in small engines (provided of course that the overall proportions are correct), are over-thick platework and oversized rivets. Nothing looks worse than great rows of button mushrooms,

usually at too wide a spacing, spread down a running board. I for one would rather see no rivets at all. The $\frac{3}{64}$ in. holes that line the platforms should really be riveted with heads underneath and the tops hammered down nearly flush with the platform, as you can see from the photos. I don't see this as a good idea however, because it would be impossible to maintain a constant size of rivet head. The next best thing is to smooth down the heads with emery cloth or a file to simulate the beaten down rivet head.

To return to plate material, I prefer steel for other reasons as well as strength. It takes paint far better than brass does. To get paint to stick to a shiny brass surface, one has to first daub on an etching primer to give a key to the undercoat, and even then the paint has a rather tenuous grip on the metal. Another point is that friend Bob Wilkinson, he of the superb *Bulldog*, a Keith Wilson design of course, made a point of not repainting his loco when he entered it in the last Model Engineer Exhibition. He, quite rightly in my opinion, decided that he would exhibit it in 'as running' finish. Unfortunately, the few honourable scars that the loco had picked up in its



Right hand side of H.R. No. 103. Note the rod for the sanding gear.



Detail of front platform showing the fairing over the cylinder flange. Note the nearly-flush rivets on H.R. No. 103.

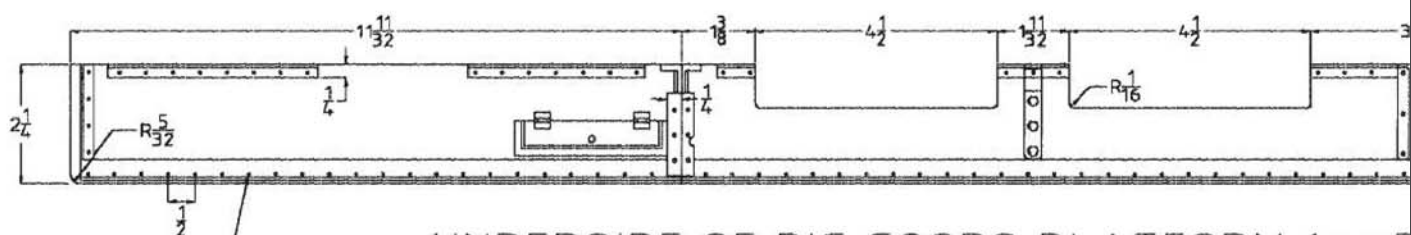
active passenger hauling life showed up yellow, due to the platework being made of brass. He was marked down for this and only got a Bronze Medal for this superb piece of work. This is not to denigrate the lovely Midland 0-6-0 that was awarded the Gold, although I must say that a matt red finish was entirely outside my experience. I thought that nearly all engines were gloss finished before leaving the works. Wrong again, Evans!

As to the problem of rust, well the platework of my 3 1/2 in. North Eastern Atlantic seems largely to be made of tinplate, and due to a lovely bit of paint, has suffered no corrosion at all over the

last 50 or so years. This loco incidentally was made by Mr. W. A. Tucker, son of Wilfred Tucker, who built the Bramhall Light Railway in the 1940s, and in later life specialised in winning Gold Medals for models of Beyer Garret articulated locos. If anyone has



A view of the front splasher of H.R. No. 103 showing the sandbox lid.

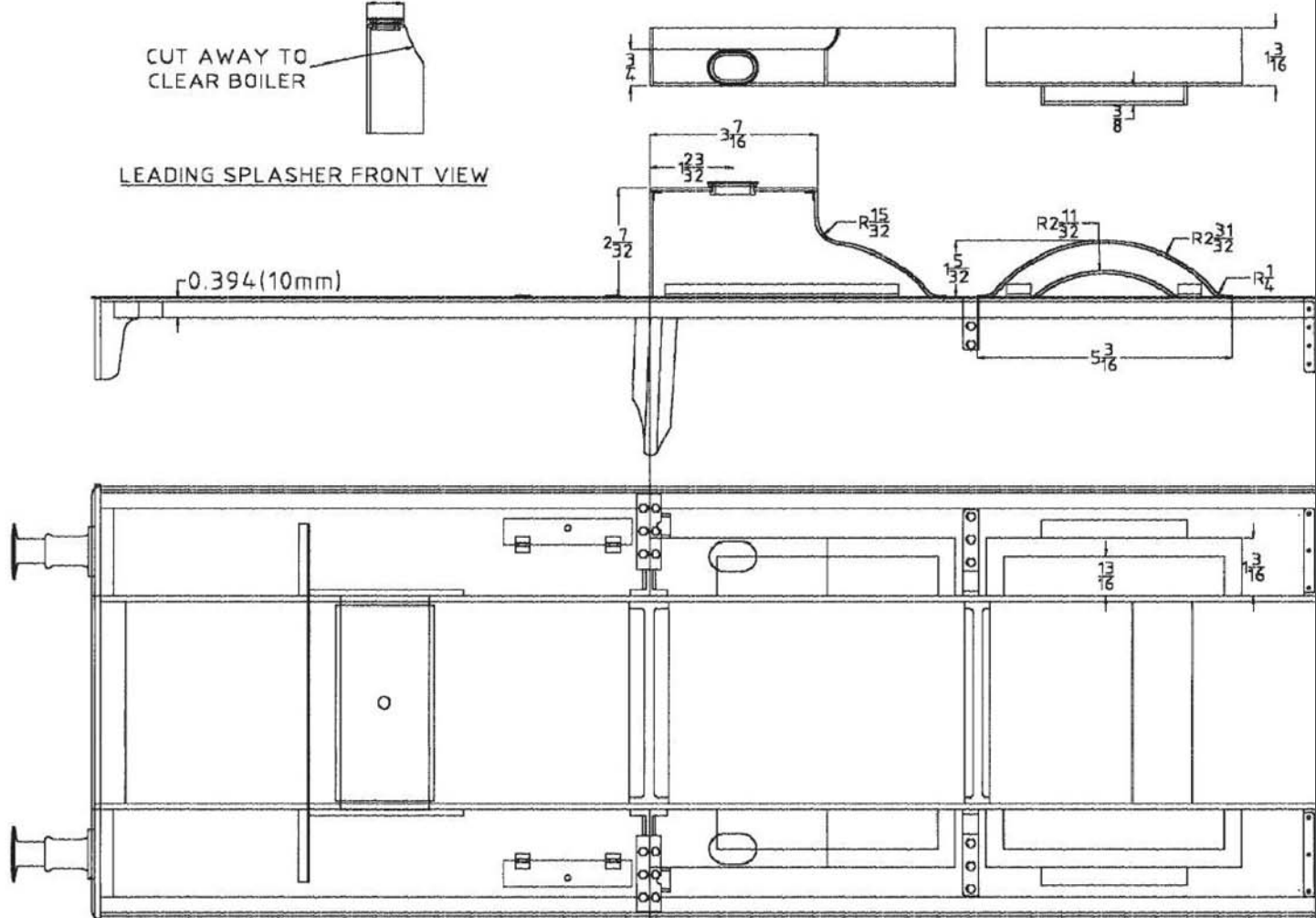


3/63" FOR RIVETS

CUT AWAY TO
CLEAR BOILER

LEADING SPLASHER FRONT VIEW

0.394 (10mm)



PLAN VIEW OF BIG GOODS FRAMES

Drawings, casting
46 Pentyla, Port
Plea

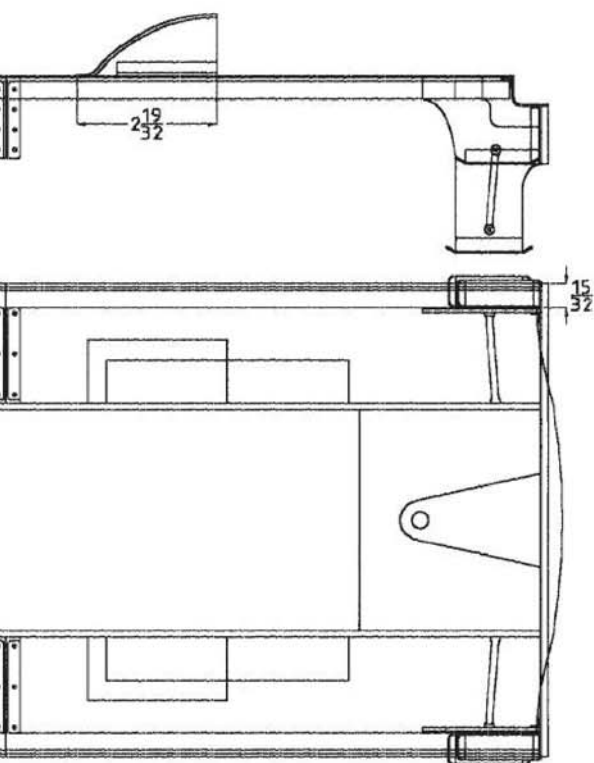
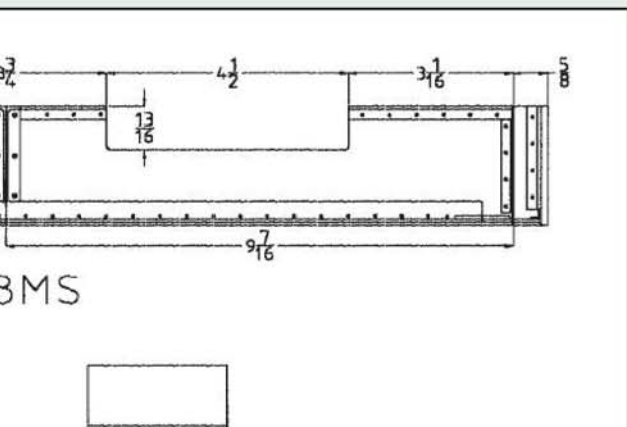
©



Left hand rear frame of H.R. No. 103 showing the cab steps bracing strut.



H.R. No. 103 cab steps viewed from the front showing the bracing strut.



ings, laser cut frames, etc. are available from Practical Scale,
Talbot, West Glamorgan SA12 8AA; tel/fax: 01639-883741.
ase send a stamped addressed envelope for list.



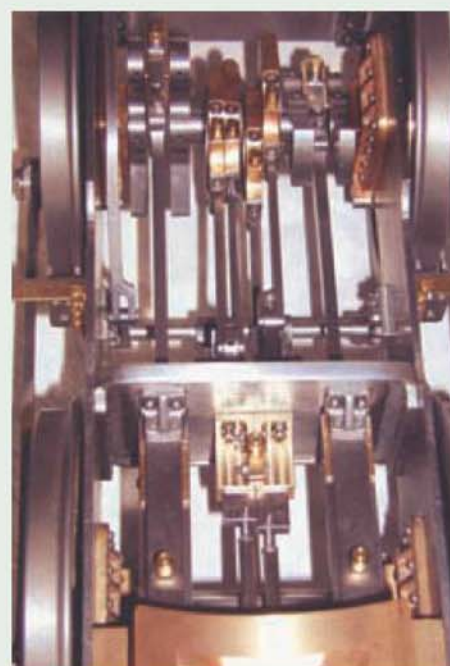
Roger Davis' GWR 14xx to the Didcot design — not bad for a first attempt!

any knowledge of the whereabouts of Mr. Tucker, who I believe lived in the Chester area, I would be most obliged to hear from them.

My own platework is largely made of 1mm Zintec, which is a lovely material that has been zinc coated on both sides, I don't know what the process is, perhaps someone can elucidate, but it seems to be more like anodisation than anything else. Besides being rust proof, it takes paint wonderfully well and is easy to bend and to form into compound shapes.

Platforms

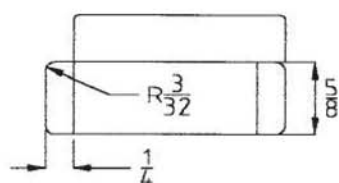
Each side platform is made in three pieces as riveted assemblies which are bolted to the mainframes. The frame drilling drawing shows more or less continuous carrying angles, which obviously have to be cut away to clear the various wheel arches and the like. I can't foresee many difficulties, just a long painstaking job that has to be very accurate or it looks a bit grim. One point emerges though. We are told over the years that we shouldn't cut steel plate on a guillotine for fear of rounding the edges and generally distorting the metal. However, the other day I was with a friend who builds little 16mm scale electric engines on a commercial basis; he uses 1mm steel plate which he buys in long sheets that are then cut to size by a local firm. I experimented with a few small pieces, and found that with about 5 seconds draw filing, the edges came out perfectly straight and square. I



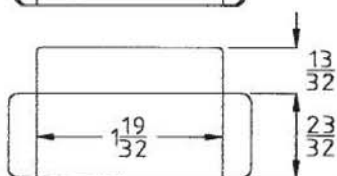
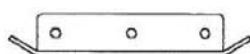
can thoroughly recommend it to anyone provided you can find somebody with a sharp guillotine who can cut a few strips accurately to width.

