

# MODEL ENGINEER

Vol. 190 No. 4187

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VOLUME 189

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INSIDE

•  
COMPLETE  
CLASSIFIED  
COMPILATION

## WORKING INJECTORS

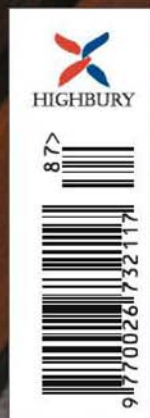
Fascinating photographs

## ENGINE INDICATORS

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*REVIEWED IN MODEL ENGINEER WORKSHOP  
ISSUE 87 DECEMBER*

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### On the cover ...

Les Chenery's model Aeronca E113 aero  
engine runs as well as it looks.  
The 1930s prototype developed 36hp,  
ran at 2,500rpm and weighed 120lb.  
with overhead valve cylinders  
fitted to the crankcase of  
an earlier model E107 engine  
to increase its output power.  
Aeronca engines were manufactured  
in England under license by JAP  
in a slightly modified form.  
Les Chenery's 36cc model has cylinders  
of 1 1/8in. bore x 1 1/8in. stroke  
and runs at 2,800rpm with a  
20in. dia. x 10in. pitch propeller.  
Turn to page 66 in this issue for the start  
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(Photograph by Mike Chrisp)

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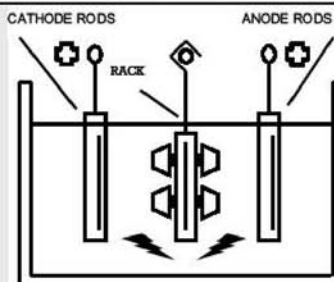
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# SMOKE RINGS

With the Editors

## The Model Engineer Exhibition

I very much hope that readers will indulge me this space to say how pleased we are that the 72nd Model Engineer Exhibition, recently presented at the superbly appointed Sandown Park Exhibition Centre, was such a success. We admit to a few administrative problems, for which we apologise and hope to have resolved for future events — in fact, a meeting has been convened tomorrow (as these words are being prepared) for the very purpose of reviewing the Exhibition with the aim of ensuring that we can build on our successes and eliminate the problems.

It was my privilege and pleasure to present the Medals and Trophies at the Award Ceremony on the final afternoon of the Exhibition. This gave me an ideal opportunity to express our appreciation of their efforts to those who made the exhibition the success it undoubtedly was. I would like to publish our thanks more widely through the medium of these columns.

First, we were delighted with the superb quality, wide range and good number of models brought to the Exhibition for Competition and display. Without the generous participation of exhibitors and competitors, some of whom travelled a considerable distance to do so, the event would have been very much the poorer.

We are also indebted to Highbury Nexus Limited for their sponsorship of the Exhibition. We must remember that no matter how important we consider *Model Engineer* and its associated Exhibition, these are but a relatively small part of the Highbury Nexus portfolio and business plan. We are grateful to members of the Events, Sales, Advertising and Marketing teams for their contribution to the success of the event.

With models in Competition of such quality and variety, the Exhibition requires a team of expert Judges to assess, cogitate and deliberate in order to reach fair and uniform decisions as to which should be awarded Medals and/or Trophies. During the very long life of the Model Engineer Exhibition, comprehensive and detailed marking schemes have evolved by which Competition models may be judged. That said, we still need the experts to actually do the job, people who are prepared not only to put their heads over the parapet, as it were, but also prepared to contribute to these pages with their views and opinions. We are indebted to our Chief Judge and his team for discharging their work with skill and patience.

On arrival, models have to be received and booked in to the system so that there is a record of their presence at the Exhibition. While the job itself may not be arduous, the circumstances under which it is carried out are far from favourable. We therefore wish to express our thanks to those who volunteered for this job.

While this is going on, our team of Stewards are fetching and carrying, unpacking and placing, helping with problems and generally maintaining an air of authority against all odds. These same Stewards attend throughout the Exhibition to keep an eye on the exhibits, to answer questions from visitors and, at the end of the exhibition to repack the models and ensure their safe departure from the venue. Not only all that but this year



some of the models had to be moved from where they had first been set up to another, more appropriate location, a task demanding extreme care and expertise. We are very grateful for the much appreciated efforts of our Chief Steward and his team of stalwarts.

We were of course happy to see so many of our friends from the trade and to have the opportunity for a brief chat during the Exhibition. We very much hope that they too had a good show.

With eighteen clubs, societies and organisations present, the Exhibition enjoyed first class support from this quarter this year. The range of work on display was excellent and the presentation of the club stands quite splendid. Our thanks are due to club members who gave freely of their time to set up, act as stewards for this event and break down at its close, and we hope that they too enjoyed being part of the Exhibition.