The alternative of course, is to saw the sheet. This is where a band saw is invaluable. Use a fine toothed blade and don't cut on the line, but leave a small distance between the cut and the line for cleaning up purposes. I finish off on my long Linisher; if you haven't got one then you're going to have to use a file. Don't be tempted to use a pair of tin snips as they are a certain way to curly

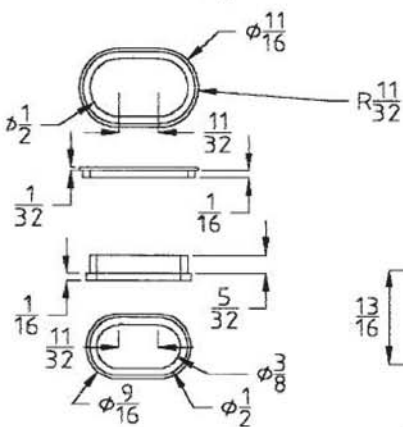
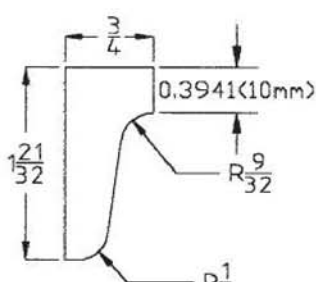
DEVELOPED SHAPE



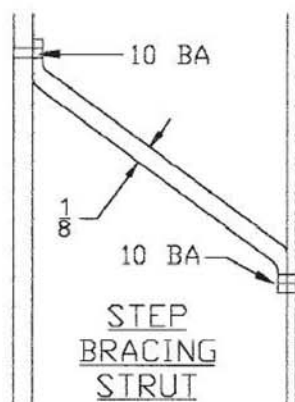
TOP STEP



BOTTOM STEP



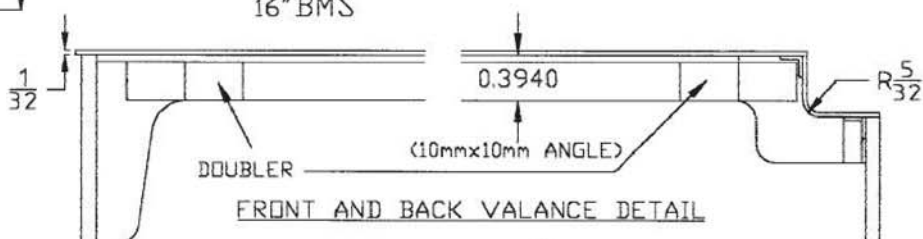
SAND BOX FILLER
2 OFF



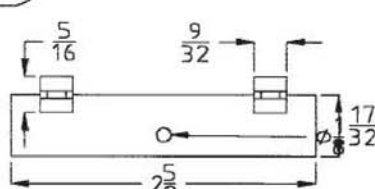
STEP
BRACING
STRUT

CAB STEPS
BIG GOODS

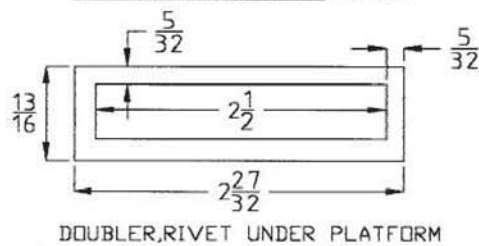
1/16" BMS



FRONT AND BACK VALANCE DETAIL

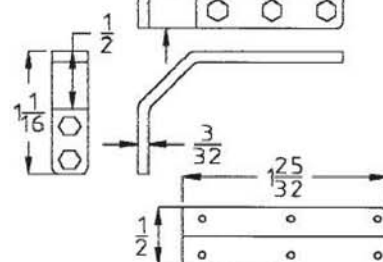
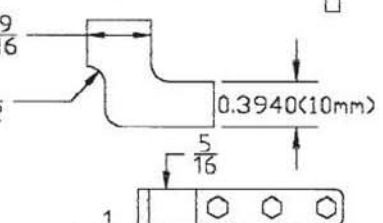
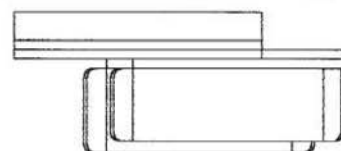


INSPECTION COVER 2 OFF



DOUBLER, RIVET UNDER PLATFORM

BIG GOODS PLATFORM DETAIL



REAR
DOUBLE
STAY

©

cuts. The main thing is to get a bit of practice in on small pieces of scrap metal before you start on the main job.

I have appended a few detail photos of H.R.103 and also two photos sent by friend Roger Davis,

of his *Didcot*, a GWR 0-4-2T, of the 14xx series. Don't confuse this engine with the Winson kit, of which so much has been spoken and written over the last few years. Suffice it to say that Roger visited me a few years ago and left with some

parts, castings and drawings. The result is as shown. Anyone, however experienced, would be proud of such workmanship; for a first attempt it is truly outstanding.

●To be continued.

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

Martin Wallis

describes a home made boring and facing head and deals with the eccentric sheaves and straps.

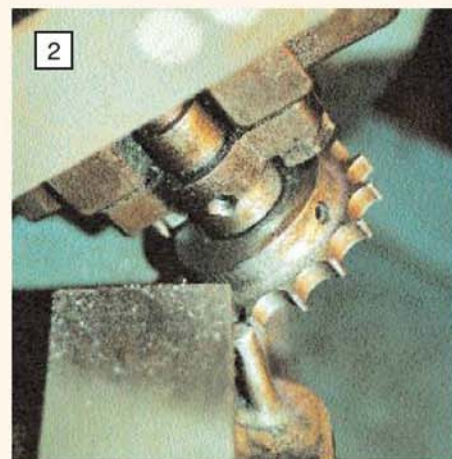
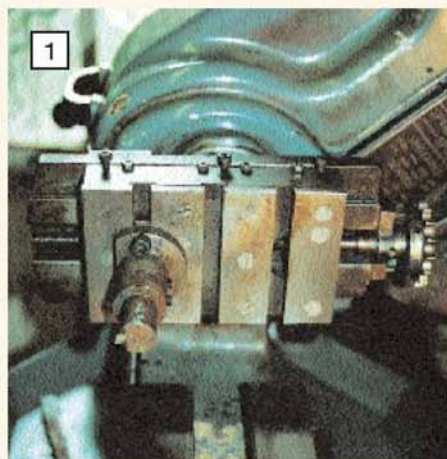
●Part XXXI continued from page 392
(M.E. 4180, 18 October 2002)

When dealing with the trunk guide (M.E. 4176, 23 August 2002), John Freeborne's boring and facing head was shown. I have had some enquiries about its design and operation and in answer John has kindly supplied a couple of views of it which are included here (photos 1 and 2). Made from a discarded lathe top-slide, it was bought at a club sale for the princely sum of £6.

Fortunately it is easy enough to find top-slides at the trade shows; indeed, some second-hand tool dealers seem to have quite an assortment! I understand that once some vital bit is lost, broken or worn out, lathes are worth much more to a dealer as spare parts. I imagine a small lathe saddle and cross-slide could equally well fit the bill, but a little work with a hacksaw would be needed to remove superfluous bits of the casting. I have already illustrated a second-hand Boxford top-side which I purchased and converted into a planing attachment for cutting keyways.

Valve gear

And so to the valve gear of our *Little Samson*. Full-size road steam greatly favoured Stephenson's valve gear with its two eccentrics, two rods and an expansion link. At its most basic, the purpose of the valve gear is to admit steam at the right time into the cylinder, allow the steam to expand, driving the piston along as it does so, and then to open the cylinder to exhaust to let the steam back out again. At that level of complexity I can understand it perfectly but I do not consider myself a valve gear expert in any way, particularly on the mathematics front. For this series I scaled the valve gear for our *Little Samson* carefully from the works drawings, dividing by either three or four to give 4in. or 3in. to the foot respectively,



John Freeborne's boring and facing head is made from a redundant lathe top-slide. The tool is fed outwards when facing by rotation of the feed screw which is driven by a peg interacting with the sprocket. The peg is mounted on a bar fixed to the back of the bed where the taper turning attachment would fit. The close-up view shows the drive arrangement on the boring and facing head. The number of teeth on the sprocket controls the feed. (Photos: P. Kybert)

and then had it checked by an expert. The expert was Duncan Webster, introduced by our editor, and I am truly grateful to Duncan for his help. More of this later.

Valve gear: road versus rail

Before looking at the construction details, a brief aside comparing general road and rail practices might not go amiss. There are some striking contrasts.

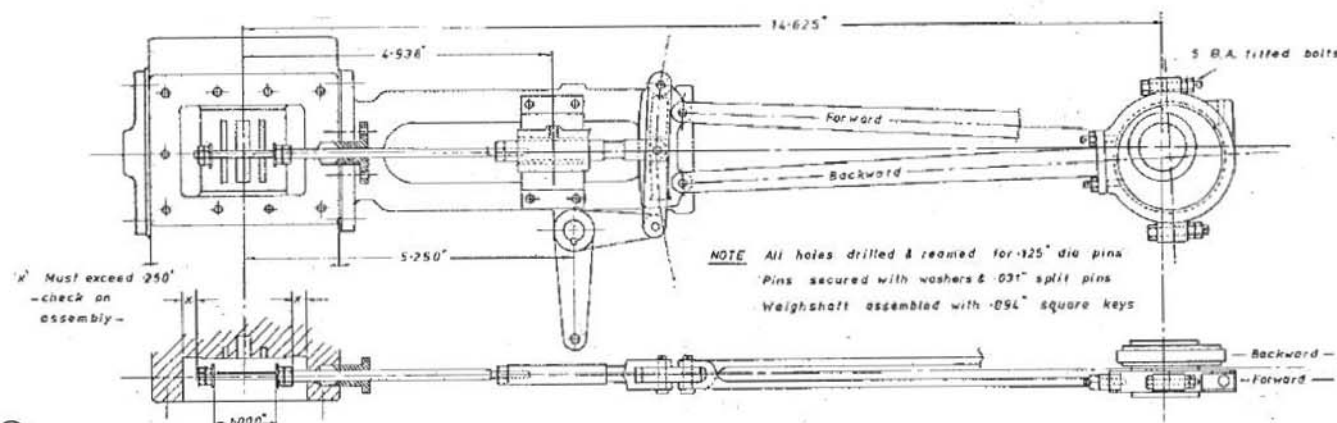
First, with road steam the vast majority employed Stephenson's valve gear, as laid out in photo 3, which is of Stan Nipper's fine 3in. *Little Samson*. Granted, a few makers experimented and used other arrangements. Marshalls, for example, designed and patented their own radial valve gear which they used on many of their later rollers and traction engines. Fowlers developed their own single eccentric valve gear but it was used on very few engines, none of

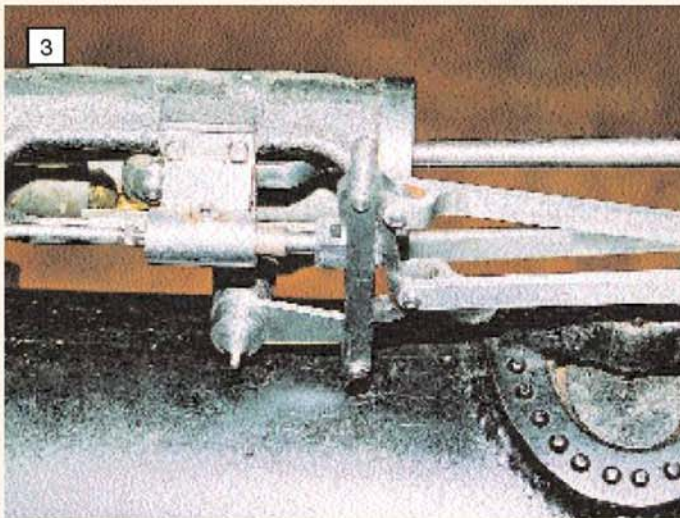
which survive. Fosters used the American Starke valve gear on a similarly small number of engines of which, happily, one survives.

I would lay money that the very last Fowler, Burrell, or whatever, was turned out with near identical valve gears to those built when the companies were still in their infancy. By contrast the railways used a whole array of different valve gears, of greater or lesser complexity, evolving and improving as the years passed.

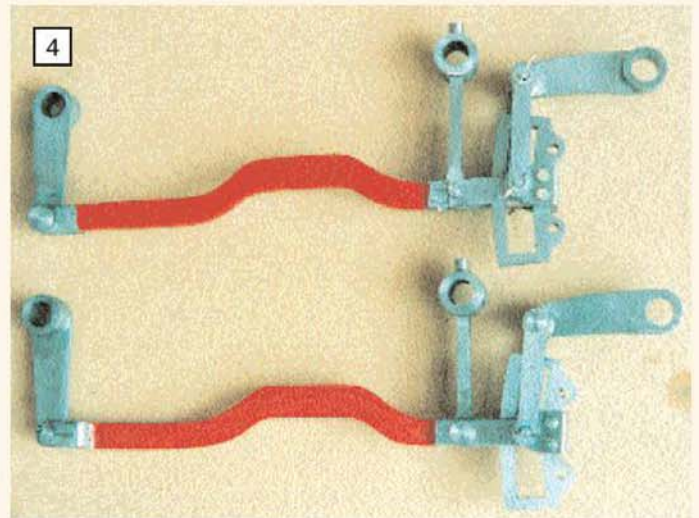
Secondly, road steam remained very much wedded to the slide valve which was used widely on the railways at first, but was largely dropped in favour of the piston valve. Most road steam manufacturers *did* make engines with piston valves at some time or another, but the market seemed to prefer the 'old-fashioned' slide valve. Aveling & Porter were one manufacturer that did change their production to the piston valve, stating in their literature "By use of a piston

Little Samson - VALVE GEAR - FIRST ANGLE PROJECTION





Stephenson's top suspended valve gear on the 3in. Little Samson.
(Photo: S. Nipper)



Above: Stephenson's link valve gear with centre link suspension.
(Photo: B. Terry Aspin)

valve, wear on the link motion is greatly reduced and the efficiency of the engine increased by 6 to 8 per cent." Having said that, they then promptly moved back to the slide valve a few years later, by customer demand as I understand it.

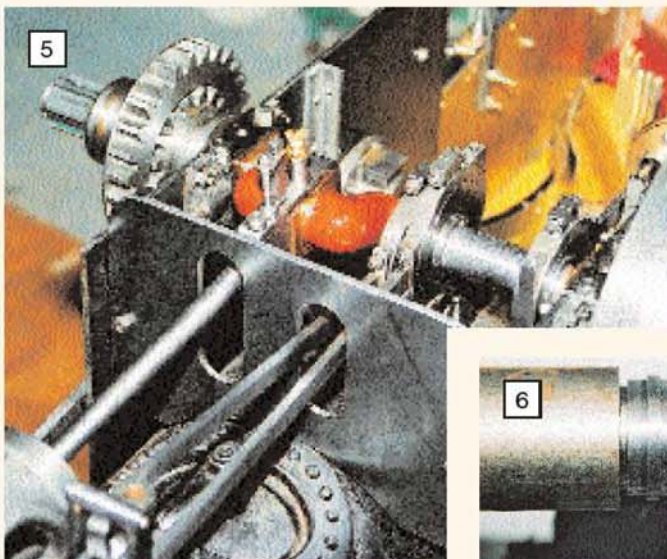
My belief is that road steam took the slide valve to its heart for practical reasons rather than any endeavours relating to fuel economy. A traction engine is much more likely to take water over into

the cylinder than its railway counterpart. Steam, as is widely known, expands and thus by the same token compresses. It is good practice for the exhaust to close a fraction before the piston comes to rest at the end of its stroke, the trapped steam is thus compressed to bring the piston to rest and save some wear on the bearings. However, any water taken over will not compress; a hydraulic lock ensues which can, and does, blow the cover off.

During the rallies I have attended in the last 20 years or so I have seen the results of three such instances, two on Aveling rollers and one on a Marshall roller. It is true that piston valves are invariably fitted with pressure relief valves, which should alleviate the pressure, but in these cases whether they were incorrectly set or corroded shut, they did not do the job for which they were designed. By contrast a slide valve will simply lift off its seating to release any trapped water.