For our sponsors to allow the event to continue, it must be financially successful. It was therefore a great pleasure (and relief) to be present at an Exhibition which attracted so many visitors despite the extremely inclement weather. In that particular respect, I was reminded of having to

queue for three hours in the snow on the pedway at Wembley Conference Centre many years ago, and of wondering where to park the car on visits to Seymour Hall before the days of Wembley.

So, to everyone who made a contribution to the undoubted success of the 72nd Model Engineer Exhibition at Sandown Park Exhibition Centre, please accept our sincere and heartfelt thanks for your efforts without which we surely would not have had an event.

## Good news, bad news

The bad news is that while it may only be 10p, readers will have noticed an increase in the cover price of this issue. We regret the increase and very much hope that readers will bear with us.

The good news is that we have been assured that there are no plans to increase the cover price throughout 2003 and that the additional income is to be used to reinstate the eight pages by which the magazine has been thinner for the last two years.

This actually means that from this issue the price per page has fallen from 4.2p (£2.20 for 52 pages) to 3.8p (£2.30 for 60 pages) which is close on a 10% reduction in price!

## CHUCK the MUDDLE ENGINEER

by B. TERRY ASPIN



# POST BAG

## Mils: correction

SIRS, - Oh dear, it appears that the gremlins have struck again. My recent letter regarding mils contains a very substantial error. (M.E. 4185, 27 December 2002).

While browsing through my copy of *Model Engineer* on Christmas afternoon, my clever clogs son-in-law saw my letter and because he was bored decided to calculate the angle of a Mil on his mobile phone! Lo and behold 17.7778 minutes is wrong. A circle contains 360 degrees which, if divided by 6400 will give an angle of 3.375 minutes. My only saving grace is that the figures quoted were straight from the book and did not originate from me.

I felt I should submit this correction to pre-empt the hundreds of irate model engineers around the world who at this very moment must be writing angry letters to our editor.

This proves again the old saying "Check your facts before putting your foot in it!" Humble apologies. Ken Stoot, Mid Glamorgan.

## Fire hole doors

SIRS, - In his excellent article on the construction of *Saint Christopher* (M.E. 4178, 20 September 2002, p280) Keith Wilson strongly implies that LBSC (Curly) had not thought of a cure for the jamming of firehole doors when small pieces of coal become wedged in the slot of the bottom runner.

Curly was well aware of the need for such a slot and in M.E. 2999, 13 November 1958 he not only describes the need for it but also describes the runner complete with slot and also gives a drawing of it. This is one of the articles Curly wrote in his construction series of the 0-6-0 GWR 5700 series tank engine under the name *Pansy*.

Curly was not known for passing off lightly any aspersions cast on his knowledge or writing. He would have undoubtedly responded to Keith's article in firm tones with acid comment. In fact he would probably called down the wrath of the gods upon Keith's head. However, Curly has been dead for some thirty years or so and has, it can only be surmised, been driving the heavenly *Astral Belle* that he longed for while here on earth.

In such circumstances one would expect Keith to be safe from Curly's response but it was not to be so. In Keith's very next article (M.E. 4179, 4 October 2002) Keith describes the

disaster that occurred when not one but two lightning strikes,

straight from heaven above, hit him right in the computer used in writing his articles. 'Nuff said!

I have built Curly's *Pansy* and very good it is too, still standing comparison with more recent designs by others. I consider Curly pioneered the methods and many other aspects of the construction and use of small locomotives.

Nevertheless things have moved on with people such as Martin Evans, Don Young and Keith Wilson among others, all of whom have evolved and developed small locomotive construction to the point where we amateur constructors are spoilt for choice between the really excellent designs available.

Long may it continue.

John Freeborn, S. W. London.

## Extra time!

SIRS, - Following your editorial appeal in M.E. 4184, 13 December 2002 for anyone who could extend a day to more than 24 hours, I have achieved this feat.

Taking a convenient time period, say 21 June (the longest day) to midnight of the publication date of M.E. 4185 (27 December 2002), I have successfully managed to extend every day by an average of nearly 19 seconds.

The exact method I use requires a level of comprehension that may be beyond readers of *Model Engineer*. If you index my name to *Post Bag* and the value of 'g' you will find three references. I am reluctant to expand on the science and mathematics used unless specifically requested to do so with incentives such as a workable quantity of bitter beer, or I might accept a set of Scott engine castings for my son!

I can extend the average length of day to anyone who comes here. All my family benefit from it. The only condition is to avoid arrival here near ancient time markers such as Lady Day or the Spring Equinox. In short: "Beware of the ides of March".

PS. I cannot see the Eiffel Tower due to snow fall at 11h 25 Saturday 03/01/2003.

Ron Wallman,  
Frémécourt, France.

## Drawings in colour

SIRS, - As a builder or 'end user' my worst fears have been realised over the debate on coloured drawings. So far the correspondence on this subject cannot see the wood for the trees. This debate could equally apply to the revolting coloured

paper now used for this magazine, making reading difficult and under artificial light, almost impossible.

If a prospective builder does not like coloured drawings, he can put them on a photocopier or scanner and can then have them in wonderful tones of grey. This would not apply to those who have the misfortune to be colour blind. Please remember that a prospective builder requires accuracy, what colour the lines are come a poor second. Should a designer decide to use his ink cartridges trying to make a drawing easier to understand then he should be applauded. For those who prefer tradition perhaps blue prints could be re-introduced, thus keeping all the readers happy.

I am sure that there are better things to discuss in *Post Bag* than what pretty colours drawings should be. All that should be required is that a drawing should be accurate and reasonably easy to understand. 'Nuff said!

John W. Berry, Norfolk.

(This topic has been discussed exhaustively and correspondence is now closed — Ed.)

## Meals on wheels and 'Sentinel'

SIRS, - P. B. Slater's mention of heating tins of soup on the outlet chimney of one of the small furnaces on the Rolls Royce hardening plant in Derby (M.E. 4178, 20 September 2002) calls to mind a similar method we used for heating food on rail in the 1950s.

To gain experience with the concept of fixed consist trains, such as the Midland Pullman and the High Speed Trains, British Railways at Derby produced the 'Paxman Two Car Set'. This consisted of two cars from the LMS Euston-Watford electric stock, possibly 40 years old. They were taken on to works, the seats were removed and a 900hp Paxman diesel engine and generator were hung under the floor from strengthened underframes of both vehicles. The train was run from Derby to Carlisle and back for some months, running up a total of 30,000 miles, if I recall correctly.

The route was via Leeds, stopping at Leeds Holbeck to pick up a crew passed for the road to Carlisle. With a nominal 1800hp for two vehicles, and even with the power to the auxiliaries subtracted, the power put down on the track was substantial, so that unprecedented speeds of 70mph were achieved on the climb from Skipton.

But to come to point, the engines exhausted via pipes through the

vehicles to the roofs. To these pipes, using insulating tape, we strapped tins of soup, baked beans, etc., which were nicely heated ready for consumption during the lay-over at Carlisle. No holes were put in the tins, so perhaps we were fortunate in that we did not experience any exploding tins!

David R. Richards tells us of his days at the Sentinel Works in the late 1940s, (M.E. 4182, 15 November 2002). My brief involvement with the Company came in 1964, after the firm had been taken over by Rolls Royce. At that time they were building diesel locomotives for use in steel works and were having problems with broken axles. A broken axle under a locomotive coupled to a ladle of molten metal was a distinct embarrassment. Rolls Royce appealed to British Rail at Derby for assistance with ultrasonic flaw detection of the axles.

It may not be generally known, but in those days that sort of thing did occur from time to time between local companies. I went across with one of our British Rail produced ultrasonic angle probes to demonstrate its use. It seemed they had used a commercially produced final drive unit of some 6in. diameter bore designed for use under railcars. As a result they had used axle steel with a tensile strength much higher than the 45 ton tensile low alloy steel BR used on its 9in. diameter axles which was notch sensitive and susceptible to cracking.

What I found intriguing about the firm was that, apart from the change to diesel locomotives, they had also diversified into the manufacture of large hydraulic drawbenches for the production of large section bright drawn steel, and also automatic vending machines.

Dennis Monk, Derby.

## Straw splitter

SIRS, - I am a milliner and a colleague showed me the pictures accompanying Mr. Coulson's letter (M.E. 4181, 1 November 2002) because I had asked him whether something similar could be made.

I believe the items pictured are straw splitters. The pictures provided appear to be identical to line drawings of straw splitters in a book on the hat industry in Luton, Bedfordshire; the book is produced by the Luton Museum Service.

Straw hats used to be made of plaited straw. In the 19th century efforts were made in the UK to emulate the very fine straws imported from Italy. In order to do this each 'blade' of straw was split into strips

before-plaiting. The protruding snout was put into the hollow centre of the straw and then pushed downwards to provide even strips. The number of strips used and their width would then influence the fineness of the plait produced.

Catharine V. White (by e-mail).

### Hunslet identification

SIRS, - In *M.E.* 4180, 18 October 2002, Roger Backhouse wrote an article on the South Tynedale Railway and showed a photograph of a Hunslet to which he attributed the title *Chaka's Kraal*. This, I'm afraid, is incorrect as the locomotive in the photograph is in fact Hunslet No. 1859 of 1937, which was purchased by the South Tynedale Railway in December 1997.