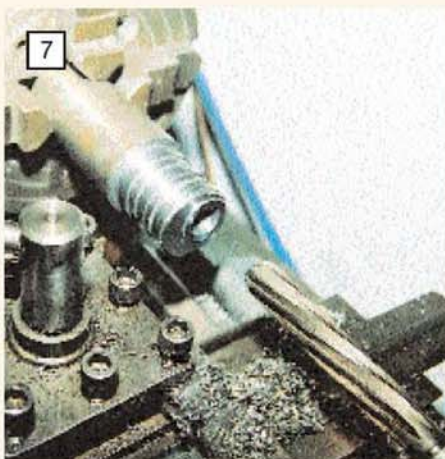
A third difference between road and rail steam was the use of compounding by which means the steam was expanded once in a high-pressure cylinder and then again in a low-pressure cylinder. Road steam, with few exceptions, used either a single cylinder, as in *Little Samson*, or a two cylinder compound. The railways, while they did build a variety of compound engines (with greater or lesser success), never built them in large numbers. Perhaps the railway engineers found they could expand their steam to their satisfaction in one go, rather than in two as adopted with road steam. Road steam manufacturers invariably claimed that the compound system offered greater economy than in a single expansion engine, but maybe that was due to their insistence on using Stephenson's valve gear.

I do not claim at all that the above is the whole truth and nothing but the truth. I would of course be happy to hear from readers who might wish to comment.

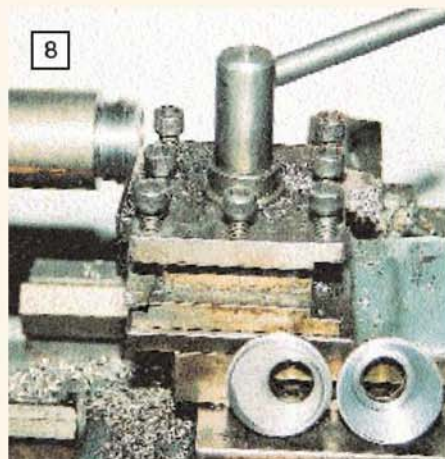


Left: The three eccentrics and straps assembled on Little Samson.

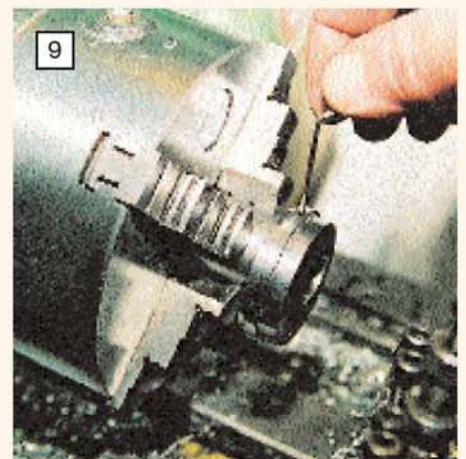
Below: The three eccentrics can be turned on a single length of steel bar but careful measurement is necessary as the corresponding diameters must be the same.



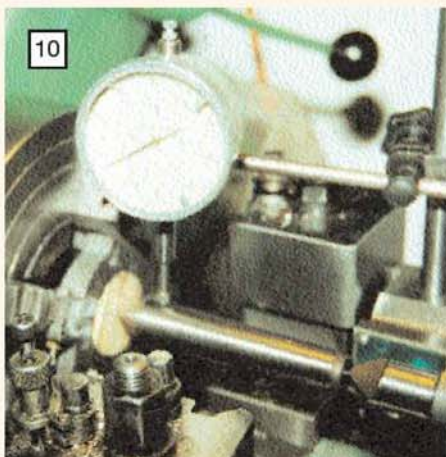
The three eccentrics are then offset in the 4-jaw chuck and the hole for the crankshaft is drilled and reamed. (Photos 5-9: S. Nipper)



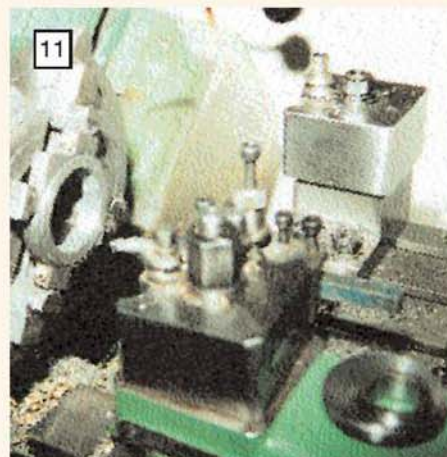
The individual eccentrics are then parted off. A free-cutting grade of free cutting steel will make this a more pleasurable job.



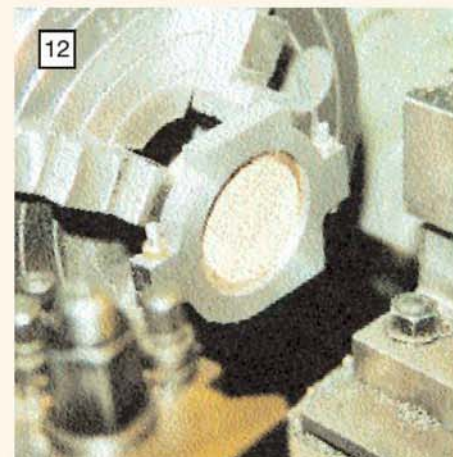
The eccentrics are then mounted on a stub mandrel to machine the side faces. The 5BA grub screw is used to hold it in place.



A wooden bung, 'floating centre' and DTI are used to help true up the strap in the 4-jaw chuck.



The strap is bored and faced. Note that the casting will distort if the chuck is overtightened.



The strap is mounted on a stub mandrel to face the other side. (Photos 10-12: S. Nipper)

Stephenson's valve gear: an interesting point

I said at the beginning of the valve gear description that I would return to Duncan's assistance with *Little Samson's* Stephenson's valve gear. Indeed Duncan's kindness extended to sending me a computer simulation written by a friend of his. I am very much in debt to Duncan for his assistance and patience, also to Jim Winrow whose valve gear drawings are spread all over the dining room table as I write these notes.

An interesting point made in Duncan's letters concerns the method of suspension of the expansion link. All the road steam engines I have seen have the expansion link suspended from the top, (photo 3). However, it appears much better practice is, as on the railways, to suspend it from the middle. This is illustrated in photo 4, with my thanks to B. Terry Aspin whose photograph it is and which featured in his recent fascinating series: *869 - A Chuck Venture*.

Duncan says "You will note that the events are not terribly well balanced between front and back of the cylinder. This is probably because of the way the link is suspended, but you don't have a lot of choice if you are sticking to the prototype. It will run well enough." In another letter he adds "I am fairly sure that this is because of the suspension of the expansion link, way off to one end, and in front of the eccentric rod pins. Locomotives tend to have the suspension point midway between the eccentric rod pins."

It seems that the method of suspending the expansion link on a traction engine is not ideal. I

imagine it cannot be of any great consequence or the traction engine designers would have changed the design accordingly. Perhaps, while avoiding a detailed mathematical treatise which I would not understand, someone may be able to offer an explanation and suggest how much difference it might make.

Making a start on the eccentrics

It is high time to make some progress on *Little Samson*, so on with the eccentrics and their straps. The eccentrics are straightforward turning exercises. There are three to make, two for the valve gear and one for the feed pump. The feed pump eccentric is a little thicker to give it a larger bearing surface to cope with the greater loads inflicted upon it by the feed pump.

The one thing that matters when turning is that the throw, i.e. the offset of the hole from the middle, is the same on both valve gear eccentrics. If they are not the valve travel will not be equal in forward and reverse motion. This will introduce difficulties when setting the slide valve. One way to achieve equal offsets is to turn the outside profile of both the valve gear eccentrics together on a bar. This bar is then offset in a 4-jaw chuck and the hole put through both of them at once. The individual eccentrics are then parted off. All three could be done at once, and this is shown in photos 6, 7 and 8.

Another way is to make the eccentrics individually. A little offset jig is then required, which is fixed to the faceplate, into which the O/D of the eccentric fits snugly. Each eccentric is then

popped in, centred, drilled and reamed individually. As long as the jig is not moved, all the offsets should be equal.

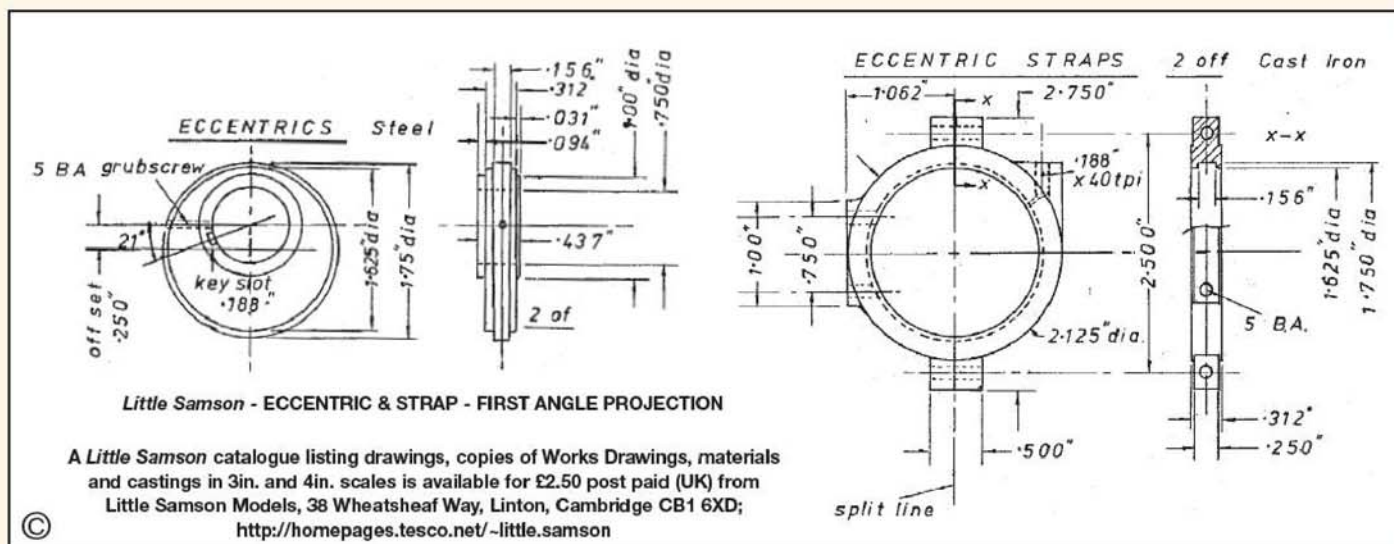
Straps

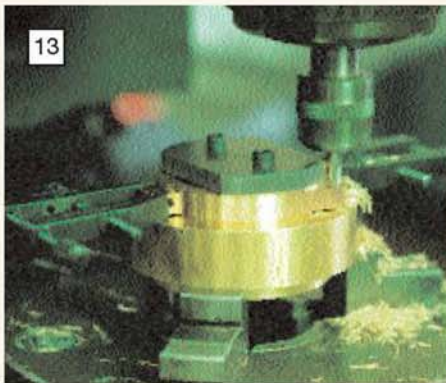
Iron castings are provided for the eccentric straps. Cast iron is a good bearing material and is prototypical so I see no reason to depart from it. Some builders may prefer bronze as it is easier to machine, but that is a matter of personal preference. As with the eccentrics the builder might as well machine all three at the same time, remembering the feed pump one is thicker.

The casting supplied will have an oval hole in it. This is to allow for the metal lost when splitting it in half and machining the mating faces. The first thing to do with the rough casting is to machine one of the flat side faces to provide a datum surface to work from. Just enough needs to be removed to clean up one side and just enough is then skimmed off the faces where it will be drilled for the fitted bolts. The machined face is then clamped to an angle plate and the holes for the bolts drilled. Since the drill is starting on a machined face it certainly ought to drill a hole exactly parallel to the datum surface.

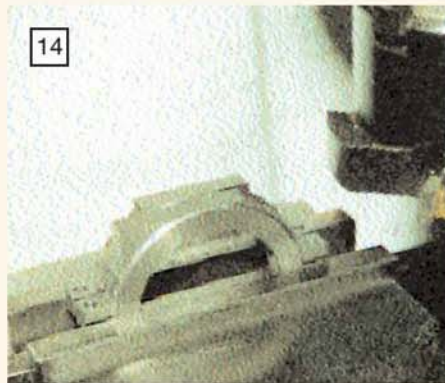
Sawn in half

The eccentric strap may then be sawn in half, a hacksaw will be just fine, and the mating faces are then machined flat using the datum surface again as the register. The two halves may then be reassembled at which point the still 'as cast' hole will be much nearer to round this time. Remove

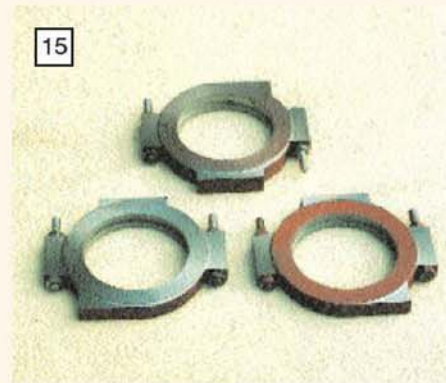




13
Peter Hall decided to make his strap from bronze; here the outside is being profiled using a rotary table. (Photo: B. Camps)



14
Stan's straps are seen here having the flats machined on them for the eccentric rod to fit up against. (Photo: S. Nipper)



15
John Freeborne's completed 4in. scale eccentric straps. (Photo: P. Kybert)

a little more from the mating faces and the faces against which the bolts fit, if need be, until all is as desired. I always turn up special fitted bolts to hold the strap halves together with the thread only just long enough to receive the nuts. Commercial bolts might be fine, but if they are not a really good snug fits in the holes, the two strap halves may not always bolt up *exactly* true to one another.

The assembled strap is then put in the 4-jaw chuck with the machined face outwards and trued up both to that face and to the casting itself.

Stan used a wooden bung to facilitate this (photo 10). The eccentric may then be bored and refaced. Use the eccentric itself as a plug gauge, one can be seen sitting on the topline in photo 11. The internal groove in the strap will have to be done by dead reckoning. A mandrel is then required to machine the other side of the strap, the two fitted bolts being used to clamp the strap to the mandrel. A small step is needed on the mandrel against which the strap can be pushed to ensure alignment. Some fiddling about is then inevitable to get the overall width of the strap to

drawing *and* to keep the two fitted bolts in the middle of the casting.

The remaining faces that receive the eccentric rods then need to be machined. This is easily done in the milling machine and the holes drilled and tapped for the fixings that secure the rods. My preference is to start the tap by holding it in the drill chuck and turning it by hand to make certain the tap runs true. The distance from this face to the centre of the eccentric strap should be the same on both the valve gear straps.

● *To be continued.*



A Very Special Christmas Offer from Motors Direct

Motors Direct are able to offer just ONE lucky M.E. reader the chance of a lifetime!

In addition to their usual remarkable and diverse stock of all types of drive motors used in model construction of all kinds from clocks to catamarans and machine tools to motorboats, Motors Direct are offering an exceptional ONE OFF special find!

Motors Direct have located a timewarp in the form of a totally complete Swedish Construction Kit. This marvel is the equivalent of a Meccano No. 10 set, weighing in at over 40lb. Made with typical Swedish precision, these kits were once sold at Weyco, London E7 in the 1960s. Indispensable for all prototyping, laboratory and workshop use and for proving designs, this kit will be a boon to any serious engineer who need never again cut any worm, bevel or straight gears, or make up any roller bearings (with cages), or tap or thread any other components, for all this is already done for over 1500 metal pieces

included in their original wooden box. Complete with all the instructions full of engineering drawings dimensioned, true to type, in both metric and imperial units.

The price for this rarest

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is £380, carriage NOT included.

ONE only, it will be sold on a first come, first served basis.

However, the large range of discounted drive motors, controls and usual friendly, free advice are still available from Motors Direct on 01749-860111 at Harvester Yard, Dicheat, Somerset BA4 6RB. A.G.

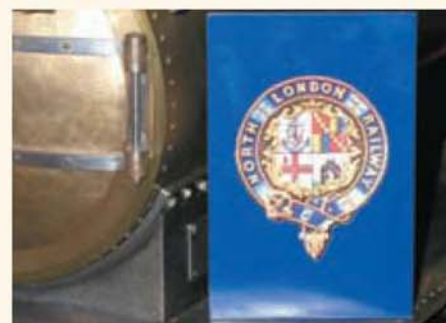
Make your own waterslide transfers with Jetcal

Realistic and accurate decals can transform a model and while many are commercially available, problems arise when the model requires something outside this range. Jetcal is a new medium which enables modellers with access to a computer and normal ink-jet printer to produce their own full-colour custom waterslide transfers.

I tested this innovative product by scanning a full colour North London Railway crest which I had to hand. I checked the result by printing it on regular photo-quality ink-jet paper, sizing it to

suit a small steel panel which I also happened to have by me and had been previously painted with a rich blue enamel paint.

The crest was printed in one corner of a sample A4 sheet of Jetcal and set aside (in the airing cupboard) to dry for an hour. The crest was then carefully cut from the Jetcal paper using a scalpel, and immersed in a saucer of cold water for a minute to release the image from the backing paper. Sturdy enough for careful handling, the transfer was placed on the panel, positioned and blotted dry using a tissue, then set aside again for an hour to dry. The result is shown in the accompanying photograph; the panel is 2 1/2 x 3 1/2 inch.



When dry the transfer should be protected with varnish, but I have not yet had any opportunity to test its durability in service. Jetcal is supplied on white paper, unprinted areas therefore remain white. The makers state that these can be made transparent by the use of a solvent based varnish or left white by the use of a water based acrylic varnish. Available in packs of 10 x A4 sheets for £14 plus 80p p&p (UK) or 5 x A3 sheets for £14 plus £1 p&p (UK), further information can be had from www.thedecalpaperstore.com e-mail questions@thedecalpaperstore.com or write to The Decal Paper Store, PO Box 1687, Stoke-on-Trent ST13TR. M.H.C.

A GWR LOCOMOTIVE for 7¹/₄in. gauge

Keith Wilson

reports on a visit to Beamish and describes the operation of his modified vacuum brake gear

●Part XXXII continued from page 395
(M.E. 4180, 18 October 2002)

On a recent weekend away I visited the model engineering society at Beamish Museum, just a few miles south of a certain nose-thumbing statue of a giant man exposing himself towards the South, and there I did behold a kuppel of Koppels, or a couple of copples, two very nice but functional locomotives of the rack-railway type, designed by Ken Swan, who was there and surprise! we had a good interesting chat. The unfortunate Meccano appearance of this fine locomotive is entirely, I repeat *entirely* due to the lighting conditions which were dull, murky and under trees. We can't win 'em all, alas!

There cannot be many miniature railways with a rack section, but there is one here. I hoped for a ride thereon, but British weather did its best, or worst, and took over. Even the most interesting train ride can lose some of its attraction in soaking cold clammy rain, so I was unlucky. However, friend Bob Symes got one in just before the rain, and spoke very highly indeed of the experience; just my luck!! To add to the disappointment, my photograph of the episode did not come out.

Few club workshops are better or more well furnished than mine, but this is certainly one of them.

Back to work Sir, this instant!

Having dealt with a good way of raising lots of nothing or, if you prefer, creating a vacuum, what do we do with it when we've got it, or not got it depending on how you look at it — that is, if you can see a vacuum!

We need the larger cylinder (30in.) for the engine, be it 29 or 47, and the 22in. one for the tender of either, so it seems logical to me to describe both at one time.

The operation is reasonably easy to follow. The removal of all the air, or as much as we can manage, causes the piston to drop to the bottom of the cylinder. In full-size, I understand that the weight of the piston and rod is sufficient, but it certainly isn't for us. Now, the original 7¹/₄in. version

arranged for some help from the seal. This also applies to us, but I discovered a snag. It is clearly necessary for this seal to only just touch the cylinder bore so that the pressure difference 'twixt the top and the bottom of the cylinder is minimal. This, alas, means that if the piston should be the proverbial gnat's-cock off dead central at any time (very easy), when brakes are applied, nowt 'appens, as all the air just rushes past the seal. Not overly helpful.

So I think up a modification that overcomes both problems, and adds to the efficiency of the system for good measure.

A slightly larger seal is used, one that presses on the cylinder much more. To overcome the lower pressure differential problem, we put in a little semi-automatic non-return valve that remains closed until the piston hits the bottom of the cylinder. It is then forced open, so that the pressure differential is zero. The force of the air being removed from below the piston pulls it down with enough force to overcome any friction.

Incidentally, 'below' and 'above' the piston do not mean physically higher or lower, but apply to the air system; hence 'above' would apply to the

vacuum reservoir and its pipework only, 'below' would mean all the other pipework including the ejector, application valve, train pipe, and other vehicles involved in the train.

When air is admitted to the train pipe, the pressure thereof pushes the piston upwards, closing the little valve just discussed and sealing 'below' from 'above' so that we get maximum force from the cylinders. As mentioned last time, this force is about 59lbf. from the 30in. cylinder, quite enough to do naughty things to a protruding finger. The 22in. cylinder will give about 46lbf. — also painful — so watch it! These figures refer to the size of the prototype cylinders; it is easier to use these names than 3³/₄ and 2¹/₂ inch.

An e-mail just arrived mentions the fact that I got some figures wrong in the last episode. It looks like interpretation to me, but trouble can easily arise with negative values mixed up with positive dittos. So let us try to make things a bit clearer.

With 1in. of vacuum equalling about 1/2lb. pressure per square inch, with a piston diameter of 3³/₄in. it follows that a pressure difference of 1in. between 'above' and 'below' the piston, we get approximately 5¹/₂lbf. thrust available, or

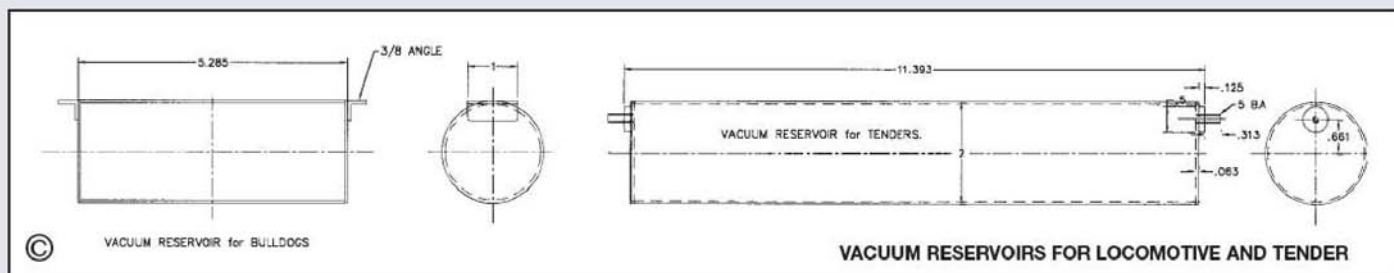
55lbf. for 10 inches. There is no point in trying to be any more precise, for friction is rather difficult to calculate, and the fact that without a vacuum reservoir (of which more anon) of infinite capacity, the pressure differential changes with movement of the piston. It is rather an Alice-in-Wonderland state of affairs to learn that an empty tank, the larger and emptier the better, vastly improves braking efficiency and power. Certes, it is apparently impossible, but examination of the facts demonstrates the truth of the matter.

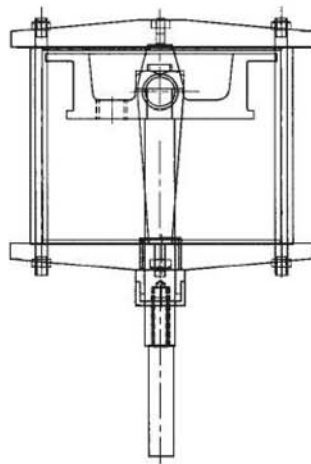
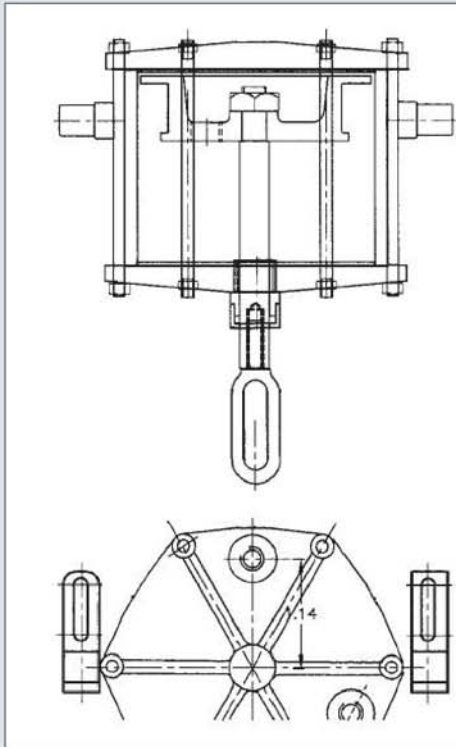
No doubt you remember Boyle's Law, to the effect that halving the volume of a gas doubles its pressure (ignoring temperature changes and one or two other minor effects)

Therefore, since we cannot get absolute zero in pressure, it follows that there is quite a lot of air above the piston. Upward movement of the piston therefore compresses this residual air, which in turn results in an increase in



One of the Koppel locomotives to Ken Swan's design photographed by Keith at Beamish at the opening of the rack railway there.





Brake cylinders ready for use. The two at the top are to the 22in. design shown here.

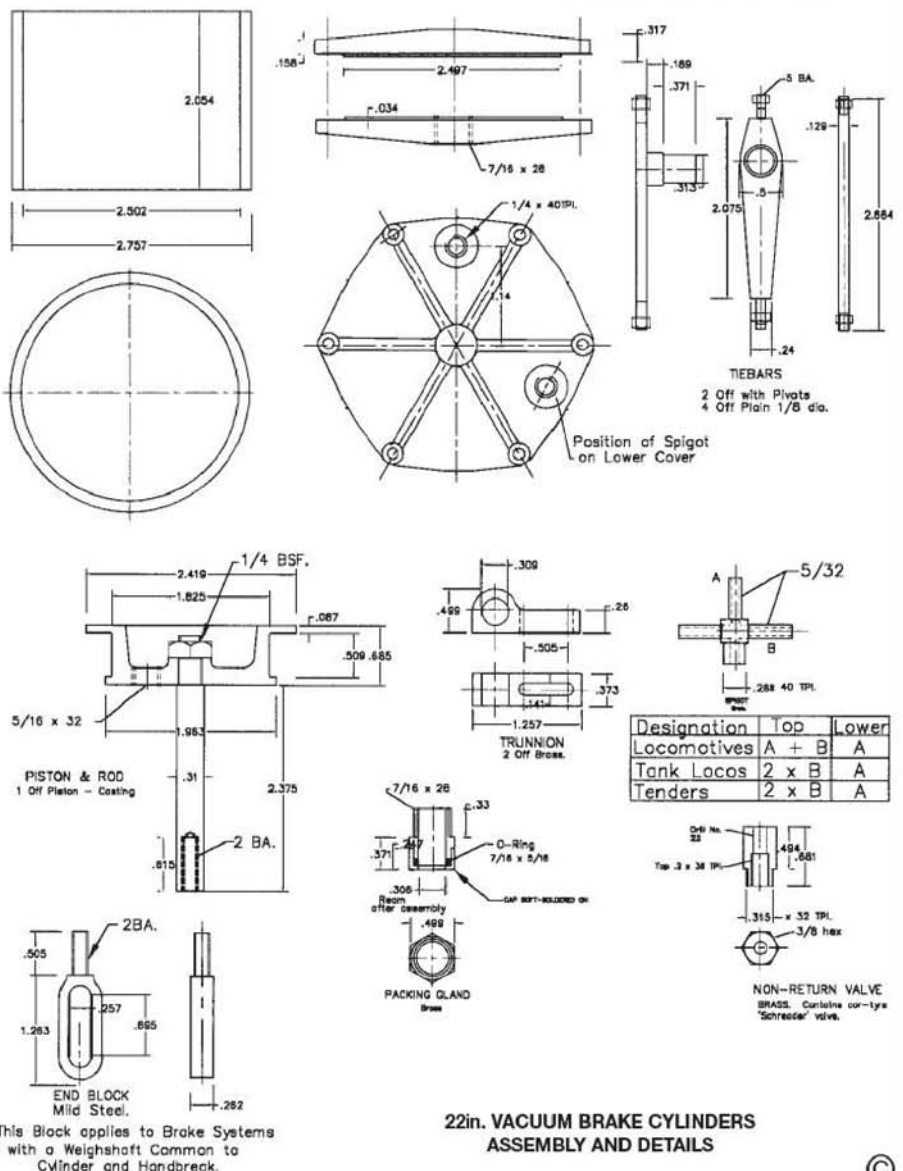
its pressure. Back pressure in fact, tending to neutralise any braking force. Unhelpful indeed! So somehow we must do summat about it.

Increasing the length of the cylinder (for the same piston travel) will clearly reduce the effect of this residual-air compression (thus reducing the compression ratio leading to a lower back pressure for any given piston travel) but clearly there are close limits as to how much this can be done. But it is clearly possible to artificially increase the effective length of the cylinder above the piston, by connecting it to a large empty space. Hence the vacuum reservoir.