*Chaka's Kraal* is at the railway and is Hunslet No. 2075 of 1940 and is, indeed, privately owned. I am not sure how he managed to mix these up as 2075 is in working condition and 1859 is still basically as it arrived from South Africa some years ago.

Brian Gent, Hon. Secretary,  
Narrow Gauge Railway Society.

### Lubricating Oil

SIRS, - Neil Heppenstall wonders (*M.E.* 4186, 10 January 2003) how multigrade motor oils compare with straight SAE grades.

In simple terms, an SAE 10W-40 oil has the viscosity of a cold straight SAE10 oil when cold and that of a hot straight SAE40 oil when hot. This is brought about by viscosity improvers, which are spiral molecules that open out into long strings when heated, and increase the viscosity relative to that of the straight oil when at temperature. The unmodified oil base has to be SAE 10, and so it is very thin: only when hot does it achieve a viscosity similar to a hot SAE 40 oil.

The low viscosity when cold allows easier cold starting, while the (relatively) higher viscosity at temperature ensures that the oil film remains thick enough not to break down at an engine running temperature of about 90deg. Celsius.

Multigrade oils should *never* be used on cold running machinery, such as a lathe or gearbox, as they are too thin when cold, so the oil runs out, and the lubricating film may not be maintained. A fellow model engineer of my acquaintance recently found this out when his lathe drive pulley seized to the spindle when in backgear.

The SAE 30 oils sold for horticultural machinery and lawnmowers are straight oils, designed to

maintain sufficient lubrication when hot. Multigrade oils can be used on this machinery, although cold starting is rarely a problem here. But don't use them on your lathe!

Gear oils, which are not multigrade and are designed to run no more than warm, may be suitable if of the right viscosity index, generally about SAE 30. Gear oils have also to stand pressure, which squeezes the oil film from between the teeth, as well as the shear forces on the film in the bearings.

The right oils are often available in smaller quantities from machinery dealers, or at model engineering shows, so you shouldn't have to buy a 25 litre drum.

Tony Finn,  
East Riding of Yorkshire.

### CAD Printout

SIRS, - I think I can offer Mr. Chris Smith a solution to his problem of printing large drawings (*M.E.* 4182, 15 November 2002). He should invest in a wide carriage dot matrix printer, available second-hand for a song! The reason these printers are still produced is that they alone can handle the continuous print stationery that we used to have to tolerate from so many account sources in the early computing years.

My own printer is a Star LC24/15 colour model, which means that it handles paper sheets 16<sup>5</sup>/<sub>8</sub>in. wide and 23<sup>1</sup>/<sub>4</sub>in. long, i.e. A2 size. Because of the way the print system is configured I have to accept a maximum print width of 13.6in. or, in other words, a margin of 1<sup>1</sup>/<sub>4</sub>in. on each side. I do understand from advertisements that a 20in. model of printer is also available, although I have never seen one. If Mr. Smith wants to assess the quality of print which my machine produces, he could turn over a few pages from his letter to page 486 where he will find the series on the Ferris Wheel clock, all of whose drawings were produced on this machine.

The world has moved on since the days of half imperial, imperial and double elephant paper sizes and even if you could find such packets of paper for sale they would probably carry a hefty premium. Settle for A2 as a substitute, four times the area of A4 paper. It is this very size that the whole world (apart from the USA) has made a standard for office work, enabling reams of paper to be sold for under 1/2p per sheet and ink-jet printers for very reasonable prices. If you depart from these standards, then you will have to be prepared to pay a lot of money for the privilege. For example,

when last I bought a packet of A2 size paper I had to pay twelve times the price for just four times the sheet area. My consolation is that a packet lasts a very long time!

D. A. G. Brown, Rutland.

### Leaf springs

SIRS, - In *M.E.* 4182, 15 Nov 2002, Mr. Duncan Webster writes regarding Tufnol springs. He mentions the possible use of polystyrene sheet for locomotive leaf springs. In my opinion this is not advisable. The first reason is that, as he mentions, polystyrene is 'thermoforming', that is it will deform any time the material is exposed to heat. In addition, the material will also 'creep' and change shape over time with exposure to any increase of heat above room temperature. Polystyrene is also prone to attack by oil or oil based solvents.

The second reason is that when exposed to oils and solvents, it may crack and lose strength. Given the proximity of locomotive springs to hot fireboxes, boilers, steam, and lubricating oils, it is not advisable to use polystyrene for them.

The terms generally used here in North America for the two main types of polymeric resins are 'thermosets' and 'thermoplastics'. The thermosets are types like Tufnol and Bakelite which can be processed and moulded with heat one time, then hold their shape. Even when subjected to high temperatures, they will hold their shape and char before deforming. However, thin sections of phenolics can be moulded slightly such as in leaf springs for model locomotives. The thermoplastics, or 'thermoforming' resins can be repeatedly heated and reprocessed into different shapes. Many commercial thermoplastic products have some proportion up to 20% of reground scrap thermoplastic in the raw resin to aid economy of manufacture. An example of this is polypropylene garbage bins which can be moulded with up to 20% reground scrap resin, such as the runners and gates from previous moulded parts.