The astute reader (clearly this means both of you) plus any others will now perceive a possible advantage in treating a vacuum as though it were something rather than nothing; name-calling could then be somewhat simpler. The term 'vacuum inlet valve' begins to shew some vague meaning, but a leak in the vacuum pipe spoken of as 'letting the vacuum out' perhaps not. Either way leads to problems depending on what one is used to.

It will be noticed that a very slow application of the brakes could result in no braking at all, for the air could (in theory) leak through the little non-return valve instead of forcing the piston upwards; in practice this doesn't happen, for the 'leakage' through the valve is very small indeed. Also, 'we' don't often require a very slow application, for friction's effect on trains of our size is vastly greater than full size and a normal or 'service' application has a different requirement and effect.

Now I don't want this following bit to be an adverse criticism of anyone else's version of a brake cylinder. I have in mind here the version of a single diaphragm between two identical shallow-coned disks or covers. They work perfectly well, but we need 'scale' cylinders anyway, and the design herewith gives a longer stroke. This can be useful, for no matter how big the vacuum reservoir is, immediately the piston moves, residual-air compression takes place and brake power is reduced. It follows that the two-disk system is best used with close adjustment i.e. set up with rather limited clearance. I might well be wrong in this; if so, I apologise in advance to those with alternative views but that's how it seems to me,



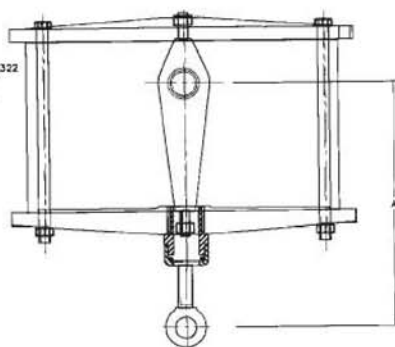
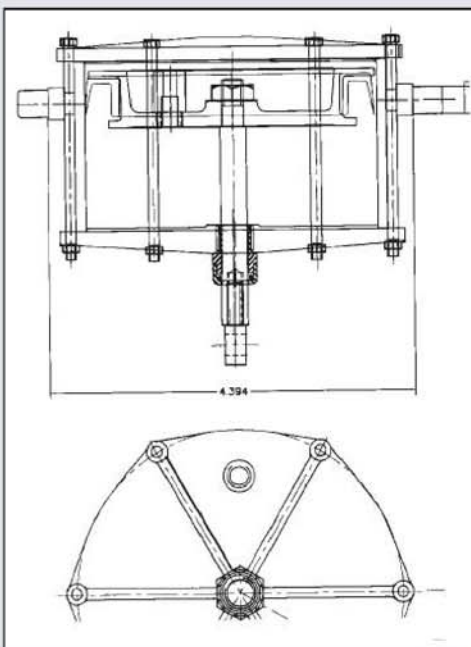
22in. VACUUM BRAKE CYLINDERS ASSEMBLY AND DETAILS

and I have used this type of cylinder on other types of locomotive (*Romulusses*, *Hunslets*) with some success.

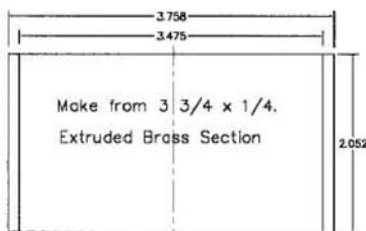
The seal used on the piston is a 'U'-seal, a name that I think explains itself. I think it might pre-date the good old 'O'-ring seal. It certainly tolerates more tolerance on sizes, but surface finishes must not be neglected. I polish the inside of the cylinders before assembly, and liberally

besmear this surface with a Moly slip grease. In theory I think that greases of any sort might not be too happy under vacuum conditions, but I have yet to have any trouble on this score. In any case, the molybdenum disulphide content of the grease should remain on the seal and cylinder wall, imparting lubricating qualities to both.

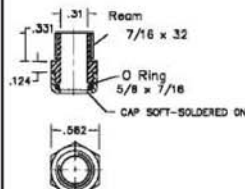
A good tip on cylinder assembly is to soft-solder the top cover onto the cylinder, this helps to ensure



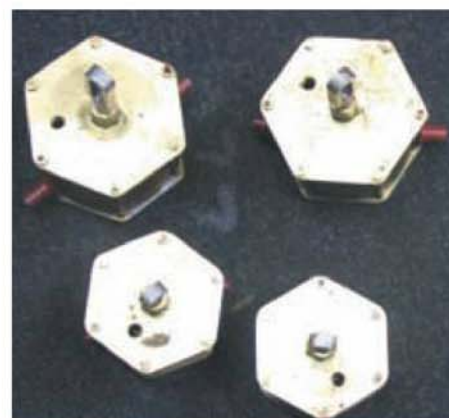
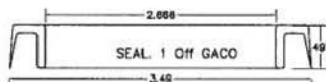
The Maximum Travel of the piston is about 1.165"
It may be varied from a minimum displacement "A" of
2.444" by varying the Piston Rod Length.



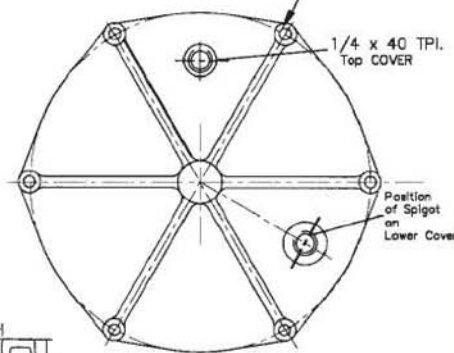
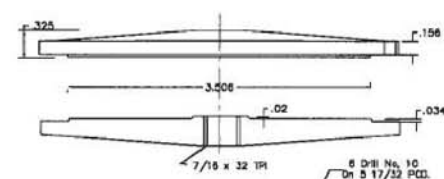
CYLINDER. 1 Off.



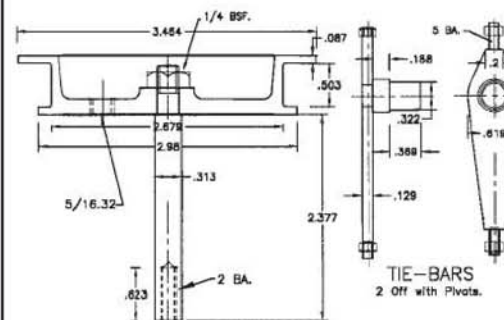
PACKING GLAND
Brass



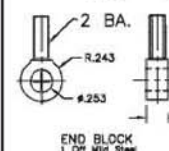
An alternative view of brake cylinders ready to be fitted. The two at the bottom are 17in. cylinders.



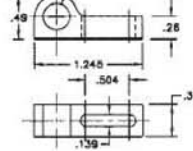
30in. VACUUM BRAKE CYLINDERS ASSEMBLY AND DETAILS



PISTON AND ROD
1 Off Piston - Casting
Rod - Stainless

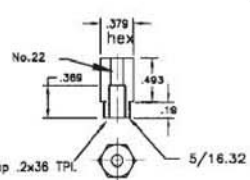
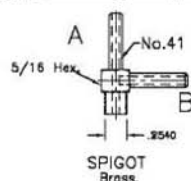


END BLOCK
1 Off Mild Steel



TRUNNION
2 Off Brass.

Designation	Top	Lower
Locomotives	2 x B/A	
Tank Locos	2 x B/A	
Tenders	B	A



NON-RETURN VALVE
BRASS. Contains car-tyre
'Schredder' valve.

leak-proof-ness above the piston. For as you will soon see confirmed for yourself, leaks below the piston are a (doubly-censored) nightmare but leaks above it are bad news indeed, this (like the lubricator system for cylinders) must be 110% (sic) non-existent.

I recommend the use of some fine emery paper on the piston rod, used parallel to the axis. Even using precision-ground stainless steel, this little dodge helps in maintaining a tight seal. Make sure that the fit of this gland on the piston rod is good and true; this aids operation.

The two photographs shew a set of these cylinders (almost) in my drawer of completed bits. I would mention that the two large ones are the small ones, bejabours! In other words, they are 22in. cylinders, for the tenders. The two small ones are 17in. cylinders for the two locomotives I am building. *Bulldogs*, in fact. They had a 'parallel' pair of 17in. cylinders, for there just isn't room for the ideal 30in. cylinders, nor yet even the 22in. one. The brake force available is of course less, but a greater ratio of leverage in the brake lever system gives some improvement.

To connect these cylinders into the vacuum system, transparent plastic tube is very cheap and easy to get. Short lengths of the 1/8in. bore size couple the cylinder into the system. This 1/8in. bore size is a super fit on 5/32in. spigots; 1/4in. bore is reasonable for the train pipe couplings between vehicles. Said train pipe should be of 1/4in. O/D copper tube through each vehicle. With this system, silver-braze a 5/32in. spigot about 3/4in. long into the train pipe where each cylinder is needed, then if not required it can be temporarily blanked off. If it is required, then a piece of the 1/8in. plastic pipe will do all the connection necessary.

An import point with the automatic vacuum-brake system is that just one small connection is required for each brake cylinder and the system is therefore fail-safe. With the 'simple' system, it is 'fail-dangerous', for if there is any disconnection in the system, *whatever and wherever*, then you have no brakes and what is far, far worse, you don't know it until it's uncomfortably too late. BAANNGG! Whereas, with the automatic system, the leak is self-detecting and with the vacuum gauge in the cab plus jammed-on brakes preventing a start, the system is fail-safe.

If one of the brake cylinders should jam up solid or its brake linkage come unstuck or its pipe become blocked (it *could* happen) then the worst that can happen is a momentarily reduced brake application, which except for full emergency applications can be instantly corrected, usually instinctively.

I know which system I prefer, and virtually everyone I have discussed the matter with, most of them drivers in their own right like me, are on my side. Some of these names are virtually household words where trains are concerned.

●To be continued.



An embryo cylinder roughed out and with the mounting thread turned on the end. This locates in the specially prepared socket on the lathe mandrel.



One of the cylinders being bored using a stout boring bar. The fixture ensures that the bore is truly perpendicular to the base of the cylinder.



The original lap in use on the lathe before the incident with the dislodged honing stone. The cast aluminium alloy laps proved more serviceable.

THE BURNT AIR ENGINE

Frank Taylor

explains how he dealt with the cylinders for his unique engine.

●Part IV continued from page 379
(M.E. 4180, 18 October 2002)

In order to ensure correct fitting of the cylinder heads it was essential for them to be correctly located in the crankcase casting and that they were all truly vertical. This was achieved by making the equivalent of a lathe mandrel nose on the cylinder and a back plate type socket in the casting. The next question to rear its head was do I use a boring tool with the cylinder rotating or use the boring head with the job on the cross-slide? The former would ensure cylinder would be vertical, the latter would ensure a perfectly parallel bore.

I chose the former and checked the lathe over in accordance with the useful advice given by the late Tom Walshaw in order to reduce parallelism error to a minimum.

Machining the cylinders

These were first roughed out and the threaded nose and location faces machined. Another simple aluminium alloy casting was made (photo 29) and a socket machined in it such that the cylinders



A finished cylinder with the cast aluminium alloy rings used for gauging and lapping purposes.

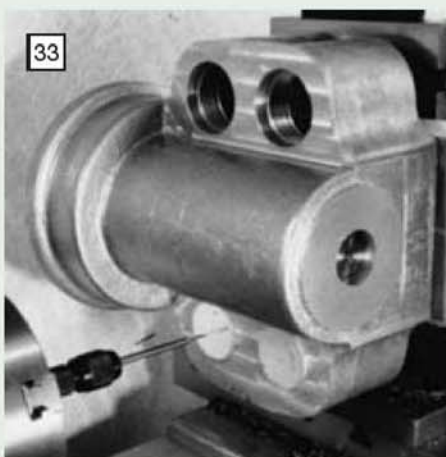
could be screwed in for final machining and lapping. A half-completed cylinder sits and awaits treatment

in photo 29. Photograph 30 shows the boring of the cylinder in full swing.

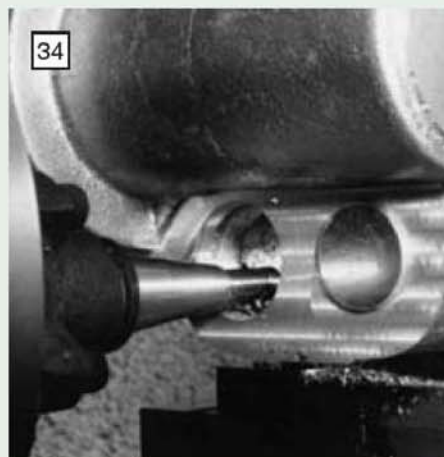
I made the lap that you see in photo 31 for finishing the cylinder bores. The stones were shaped to a good fit in the milled slots and one stone was adjustable. All seemed to be going well with me squirting paraffin into the bore, which washed out the grinding debris down the gully and into the jar. Suddenly there was a nasty squeak and I knew I had messed it up.

The lap was of my own design and in retrospect, it is thought that the stones and grooves were not deep enough. This allowed them to ride up on one edge and jam. I 'chalked up' two out of ten for that one. Fortunately the damage was not too bad and it was lapped out with a different design of lap. It appears I did not photograph this but it is virtually the same as the device for measuring the bores shown in photo 32.

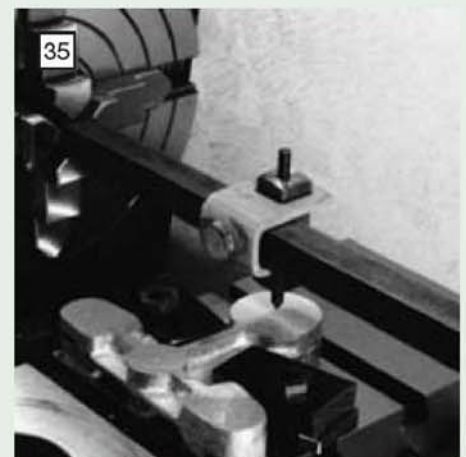
These gauges and laps involved more aluminium alloy castings; the furnace never seems to cool down. Eight items were made similar to that in the foreground of this picture. Some were used for lapping and some for measuring and for both functions they worked very well. The small hole that you can see is tapped with a taper tap to about half way through the split casting. When a hexagon socket type grub screw is screwed into the tapped



Using the 'sticky pin' from a 'wiggler' set to pick up the marked centres for the cylinder holes. The top two holes have already been machined.



Screwcutting the cylinder base threads in the crankcase using a screw cutting tool mounted in the boring head.