An often overlooked material for general use as light duty flat springs

is steel packing crate banding. These steel bands hold shipping crates and boxes together and can be had by the metre free for the asking from any shipping dock. The material can usually be found in bins ready for sale to the scrap merchant. It is a pre-tempered medium carbon steel, in strips 0.7 to 1.0mm thick, from 10-15 mm wide. It can be punched, cut with snips, drilled, and welded easily but holds a set when formed and is much harder than normal mild steel. It usually has a brown or blue varnish/oxide coating which is rust resistant. This material would be excellent for locomotive springs I think, if high carbon steel is not desired due to its more difficult workability. Springs of this steel banding can be cut with normal tools, formed over a rod of suitable diameter, and fitted with no further heat treatment.

I have never understood why Tufnol came into use for model locomotive springs at all given that there are a great many medium carbon steels that would work as well and be as easy to make into springs. Considering some of the difficulties people have written about in these pages with making and forming Tufnol springs, perhaps the banding is worth a try. I have not tried it in a model locomotive, as I am building a steam roller and have previously built several stationary steam engines. However, I have used the banding many times for general and tooling spring use, with complete success.

Jeff Dayman, Ontario, Canada.

### George Churchward

SIRS, - I draw your attention to an article appearing in the *Engineering Management Journal* published by the Institution of Electrical Engineers entitled *Great Engineering Managers - George Churchward* by Alan Webb.

The first part of this account appears in the October 2002 issue of this magazine.

I feel sure that those of your readers who are interested in the history of steam locomotive design will find this article very interesting.

Philip Amos, Mosman, Australia.

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Publication is at the discretion of the Editor. The content of letters may be edited to suit the magazine style and space available. Correspondents should note that production schedules normally involve a minimum lead time of six weeks for material submitted for publication.

## COVER FEATURE

### Les Chenery

introduces his quarter scale working model of an Aeronca E113 36hp horizontally opposed engine and starts work with the crankcase.

#### ●Part 1

In America in 1930, the Aeronca aircraft company designed an engine for their small single seat aircraft, the C-2. It was a twin-cylinder, opposed side valve or L-head engine of 30hp and ran at 2,400rpm. Its weight was 113lb. and the finned sump blended with the front of the fuselage. The engine was identified as the E-107.

By 1930 there was a demand for a more powerful engine to power a small two-seater aircraft. Cylinders with overhead valves were fitted to the original crankcase increasing the horsepower to 36hp with 2,500rpm and a weight of 120lb. The engine was re-numbered E-113 and the aircraft re-named the C-3.

Aeronca engines were manufactured in England under licence by JAP. These had a re-designed rocker box and cover to accommodate two spark plugs per cylinder with two magnetos for dual ignition placed at right angles across the rear of the engine and a power increase to 40hp with 2,540rpm. But the engine had reached the end of its growth potential and was superseded by a variety of more powerful engines.

### Crankcase casting

A logical place to begin construction is with the crankcase. Clean up the casting with some small files and wet and dry emery paper. This is a tedious job and the temptation is to rush but patience is more than a virtue here for the longer the time spent on it at this stage, the better the result and whenever you look at it in the future you will not have the 'I wish I had spent a little more time on that' feeling. When you figure that you have done as much as you can, bring the casting up to a finish with a soft brass wire wheel and then a rag buff held in the lathe.

This stage may well be the best time to turn up



The author's engine on test in his workshop, running at 2,500rpm with a 20in. dia. x 10in. pitch propeller.

# AERONCA E113 AERO ENGINE in 1:4 scale

two plug gauges, one for the central hole in the nose of the casting (1.000in. dia.) and one for the ball race recesses (1.125 +0.000/-0.0015in. dia.), which will give a light drive fit. When this is all done you can start on what you have been wanting to do all along — set up the casting for machining.

All the machining operations which I have completed on this casting have been done on a Myford Super Seven Lathe with a Myford

swivelling vertical slide. When using the slide, the central clamping bolt must be very well tightened to prevent pressure from the drills and cutters from moving the table of the vertical slide some degrees out of true which, if not frequently checked, can mean trouble. Builders with a milling machine and a rotary table will no doubt find easier ways of doing the job.