Marking out a yoke using a centre punch fixed to a bar rigidly located between the lathe chuck and tailstock centre.

hole the diameter, of the lap/bore measuring device is increased.

The range of adjustment was deliberately limited to about 0.002in. to minimise distortion from a true circular form. This was how I designed it and I made several diameters to cover the range I wanted. In practice this was not necessary and a range of 0.010in. could be obtained before the out-of-roundness became significant. A completed cylinder is also shown in this picture and is standing on the lathe, mandrel type nose machined on its base.

When I purchased my first set of tools I was persuaded that I would need a 'wiggler' set (photo 33). This is a little chuck in which various fittings can be placed. These fittings include a needle point (shown in photo) ball and discs plus a dial test indicator holder. It took me quite some time to realise the full potential of this little set but these days it spends very little time in the tool cupboard. It is seen here picking up a small punch mark placed with the slide index in a piece of scrap aluminium alloy plate stuck to the casting.

With a x12 glass one can see the point run down the side of the cone of a tiny punch mark and with a little patience get placement within 0.001 inch. The ball and disc fittings allow one to



A finished yoke. Note the use of a steel cap, which was chosen to increase the strength of the component in this area.

align the lathe centre with an edge or the centre of an existing hole. In terms of money for usefulness it is the best thing I ever purchased. They are still available from advertisers in this magazine.

As can be seen in photo 33, boring and threading of the upper two cylinder sockets has already been completed. With a threading tool in the boring head, photo 34 shows how the cylinder socket threads were cut.

The next items to be tackled were the yokes, which were again aluminium alloy castings.

I have a dozen or so photos of the making of these but feel I must limit them in order to save space.

Photograph 35 shows punch marks being placed for subsequent drilling, boring, and reaming operations. The arrangement consists of a small punch and holder clamped to a bar located between the lathe chuck and tailstock centre. The mandrel is locked in position. The cross-slide and leadscrew index dials provide co-ordinates for accurate placing of the centre dots.

The tool is designed such that if the punch holder is removed and placed in the toolpost, the punch is exactly at centre height and can be used in conjunction with dividing apparatus mounted on the lathe headstock.

Photograph 36 shows a 'full frontal' view of one of the yokes awaiting insertion of its cast leaded bronze big end bearing. The top part of the bearing clamp is made of steel to provide adequate strength. The fine finish on this item was obtained by fly-cutting at a slow speed with a sharp high rake tool using paraffin as a coolant. This is half the story, the other half is that the cast metal was free from gas and oxides. There will be more discussion on this subject in the next article in this series.

●To be continued.

SIMPLE BRAZING HEARTH

John Rockey

explains why this inexpensive and simple unit may make a good winter project.

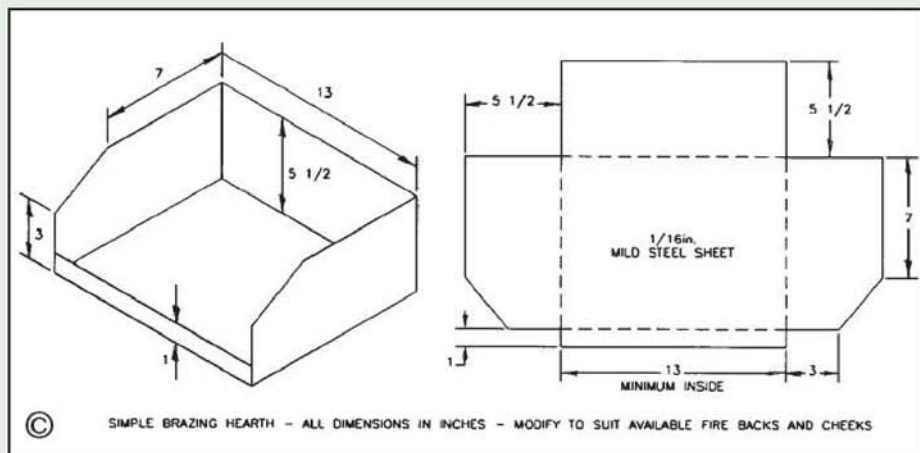
It may seem odd to state that it is easier to make a brazing hearth in the winter than the summer, but a glance at the accompanying picture will explain why. Fire 'backs' and 'cheeks' which form the basis of this project, are obtainable from most ironmongers' shops (not DIY stores). These are more likely to be on display during the winter months although, of course, there may well be some hiding in the stockroom during the warmer weather.

You will require two 'backs' and two 'cheeks'. If they differ in size to the ones I used, this will have to be allowed for. However, I think you will find the sizes shown are standard.

I used 1/16in. mild steel sheet for the tray. Access to shears and a bending machine would be useful, but two pieces of angle iron held in a 'Workmate' or even in a vice will serve.

Four 36in. lengths of angle for the legs and a few oddments for stiffeners at the base will be all you need, plus of course nuts and bolts or pop rivets to hold it all together. Bolting the legs to the sides of the body eliminates any need for welding the joints.

I have successfully silver-soldered a small pot boiler in my hearth and find it an ideal size and height for general use. Standing on its own legs it is far less of a fire hazard than a hearth built up on a wooden bench; it also benefits from being very portable and can easily be taken outside should you wish to work in the open. Best of all, it is simple to make and dead cheap!



Portable, robust and stable, the brazing hearth is supported on an angle iron frame.

CLUB CHAT

With Stan Bray

UK News

The second Plymouth Miniature Steam exhibition was held at Goodwin Park throughout a weekend instead of just for a single day, as last year. Presented in conjunction with passenger hauling on the track, it attracted many members of the public and was very successful. In spite of some very hot weather, expansion problems normally a regular occurrence with the club track have not arisen this year. It is believed that this is due to the increasing number of shrubs and trees now growing in the area which shade the track from the sun. Every silver lining has a cloud and in this case the growth of these trees and shrubs means that they are encroaching on the club facilities and the effort required to keep them under control has increased accordingly. Members find that they are also having to install more and more security devices and methods to combat increasing levels of vandalism.

To celebrate the 70th anniversary next year of the founding of Norwich DMES, an exhibition is planned for 26/27 April at Hewitt High School, Cecil Road, Norwich. In keeping with such an occasion, members intend to make it a grand affair and already have promises of support from other societies. To accompany locomotives operating on the portable track and traction engines in steam, displays will include kite flying, model boats and aircraft, some of the latter giving flying displays. Anyone wishing to exhibit will be welcome to do so and should contact Exhibition Co-ordinator, Ramon (Tug) Wilson, e-mail modeng@waitrose.com (tel: 01502-714905), or send him a stamped addressed envelope to 6 Broadland Close, Worlingham, Beccles, Suffolk NR34 7AT. After many years of service Barry Steel has retired from the post of Secretary and newsletter editor. He was presented with a computer printer at the AGM as a token of gratitude for his efforts on behalf of the society. Having stood down from these posts, Barry has now decided to compile a history of the society and is seeking suitable material that will help him in the task.

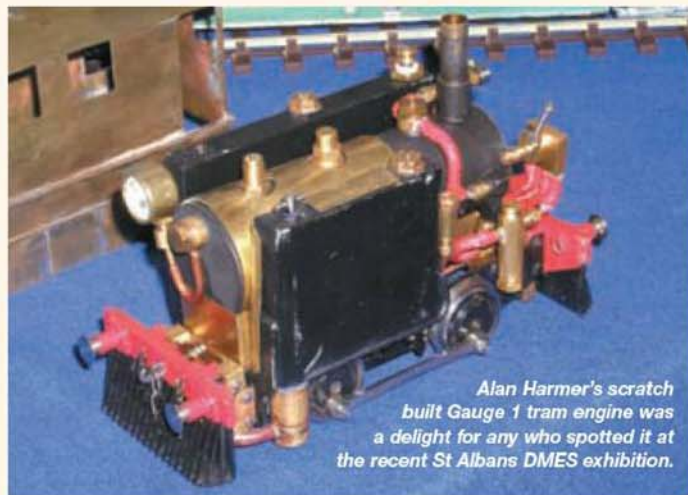
Following a successful year for the society, the Erewash Valley MES AGM was well attended. Some of the committee members wished to stand down with the result that there were a few changes to its

membership. The portable track had been taken to various events on eight occasions,

bringing in valuable finance for the club. It would have been out on two other occasions but the torrential rain suffered during the UK 'summer' caused last minute cancellations. Several improvements have been made during the year at the Borrowash headquarters, including the construction of a store room, a signal box and a trailer port, all now either completed or nearing completion. There have been a number of visits to other societies as well as a series of special events at Borrowash, thus ensuring that the year has been far from 'all work and no play' for the members. It was agreed at the AGM that logbooks should be organised and used to record the operation of the two club locomotives, thereby providing ready information regarding their use and any faults that might occur.

A question presently uppermost in Brighton & Hove SMLE members' minds concerns a proposal to build a club locomotive and whether or not sufficient volunteers would come forward to produce the required parts. Construction of models by a consortium can present problems but many clubs have been successful, to the extent that we now hear of quite a few models built as club locomotives in this way. The problems seem to be less in the construction than in the necessary maintenance once these club engines are up and running. Children's birthday parties have been a financial success for the club, as indeed they have for a number of societies. As their frequency increases, some members who consider them to be somewhat too frequent, feel that it may be time to stop them for a while. While they produce regular and useful guaranteed cash, they can be difficult to run, particularly when attended by a few unruly youngsters whose parents are either absent or decline to keep them under control.

Since August is a holiday period for many members and visitors, Basingstoke DMES have no public running during that month. This year some who do not travel to exotic places at this time took the opportunity to completely renew the station canopy which was beginning to show its age. To combat any future tendency to rot, much of the canopy has been made from plastic and although probably more difficult to work with, the additional effort should prove worthwhile in the long run. A noticeable decrease in the number of passengers carried has



Alan Harmer's scratch built Gauge 1 tram engine was a delight for any who spotted it at the recent St Albans DMES exhibition.



Also to be seen at the St Albans show was this Meccano model of the intriguing LMS Ro-Railer designed to run on road or rail, introduced in 1931 but retired after only two months' service.

been observed this year but there has been an improvement following September announcements on the local radio station about the activities of the society.

With some 20 locomotives of various types from all parts of Northern England in attendance, the annual Wortley Top Forge ME open day was one of, if not the best organised by the club. There was also an excellent display of stationary engines and a range of hot air engines, together with a display of boats and many other model engineering artefacts. Problems with accommodating visitors' cars were resolved by marking out the parking spaces using tapes, resulting in over 100 cars in the car park at one stage. The public attended in large numbers and while the raising of cash was not the prime object of the event, it proved financially successful as well as very enjoyable. The club is considering the purchase of a battery electric locomotive to increase the motive power available on regular public running days.

The staggering sum of £1400 was raised for Macmillan Nurses during a special day organised by Bedford MES in aid of this very worthy cause. The society also raised money for MENCAP and for a Cerebral Palsy organisation as well as entertaining several groups of disabled children. In the latter case it is

suggested that the members seemed to be enjoying themselves even more than the children. This society is one of a growing number that organise children's birthday parties as a means of raising funds and this year saw two particularly unusual such events. One was a party with a Disney theme when not only were Disney characters roaming the track site, but members were also entertained throughout by a full-blown jazz band. The other had a Harry Potter theme for which the club was able to provide the *Hogwarts Express*, which departed from platform 9^{3/4}. Also provided for the event was a *New Hogwarts Express* hauled by a specially prepared Class 60. The club's annual traction engine rally attracted a large number of model road vehicles again this year and was considered to be one of the most successful events of recent years. Visitors enjoyed an excellent barbecue and many stayed overnight.

Many societies now have websites which can provide a great deal of useful and interesting information. One of the more recent to be set up is the Cambridge MES website at www.cambridgemes.co.uk. It is also one of the best we have seen so far with a limited number of pages set aside for public viewing. These include a history of the club and a review of its current range of activities while members can register

In Memoriam

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

Peter Kershaw

Robin Lee

Bryan Whitman

City of Oxford SME

Manx Steam and MEC

Colchester SME

to gain access to pages not available to the general public. Links to 11 other websites provide cover for a whole range of activities, not all of which are necessarily directly associated with our hobby, but all contain information of interest.

Members of **Manx Steam and MEC** have met regularly for many years at the Manx Automobile Club which we are told is to close permanently in the not too far distant future; a new arrangement has therefore had to be made which involves the use of RAF Association premises. Members' views are being canvassed and discussions are in hand concerning meetings and whether they should remain on a monthly basis or perhaps held less frequently. TV personality Fred Dibnah paid a surprise visit to the society, enjoyed a couple of rides around the track and delighted some of the junior members by posing with them for photographs which they will doubtless show with great pride to all their relatives. Arrangements are in hand to prevent members from feeling unwanted and at a loose end during the winter when it is proposed to carry out some track renewal, redesign and reconstruct the steaming bays and sort out the engine shed.

Although the **St Albans DMES** August Bank Holiday Regatta was successful we learn that attendance was significantly lower than it used to be in years gone by. That said however, those participating were similar in number to recent years and there were sufficient boats for everyone to enjoy themselves. Despite a change of venue from one end of St Albans to the other, and a minor readjustment of the date, the annual society exhibition was also successful. We understand that the society sales stand did a roaring trade, that the catering arrangements were very much appreciated by all and sundry, and there was good support from other local societies. As well as the fine display of models, other attractions for visitors included a portable boating pond and a portable railway track in a courtyard adjacent to the exhibition halls while control line flying took place on an adjacent playing field.

The official opening of the new 2 1/2in. gauge track at **Fylde SME** took place at the end of August, the ceremonial cutting of the tape being performed by Ernest Mann who, at a sprightly ninety something (and we are informed that the something is quite a bit) is the oldest member of the society. After making a speech, Ernest cut the ceremonial tape and

shortly afterwards took a ride round the track behind a model of a South African railways 4-8-4+4-8-4 Garrett built and driven by Steve Eaton. A number of members of the **National 2 1/2in. Gauge Association** attended with locomotives and many of the onlookers were amazed at how well these small engines performed. Could it be anything more than a coincidence that a new member recently joined is already the owner of a 2 1/2in. gauge locomotive?

The regular quarterly meeting of the **Midland Federation of Model Engineers** was attended by 12 delegates from associated societies; the fact that there was nothing controversial to report reflects favourably on how well the member societies run their affairs. This year's annual Federation rally was hosted by **Sutton Coldfield MES** in late June and was a well-attended and enjoyable event; next year it will be held at Burton on Trent. The annual Town and Country Festival at Stoneleigh is always well supported by the Federation at which a number of associated societies also put on displays.