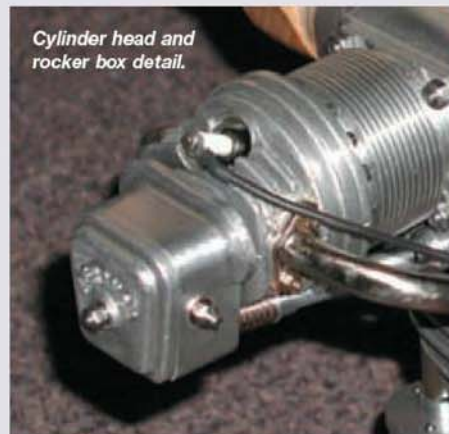
●To be continued.

#### Details of Model

1 1/8in. bore x 1 1/8in. stroke  
36cc  
2800rpm  
Propeller: 20in. dia. x 10in. pitch  
Anti-clockwise rotation (viewed from front)  
Coil ignition  
Contact breaker and distributor  
housed in dummy magneto casing  
Gear type oil pump  
Pressure relief valve set to around 40psi.

Castings and drawings for this and other engines are available from  
**Les Chenery, 18 Orchard Grove,  
Edgware, Middlesex HA8 5BH.**  
Please enclose SAE with any enquiries.

Cylinder head and rocker box detail.



The Author's engine mounted on its test stand. Careful attention to the finish of the castings makes this a most attractive power plant.



A rear view of the Author's engine to further whet the appetite of prospective builders.

MODEL ENGINEER 24 JANUARY 2003

# AERONCA E-113

## 1931

### 1:4 SCALE MODEL

*L.D. Barney*

**WIRING DIAGRAM**  
DRG N° 4.8

**LUBRICATION DIAGRAM**  
DRG N° 4.9

**GENERAL ARRANGEMENT**

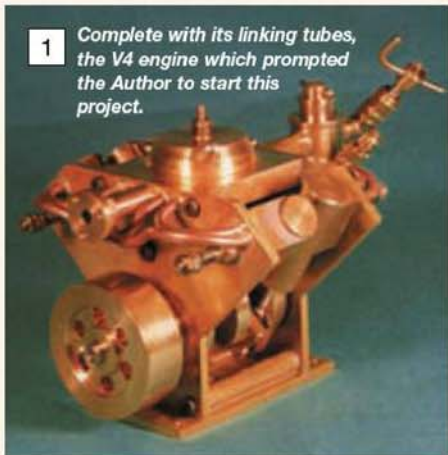
TWIN CYLINDER OPPOSED.  
BORE 1 1/2" STROKE 1 1/2" 36-16 cc.  
PROPELLOR 2.0" DIA.  
CLOCKWISE ROTATION VIEWED FROM REAR.

Sheet 1 of 9  
7/4 2000

| RAWING N° | DISCUSSION            | SHEET N° |
|-----------|-----------------------|----------|
| 1         | CRANKCASE             | 9        |
| 2         | CRANKSHAFT BLANK      | 3        |
| 3         | CRANKSHAFT            | 3        |
| 4         | PROPELLOR HUB         | 3        |
| 5         | HUB FLANGE            | 3        |
| 6         | HUB PULLER            | 3        |
| 7         | HUB NUT               | 3        |
| 8         | HUB BOLTS             | 3        |
| 9         | THRUST COVER          | 2        |
| 10        | CAMSHAFT COVER        | 2        |
| 11        | OIL FILLER SLEEVE     | 2        |
| 12        | OIL FILLER CAP        | 2        |
| 13        | BACK PLATE            | 2        |
| 14        | GEAR COVER            | 2        |
| 15        | CONTACT BREAKER DRIVE | 5        |
| 16        | CAMSHAFT GEAR         | 5        |
| 17        | OIL PUMP DRIVE GEAR   | 5        |
| 18        | OIL PUMP GEARS        | 5        |
| 19        | CAMSHAFT FRONT BUSH   | 5        |
| 20        | CRANKSHAFT GEAR       | 5        |
| 21        | GEAR TRAIN            | 5        |
| 22        | OIL JET               | 5        |
| 23        | OIL BANJO             | 5        |
| 24        | OIL PUMP COVER        | 5        |
| 25        | OIL FILTER            | 5        |
| 26        | OIL GALLERY           | 5        |
| 27        | TAPPET GUIDE          | 7        |
| 28        | TAPPETS               | 7        |
| 29        | CAMSHAFT JIG          | 7        |
| 30        | TIMING DIAGRAM        | 7        |
| 31        | CAMSHAFT              | 7        |
| 32        | CONNECTING RODS       | 7        |
| 33        | CYLINDER LINER        | 7        |
| 34        | BEARETH               | 7        |
| 35        | BACKPLATE BUSHES      | 2        |
| 36        | PISTONS               | 6        |
| 37        | VALVES - ROCKERS      | 6        |
| 38        | PUSH ROD TUBES        | 6        |
| 39        | ROCK BOX - COVER      | 6        |
| 40        | CYLINDER HEAD         | 6        |
| 41        | OIL GAUGE FLOAT       | 8        |
| 42        | OIL RELIEF VALVE      | 8        |
| 43        | FRAME                 | 8        |
| 44        | CARBURETTOR           | 8        |
| 45        | INLET - EXHAUST PIPE  | 8        |
| 46        | HEATER                | 8        |
| 47        | WIRING DIAGRAM        | 1 GA     |
| 48        | LUBRICATION DIAGRAM   | 1 GA     |
| 49        | CONTACT BREAKER       | 4        |
| 50        | DISTRIBUTOR           | 4        |