The **Gauge 1 MRA** continues to attract new members which in turn has led to the formation of yet more local groups. Now that there are 17 British groups there should be a group within reasonable distance of most parts of Great Britain. There are also no fewer than 7 overseas co-ordinators taking care of association matters in other countries indicating without doubt that the interest is worldwide. The latest copy of the association Newsletter has a number of articles about visits to Gauge 1 meetings on the continent. Visits to these events is facilitated by the ease of transporting models in this gauge when compared with manhandling the larger scale locomotives. Proving itself a worthwhile investment, the association's new layout has seen several outings and for a new project has been remarkably free from problems.

Bob Breeze, member of **City of Oxford SME**, decided it was time to smarten the place up a bit and single-handedly has painted the station, carriage shed and fences as well the rolling stock for the raised track. The latter is now in an appropriate shade of Oxford Blue with CPMR lettered in yellow. While it goes almost without saying that the society is very grateful to him for all his efforts, all the fresh paintwork makes the upholstered seats on the rolling

stock look rather weary in comparison. An appeal has therefore been made for anyone in the club with experience of upholstering to come forward to help renovate them. Discussions with the local authority concerning the possibility of building a clubhouse in the vicinity of the track seem to have come to a halt with rejection of the club's request. Aware that there is some sympathy with their proposal within the local authority, members are still hoping that the decision can be reversed.

World News

Canada

An important milestone in the construction of the **Ottawa Valley LS&ME** raised track occurred in late August with the installation of the 200th support post. Although at one stage some doubt was expressed as to the popularity of the track and discussion as to whether building one was worth the effort, it has engendered considerable enthusiasm and is already in regular use. Even with the installation of this landmark 2000 ties (sleepers) and 2000ft. of rail remain to be laid, so there's still plenty for members to do. With any luck, a reasonable winter (and a following wind) the track should be ready for full operation in the spring.

New Zealand

An interesting article appears in *The Conrod* from **Otago MES** concerning a new railway in Australia to be built from Alice Springs to Darwin and the massive effort involved in doing so. A joint private and government enterprise, it is a tremendous project aimed at transporting heavy freight across very difficult terrain to a new container port at Darwin, thus cutting down the sea journey time to a number of countries. At present railways terminate at Alice Springs. As well as moving something like 5000 tons of material a day, the construction will involve building two special factories just to make the concrete sleepers, of which some 2,000,000 will be needed. As far as we can ascertain there appear to be no plans to operating steam locomotives or even steam specials over what will doubtless be a very picturesque line. Most societies now have groups that meet mid-week and which are known by various names, mostly humorous, some complimentary and others less so. The Otago group are known as the Thursday Tilers and as a break from their toil on behalf of the society they organ-

ised a mid-year get-together in August at a local hostelry where there was a chance to relax, enjoy the laid-on refreshments and have a nice long natter.

Holland

The latest copy of *De Model Bouwer* contains articles about a number of open days held during the summer. These include an event at **Stoomgroep West Zuiderpark** where there is a large 7 1/4in. gauge railway fully equipped with signal box and signalling system, a covered station and numerous sidings. A mixed turnout of standard and narrow gauge locomotives was accompanied by a display of models and owners of some road vehicles took advantage of the facilities available for their use. With about 70 societies catering for various aspects of the hobby it is evident that model making and model engineering are very popular in Holland and we know that a number of British enthusiasts take their locomotives across to some of the many events organised there.

France

Model Engineering also thrives in France and we have received details of the next annual **Steam Fair of Normandy** to be held on 17/18 May 2003 at Athis de L'Orne. The event is very popular with British visitors, no doubt partly because of the availability of cheap short stay fares on the ferries. Athis de L'Orne is within easy driving distance of Caen and the hospitality is second to none. For those wishing to take advantage of it, food and accommodation is provided free by courtesy of the local Holiday Committee, if required camping and caravanning facilities are also free, and all models are protected by complete security surveillance. The operating arrangements include a track for 5 and 7 1/4in. gauge models, lots of space for running model road vehicles and a 5 acre lake for radio controlled boats. An exhibition is included for which models are always welcome; compressed air is available for those who need it, and part built models are gladly received. Although this notification is fairly early, readers who propose to attend may prefer to make early arrangements. Further information and an application form (which includes a section for details of food and accommodation required) is available from organiser Georges Droulon, 16 Rue de la Garenne, 61100 Saint Georges des Groseillers, France; tel/fax: 00-33-2-33-96-19-73.

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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.

NOVEMBER

- 15 **Vale of Aylesbury MES. Annual Dinner.** Contact Clive Ellam: 01296-623433.
15 **Rochdale SMEE. Auction.** Contact Mike Foster: 01706-360849.
15 **Romford MEC. Photo Talk.** Contact Colin Hunt: 01708-709302.
15 **Romney Marsh MES. Video Evening.** Contact John Wimble: 01797-362295.
15 **Steam LS of Victoria. Gathering.** Contact Graham Plaskett: (03) 9750-5022.
16 **Erewash Valley MES. Steaming Day.** Contact Jim Matthews: 01332-705259.
16 **Steam LS of Victoria. Club Run, Marcus Traylen Trophy & Spit Roast.** Contact Graham Plaskett: (03) 9750-5022.
16 **York City & DSME. Ronald Redman: Narrow Gauge Railways.** Contact Ken Bateman: 01904-421445.
17 **Frimley & Ascot L.C. Club Run.** Contact Bob Dowman: 01252-835042.
17 **N. W. Leicester SME. Running Sunday.** Contact John Elliott: 01455-847040.
17 **St. Albans DMES. Track Meeting.** Contact Roy Verden: 01923-220590.
17 **Surrey SME. Members' Steam-Up.** Contact John Cook: 020-8397-3932.
17 **York City & DSME. Running Day.** Contact Ken Bateman: 01904-421445.
18 **Lancaster and Morecambe MES. J. Fish: Mechanical Fair Organs.** Contact Harry Carr: 01524-411956.
18 **Peterborough SME. Michael Porter: Garden Railways.** Contact Tony Meek: 01778-345142.
19 **Chesterfield MES. S. Gay: Slides, Glorious Devon.** Contact Mike Rhodes: 01623-648676.
19 **Nottingham SMEE. Stan Nipper: Being a Savage's 'Little Samson' Guinea Pig.** Contact Graham Davenport: 0115-8496703.
19 **Romney Marsh MES. Alan Crotty: European & South African Steam.** Contact John Wimble: 01797-362295.
19 **Surrey SME. Brian Harris DFC: The Stirling Bomber Project.** Contact John Cook: 020-8397-3932.
19 **Taunton ME. Auction.** Contact Don Martin: 01460-63162.
19 **West Wiltshire SME. John Laverick: Latest Developments in Kennet & Avon Canal Restoration Scene.** Contact R. Nev. Boulton: 01380-828101.
20 **Bournemouth DSME. Talk on Theatre Organs.** Contact Mike Baker: 01202-383653.
20 **Bristol SMEE. Joe Nemeth: Scaleway Signals.** Contact Trevor Chambers: 01454-415085.
20 **Chingford DMEC. Members 10 Minute Video Night.** Contact Martin Masterson: 0208-989-5552.
20 **Historical MRS (North West Area). Don Rowland: Wagons in Wartime.** Contact David Goodwin: 01224-880018.
20 **Leeds SMEE. Jumble Sale.** Contact Edwin Hughes: 01757-707454.
20 **MELSA. Meeting.** Contact Graham Chadbone: 07-4121-4341.
21 **Cardiff MES. Cyril Chandler: Film Night.** Contact Trevor Jenkins: 029-20755568.
21 **East Somerset SMEE. Richard Ellam: Victorian Science & Technology.** Contact Cliff Almond: 01749-344735.
21 **Frimley & Ascot L.C. AGM.** Contact Bob Dowman: 01252-835042.
21 **Leyland SME. Friends Not Forgotten Night.** Contact Alan Wilson: 01942-715072.
21 **Reading SME. Alan Davidson: 'Here & There' and the Railways.** Contact Graham Bustin: 01189-615450.
21 **Rugby MES. Chris Parrott: Cliff Railways.** Contact David Eadon: 01788-576956.
21 **Sutton MEC. Auction.** Contact Mike Dean: 0208-657-5401.
22 **Brighton & Hove SMLE. AGM.** Contact Mick Funnell: 01323-892042.
22 **Colchester SMEE. G. Austin: American Railways Past and Present.** Contact L. G. Hammond: 01376-511686.
23 **Chesterfield MES. Running Day.** Contact Mike Rhodes: 01623-648676.
23 **Historical MRS (Bristol Area). Arthur Turner: Swiss Railway Wonderland, Geneva - Graubunden.** Contact Gerry Nichols: 0117-973-1862.

- 23 **Hornsby ME. Family Day.** Contact Ted Gray: 9484-7583.
24 **Great Western Soc. (Didcot Railway Centre). Steamday.** Contact Jeanette Howse: 01235-817200.
24 **MELSA. Sunday in the Park.** Contact Graham Chadbone: 07-4121-4341.
24 **Steam LS of Victoria. Working Bee & Barbecue.** Contact Graham Plaskett: (03) 9750-5022.
24 **Woking MRS. Open Day.** Contact Ronald Dewar: 01932-343331.
25 **Bedford MES. Our Tracks.** Contact Ted Jolliffe: 01234-327791.
25 **Hornsby ME. Meeting.** Contact Ted Gray: 9484-7583.
26 **Basingstoke DMES. AGM.** Contact Ian Shanks: 01420-561741.
26 **Chelmsford SME. Meeting.** Contact D. Blake: 01376-324205.
26 **Historical MRS (E. Lancashire/N. Manchester Group). Peter Bunce: 4mm Scale Developments at Dukinfield Wagon Works.** Contact John Sykes: 01706-823989.
26 **Sutton Coldfield MES. John Moxham: Chapelon - The Greatest (French) Engineer.** Contact Roger Timings: 0121-308-5875.
26 **Wigan DMES. Bits & Pieces.** Contact John Chamberlain: 01744-882255.
27 **Chingford DMEC. Keith Brunt: 'London Transport Station Signalling'.** Contact Martin Masterson: 0208-989-5552.
27 **Harrow & Wembley SME. Roddy McKee: The Paddle Steamer Preservation Society.** Contact Dr. Roger Greenwood: 020-8427-2755.
27 **Historical MRS (Bedford Area). Colin Garrett: Around the World in Search of Steam.** Contact John Chamney: 01442-851214.
27 **Hull DSME. Chairman's Evening.** Contact Brian Rylance: 01482-647032.
27 **Staines SME. Jim Elliott: Film Show.** Contact Mike Kingham: 01932-788793.
27 **Teesside Small Gauge Rly. Meeting.** Contact Bill Foster: 01642-710198.
28 **Brighton & Hove SMLE. Workshop Evening.** Contact Mick Funnell: 01323-892042.
28 **Cardiff MES. Club Chat.** Contact Trevor Jenkins: 029-20755568.
28 **Sutton MEC. Natter Night.** Contact Mike Dean: 0208-657-5401.
28 **Worthing DSME. Bits & Pieces and Auction Pay Day.** Contact Chris Devenish: 01903-268158.
29 **Hereford SME. Video Evening.** Contact John Arrowsmith: 01432-265151.
29 **Malden DSME. Rummage Sale.** Contact John Mottram: 01483-473786.
30 **Cardiff MES. Childrens' Christmas Party.** Contact Trevor Jenkins: 029-20755568.
30 **Oxford (City of) SME. AGM.** Contact Chris Kelland: 01235-770836.
30 **York City & DSME. Bits & Pieces.** Contact Ken Bateman: 01904-421445.
30-1 **December Rand SME. Year End Function & Christmas Party.** Contact Colin Retief: (011)-763-6813.

DECEMBER

- 1 **Cardiff MES. Santa Special Day.** Contact Trevor Jenkins: 029-20755568.
1 **South Durham SME. Running Day.** Contact B. Owens: 01325-721503.
1 **Surrey SME. Members' Steam-Up.** Contact John Cook: 020-8397-3932.
1 **Teesside Small Gauge Rly. Meeting.** Contact Bill Foster: 01642-710198.
2 **Lancaster and Morecambe MES. Auction.** Contact Harry Carr: 01524-411956.
2 **Peterborough SME. Bits & Pieces.** Contact Tony Meek: 01778-345142.
3 **Romney Marsh MES. John Snell: Railways Around the World.** Contact John Wimble: 01797-362295.
3 **South Durham SME. AGM.** Contact B. Owens: 01325-721503.
3 **Stamford MES. Bits & Pieces.** Contact David Ash: 01780-751211.
3 **Surrey SME. Bits & Pieces.** Contact John Cook: 020-8397-3932.
3 **Taunton ME. Mike Johns: The Chertsey 7 1/4in. Gauge Railway.** Contact Don Martin: 01460-63162.
4 **Chingford DMEC. Bits & Pieces.** Contact Martin Masterson: 0208-989-5552.
4 **Fylde SME. Christmas Lunch.** Contact Alan Reid: 01253-882872.
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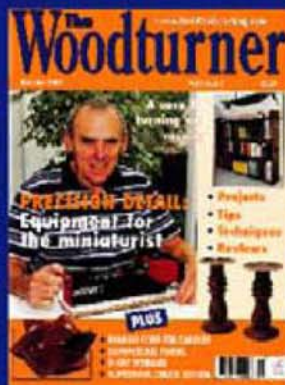
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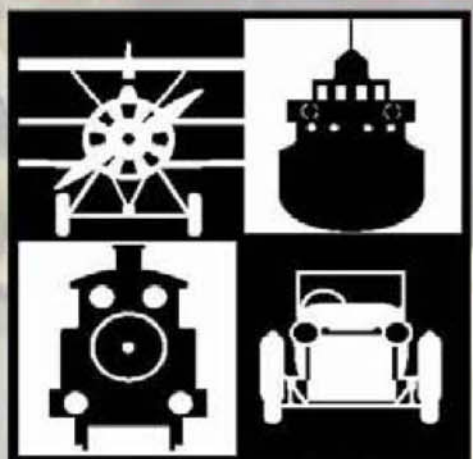
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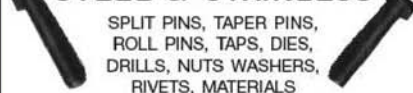
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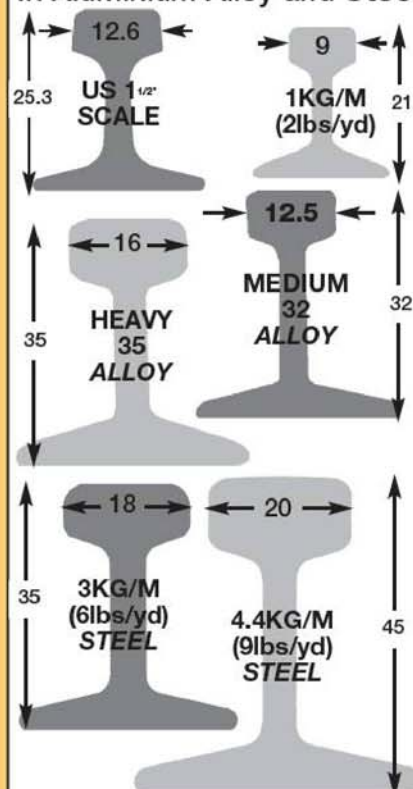