| THREAD COMPARISON CHART |        |
|-------------------------|--------|
| ENGLISH                 | METRIC |
| 1/8"                    | M2     |
| 1/4"                    | M4     |
| 3/8"                    | M5     |
| 1/2"                    | M6     |
| 5/8"                    | M8     |
| 3/4"                    | M10    |
| 7/8"                    | M12    |
| 1"                      | M16    |

1 Complete with its linking tubes, the V4 engine which prompted the Author to start this project.



**Colin Pape**

in France, introduces his thoughts concerning his 'dream machine'.

●Part I

Small engines with an oscillating cylinder are about the most basic engines available. They have few parts, are relatively simple to build and can work very well indeed. A few years ago I came across a description of an oscillating cylinder engine that was not quite so simple. It had four oscillating cylinders arranged as two V-twins with each V-twin mounted on its own backplate. It looked like a useful engine and was said to be self-starting and suitable for radio control. My interest was aroused.

On several occasions I thought about making one but each time I came up against the same problem and chose not to proceed. The problem was the copper tubes. The engine had eight lengths of very bent copper tube to carry the inlet and exhaust steam. I am pretty hopeless at bending small tubes to exact dimensions and I rated my chances of bending these tubes to the required shapes in the restricted space as pretty well nil.

Without my realising it at first, my next engine project had begun: to build a four-cylinder, self-starting engine without copper tubes. In fact, I set out to design an engine with no visible plumbing of any sort.

For some time I made no progress with a four-cylinder design, but it did seem feasible to make a single acting V-twin with all the plumbing contained in the backplate. The plumbing would be a bit complicated. The engine would only have two cylinders and it could never be self-starting, but it was a beginning. One way to achieve the self-starting capacity would be to connect two V-twins together to make a four-cylinder engine. However, to make these connections inside the frames seemed to be out of the question. I was looking for something easy to build and this was not likely to be the case with a four-cylinder version.

After a while it became clear that the only way to achieve a simple solution for the four-cylinder engine was to mount all the cylinders on the same backplate. I considered putting two V-twins back to back but none of the oscillators I had seen could be mounted back to back. The cylinder pivots always went right through the backplate and were in the way, and the steam pipes were always connected behind the backplate.

However, I now had a project aim and I finally decided on two approaches to reach it. One was to make an engine as a double acting V-twin, the other was just to keep working away at mounting

# OSCILLATING ENGINES SOME REFLECTIONS

four cylinders on one backplate. I began to call the elusive four-cylinder engine the 'dream engine'.

Photograph 1 shows the engine which I thought I could not build. It encouraged me in my first venture into oscillating engines. This venture gave me some surprises but ended in success when I managed to design and build the two engines in photo 2. I learned much about oscillating engines and thought that readers might be interested to read what happened. I think you will agree that the humble little oscillator can be developed into something quite surprising.

*It is often a good idea to establish where you are before you set out to reach somewhere else.*

## Starting point

It is often a good idea to establish where you are before you set out to reach somewhere else. I did not know much about oscillating cylinder engines and I had never built one. I re-read the books I have that mention oscillating engines. I have *Tubal Cain's* book on simple steam engines and some other books on steam and Stirling engines. There are several designs for oscillating engines in these books. Most of the engines described are of the same basic type and not adaptable to the project I had in mind.

I have listed here what I think is a fair description of the ordinary oscillating cylinder engine. The sort of engine found in small models such as those made for many years by Mamod (photo 3).

The characteristics of the typical small oscillating cylinder engine include the following:

- 1: Single cylinder.
- 2: Single acting.
- 3: Often reversible but not self-starting.
- 4: A flat face on the exterior of the cylinder.
- 5: A single port to the cylinder in this face.
- 6: A port face on the backplate containing the inlet and exhaust passageways.
- 7: Inlet and exhaust passageways symmetrical and very close together.
- 8: External plumbing.
- 9: A pivot to support the cylinder located at or near the middle of the cylinder.
- 10: A cylinder pivot pin which passes through the backplate.
- 11: A spring arrangement installed behind the backplate to act on the pivot to keep the cylinder face in more or less good contact with the port face.
- 12: A conventional crankshaft fitted with a single offset crank pin.
- 13: Power take off is always behind the backplate.
- 14: Long piston.
- 15: Rigid assembly of big end, piston rod and piston.