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MTFORD ML7 3 1/2" x 31"	changeheels, 3 jaw chuck and tooling	\$13.15
MTFORD SUPER 7 3/8" x 12"	changeheels, 3 jaw chuck and tooling	Choice \$250 - \$12.15
MTFORD SUPER 7 3/8" x 16"	gearbox, 3 jaw chuck and tooling	\$12.00
MTFORD SUPER 7 3/8" x 31"	changeheels, 3 jaw chuck and tooling	Choice \$14.50
MTFORD SUPER 7 3/8" x 31"	3 jaw chuck, power cross feed	Late model Choice
MTFORD SUPER 7 3/8" x 16"	gearbox, Power Cross Feed, cabinet stand, tooling	\$22.90
MTFORD SUPER 7 3/8" x 31"	(long bed) power cross feed, induction hardened bed, industrial stand and doors, grain machine	\$22.90
RAGLAN CAPSTAN 10" x 24"	6 Station Turner, out of side, collet chuck (lever) & collets, bar feed, variable speed, coolant	\$27.75
MANLY AND BROWN 1004	toolroom lathe, full screwcutting gearbox and power feeds, complete with 3 & 4 jaw chucks, collet set, slides and equipment	In very good condition \$22.50
RAYLOR SPINNING LATHE 7" x 20"	two speed model	A rare machine in fine order \$27.50
VICOR OF TOS 1 GBL 5" x 20"	gearbox, power slides, 3 MT millstock complete with fixed steady	\$14.00
DON MANY LATHES TO LIST		

MILLING MACHINES V - Vertical, H - Horizontal

BOCKOCK AND SHIPLEY 30 Horizontal Vertical Head, 30" x 6" powered table and feed, 3 ph motor, coolant	\$1,650
BOCKOCK VMSO variable speed / 30 IN table, table 21 1/4" x 6" + aluminum vice and collet chuck	\$1,950
BRIDGEPORT Series 1 - 2 HP Variable speed Rill head, powered (gearbox) table, 42" x 4"	\$2,250
BRIDGEPORT Belt head 2" speed (short motor) head, Rill powered head, variable speed 42" x 6" table	Very nice \$2,250
CENTEC 28 Horizontal, 1" arbor, table powered, 3 ph motor, single phase main motor	\$725
CENTEC 28 Vertical Horizontal, quill feed 2MT head, 25" x 6" table, pedestal motor	\$1,450
ELLIOT DONHAM mini lathe very nice machine, complete with collet and chuck (power down head)	\$2,250
ELLIOT 30" OM MILL 3 Motor, speed quill universal lathe 28 7/8" powered table	Just in \$1,500
ELLIOT TURBIT M & L 160-10 speed 70-3000 gpm, table 45" x 30" (powered)	\$1,500
EMCO F12 Vertical 6 speed quill feed head 2 MT, powered 24" x 6" table, full coolant tray and cabinet stand	3 phase and does not like a converter so only Now \$1,950
HARRISON horizontal, 31" x 6" powered table	\$625
HARRISON HV 30 IN table head & chuck, 30" x 6" table/powered	\$1,950
HARRISON VERTICAL 30 IN table head & chuck, 30" x 6" table/powered	\$1,950
HOBART M & L 40 for a hobbyman with metric graduations	\$1,950
SAGAN VERTICAL MILL 6 Motor table, 2 speed motor, table and inductor 175-50000 gpm, cabinet stand	\$2,950
SPF RF30, milling/drill machine complete with accessories	New \$795
TOM SENIOR M1 horizontal, 25" x 6" powered table, 1" arbor	\$575
TOM SENIOR M1 Vln, 25" x 6", 2 motor, table, 1" arbor	Selection \$1,200 - \$1,450
TOM SENIOR S1 TYPE 2 motor table quill feed motorized head, 28" x 6 1/2" table / rise and fall, coolant	\$2250
TOM SENIOR ELT MAJOR, 2 motor table quill feed head, powered 31" x 6 1/2" table in extremely nice condition	\$3,200
TOM SENIOR vertical turret mill 40 INCH 64" x 30" table, power all ways	Please Rto view \$1,650
WICKOFF AP6 40 inch horizontal 30 IN table head, power all ways	\$1,650

DRILLS

ANILGUA 0/1 25/25" Radial drill speeds (ft) 100-2500 RPM	Just in	\$1,425
ASUGRTH 14-54 001 M40 (5mp Radial Drill)	Immediate coming in	\$3,590
FOBCO 1/2" Bench, lifting table		\$325
FOBCO 1/2" Pedestal-drill lifting table		\$345
MEDDINGS 1/2" pedestal drill		\$245
MEDDINGS 2 Motor taper pedestal drills	C choice	\$275
MEDDINGS MP2 10 Speed 2MT Bench 240 volts drill		\$350
MEDDINGS MP5 10 speed 2MT pedestal drill, table rack		\$375
POLLARD CDRONA Pedestal 1/2" 9/16" nose	From	\$180
SUP HOP 600 1/2" 2MT 9/16" nose, table operated by rack, speeds, (30) 100 - 3000 rpm	New	\$175
STARTRITE MEFCURY 1/2" 4 speed bench drill		\$225
STARTRITE MEFCURY 1/2" pedestal drill, 240 volts	As New	\$300
WARCO 3MT Pedestal 2 geared drill, speeds: 150-2000rpm, table operated by rack		\$440

GRINDING / BUFFING

CLARKSON MK1 Tool and cutter grinder	80 10 1400
JONES AND SHIPMAN S40 Surface Grinder Magnetic Chuck	Ex College Seen no work 11000
MILFORD 12" Pedestal Grinder	13000
R.H.H. Buffing Machine, pedestal model Buffalo	12000
VICORIOT Grinder, pedestal model	1145
VICORIOT Buffing, pedestal model	Each 1000

MISCELLANEOUS / FABRICATION MACHINERY

OXFORD ARC welders	Choice
DUNMORE toolpost grinder / Burford size or similar	£325
CARL ZEISS p1 projection dividing head	In excellent condition £625
BCA 12" home-made / vertical rotary table	Very Nice \$425

Centres of slips, height gauges, squares, straight edges, micrometers, cubes, angle plates, scales, weights (pols) and measuring/marking tools	Just in
FLAMEFAST DS 130 canvas chip forge	£24
FLAMEFAST DS 160 hearth	£16
Bridgeport slotting head	£75
MARLCO broaching press	£42
KEMFOMAT 230 kg welder	£40
TRANSARC 150 + Transjet 1501	£42
STARTRITE 16 V 10 vertical bandsaw complete with welder attachment	£165
JONES AND SHIPMAN 4" x 24" bench centres	£24
TOM SENIOR slotting head	£45
STARTRITE 16 x 5 Woodworking / non ferrous bandsaw	£45
DIAMOND hot saw, variable speed	£34
RUH DT 125 Feltaw, variable speed	£34
SMITH AND BROWN / CLARKSON HS-HD toggle presses	Each £120 / £27
AFRANO 2MT rock milling spindle	As new £7
MYFORD TRI-Lever Attachment	£24
VERICUT Clocks, Long/Short/Metric and Imperial models	As new
FLAMEFAST LD300 Soldering Iron Stand	£7
GRANITE 18" x 12" Surface Plate	£14
VEROSHEAR Notcher	Just in
TRIUMPH Sumner 4 Jaw Chuck	£24
TRIUMPH FACE PLATE D/H	£7
VANCO Linisher	Very Nice £24
ESEWAY hardness Tester Type R	£42
JONES AND SHIPMAN Broaching Press + Stand	£37
CLARKSON M1 Radius Grinder Attachment	£42
ABB Inverter 4 1/2 hp motor, wired up	£25
FLAMEFAST 16" sliding bench	£13
SP 7" banding, horizontal & coolant	New £27
WELLSAW hacksaw	Choice £24
BRIDGEPORT CHERRY high speed drilling head	£72
MYFORD sliding head	£39
STARTRITE ad15d cut off saw	£25
DUPLEX d29 footpost grinder	£24
EDWARDS cast iron set rolls	£32
BOXFORD (Imperial only) thread dial indicator	£5
HOFFMAN ROTARY TABLES	Selection
AEWOOD 6" wheelset machine vice	Each £24
BURNERD, D13 6 jaw Gripsu chuck	£24
VANCO, 1" Sinter / vertical + extractor	£42
BURNERD, D14 lower collet chuck + collets	£42
BURNERD, D10 lower collet chuck + collets	£42
VERTIX Gliding head	New £24
VERTIX 6" - 6" - 10" rotary tables	New From £12
BOXFORD Turn attachment 4 1/2" + quantity of drill chucks	£22
MYFORD M/L / Super 7 rear tool post	£42
MYFORD 2545 rear tool post	New £42
MYFORD Vertical slide / fixed type (copy)	£27
OLIVER - ADRIAN FILER	New £42
LOCKWOOD quad headed 2nd Die Holder	New £42
LOCKWOOD quad headed 2nd Die Holder	New £42
LOCKWOOD Test Bar / 2nd Bored	New £3
LOCKWOOD Test Bar / 3rd Bored	New £4
MAGNETIC chuck - 18" x 6" fine pole	Never used £32
TOM SENIOR Model E pedestal stand	£15
BRIND tool and cutter grinder stand	£17
HARDINGE Clayton type footpost	£17
50 INT tooling, selection	£27
STARTRITE 302 woodworking band saw	Just in
STARTRITE 14-3-5 woodworking band saw	£77
ALCOA OF 0001 Rapid Melting Furnace	£30
GAERO BF 620-2, 24" Box and Fan general use folder	£32
MYFORD Burned Gripsu 3 Jaw Chucks	Bored £25
COLCHESTER / HARRISON D13 Burned 4 Jaw 8" light body independent chucks	Bored £12
RUH 4" Leisher / Vertical (Build in Extension)	£27
KILNS various	£200 / £42
MICROMETERS and associated measuring tools	£42 packaged or new
POTTERY WHEELS, limes and associated equipment	Just in China
SPECAC Powder type press	New £24
HARRISON LB Master Grader	As is £24
HARRISON LB Tailstock	£24
NEW FROM NEW ZEALAND - Machine vice, 55mm. Jawed precision miniature type ideal for vertical slides and smaller milling machines	£37
SP 1 TON MOBILE CRANE Manufactured 2000	As new £27
MITUTOYO grade A set of slips	£24
MARLCO KNULLER S (clamp type)	£24
F.J. EDWARDS 24" hole cutter	£72
Large bench vice	£32
LINK 15 ton vehicle crane + top hat	£62
MITUTOYO 103-913 metric set micrometers	£27
NORTON / EDWARDS arbor presses	£75 / £14
ALJAX 6" hacksaw	£42
SURFACE plates from 12" x 12" to 36" x 36"	Very nice items £24
WEEB 1 1/2 ton mobile garage crane, late blue colour	£12
ELLIOTT 550 STURGEON vertical head	One off (rare) £52
RUH Inisher 4" wide belt, pedestal	£34
FEEL STOCK just arrived	to callers only
ELLIOT U1 / U2 Slotting Head	£47
SWAGE BLOCKS	£125 / £14
J & S Universal grinding vice	Choice £275 / £26
BOX TABLES: Grade A and B, many sizes	£40 - £15
SLPS / GAUKES Metric / Imperial, New Sets, £7 / £1 piece	£210 / £14
HORIZONTAL METAL BANDSAW 6" x 4 1/2" capacity	New £17
COLCHESTER STUDENT / MASTER Round head, faceplates, small / large	£50 - £88
QUALTERS AND SMITH 6" Hacksaw	£34
Bored Heads 2 / 3 Morse, R8 Tap, Mar. Capacity 4 1/2" round bar	New, each £2
OSORI Machine Tool Company (pair)	Special £26.65
WEIGHT GAUKES by Cheeseman, Shandon, Moore and Wright	From £24
ELLIOTT 10M Shaper, 10" stroke	£32
DE Bona	From £4
TRANSWAVE 5HP Converter	New £55
TRANSWAVE 5.5HP Converter	New £38
TRANSWAVE 12V - 117 rotary converters	From £45
CRUMPTON PARKINSON 5 1/2 HP, resilient mount, Bostford / Myford Super 7 Type motor	£45

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MODEL B-SUPER

- Swing over bed: 420mm
- Distance between centres: 500mm
- Mill drill spindle taper: MT3
- Tailstock barrel travel: 80mm
- 7 speeds – 60 - 1300 RPM
- Swing over slide: 160mm
- Spindle taper: MT3
- Draw bar: M12
- Cross slide travel: 180mm
- Motor: 3/4 HP
- Net weight: 155kg

STANDARD EQUIPMENT

- 4" 3 jaw chuck
- 2 dead centres
- 1/2 drill chuck
- Change gears
- MT3 chuck arbor



£850
Including VAT
& UK Delivery

DB8 Precision Belt Lathe

- Centre height: 105mm
- Maximum swing: 210mm
- Distance between centres: 435mm
- Spindle bore: 20mm
- Spindle taper: MT3
- Spindle speeds – 125 - 2000 RPM
- Range of metric threads: 0.4-3mm
- Range of imperial threads: 10-44tpi
- Tailstock taper: MT2
- Topslide travel: 75mm
- Crossslide travel: 110mm

- Tailstock travel: 70mm
- Motor: 3/4 HP
- Weight: 125kg

STANDARD ACCESSORIES

- 3 Jaw chuck
- 4-Way toolpost
- Lathe tools
- MT3 and MT2 steel centres
- Hardened and ground bedways
- Vee bedway
- 4 Jaw chuck
- Steady rest
- Follow rest
- Tray and splashguard



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COMET LATHE

- Swing over bed: 250mm
- Swing over cross slide: 133mm
- Distance between centres: 550mm
- Spindle bore: 19mm
- Taper in spindle nose: MT3
- Motor: 1/2 HP
- 6 speeds – 125 - 2000 RPM
- Speed range variable: 100-2500 RPM

- Net weight: 130kg
- MILL ATTACHMENT
- Spindle taper MT3
- Head travel: 215mm
- Speed variable
- Range: 0-3,000 RPM
- Motor: 1/2 HP
- Net weight: 45kg

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