The characteristics of the engine I wanted to build include the following:

- 1: Four oscillating cylinders.
- 2: Reversible and self-starting.
- 3: Internal plumbing.

4: Power take-off to be available from the front or rear of the engine.

5: Easy to make.

6: Easy to clean.

## Two approaches

My first thoughts on building my dream engine involved a decision to pursue two possible approaches. One was to make a double acting V-twin and the other was to continue to try to make a V-four with all four cylinders on a common back plate. The V-twin seemed easier to develop. The way that I imagined it, this engine was going to need some special features that I had not seen used anywhere, and it had to be double acting. It was possible to make a first design of this engine.

The V-four would be a simpler engine provided I could mount the cylinders back to back on a common backplate. I wanted a V-configuration not a radial engine. It too was going to need some special features and I had already figured out some of them. There were some major unknowns, especially for the plumbing. It was not possible to start on a design for this engine.

The features required for the V-twin include:

- 1: Short crankshaft. It would only have one bearing and I wanted to take power from either or both ends.
- 2: Double acting cylinders.
- 3: Single backplate with all the plumbing in or on this plate.
- 4: An integrated, reversing valve that could also serve as a throttle.

The features needed for the V-four include:

- 1: As for the V-twin but with four single acting cylinders arranged as two Vees back to back on the single backplate.
- 2: More space required between the inlet and exhaust ports.
- 3: No flywheel.

## Details required

### 1: Short crankshaft

Crankshafts are almost always pieces of bent metal. They are complex things best achieved by starting from a forging. For the model engineer this is normally out of the question so we start with castings or we fabricate them. Fabricated crankshafts can give long and good service but a lot of care is needed in their construction to ensure their solidity and their perfect alignment.

The normal sort of crankshaft has bearings at the ends and often along its length as well. My requirement was for a shaft that would run with just a central bearing because there was going to be just one backplate on which a bearing could be mounted. The crank webs add length to the shaft and this means that the cylinders have to be further out from the backplate. The outer piston forces are now capable of bending the shaft and outrigger bearings should be fitted.

### 2: Double acting cylinders

One of the nice things about steam engines is that the cylinders can be made double acting. In a double acting engine the piston is driven alternately



The two self-starting engines developed by the Author in the course of his research. They are placed in front of a mirror to show the hidden detail.



Typical of simple oscillating engine design are these cylinder, pivot and reversing cam from a Mamod traction engine.

towards and away from the crankshaft. It is necessary to close the normally open end of the cylinder to provide a way for the connecting rod to pass through this closed end via a gland. Inlet and outlet ports are required at each end of the cylinder.

Double acting, oscillating cylinder engines seem to be uncommon. *Tubal Cain* described a working steam crane called *Hercules* in his book *Building Simple Model Steam Engines*. This book was published in 1981. At that time Reeves was selling a kit to make a double acting V-twin. A few years ago in these pages, Stan Bray described an engine that he had designed which was based on a real life engine. He called his model *Ossie*. It was a double acting, single cylinder oscillating engine.

So double acting seemed to be viable for oscillating cylinders. With double acting I believed I ought to be able to achieve self-starting and then my twin cylinder engine would be equivalent to a four-cylinder engine in this respect.

### 3: Single backplate and internal plumbing

By internal plumbing I mean the inclusion of all the steam or air passageways inside the frames and the absence of external pipes and joints except for the delivery and exhaust pipes. I have built several engines of other types which have most of the passageways inside the frames or shafts and these engines all run well, so it was more or less a natural inclination to try to hide all the plumbing for these multi-cylinder engines.

The only practical way to have the plumbing hidden is to design the engine with a single backplate on which all the cylinders are mounted.

### 4: Integrated reverse valve and throttle

I wanted a simple unit to control direction and speed. It was only required to demonstrate that the engines could be reversed and that they had a reasonable range of speed. I wanted one basic design of this unit to bolt onto the backplate of any of the engines. It needed to be reasonably gas-tight and easy to build. I had built throttles before and the sort of control I had in mind would be a coarse sort of throttle but I knew that I could always add a real throttle later.

## Design considerations

### 1: Short crankshaft

As we have seen, the traditional crankshaft is unsuitable for an engine that only provides one central crankshaft bearing. Fortunately there is another way of making a crankshaft. This is what I call the straight-line crankshaft.

I first came across a crankshaft of this type in a book mentioned earlier. It was used in a model of an engine being developed by Armstrong-Whitworth in the late 1970s. It was one of the engines that I built and is an impressive performer.

There are no webs, no offset throws and no alignment problems. This sort of crankshaft is suitable for small engines. It is very short. The author did not give it a name. For the lack of a better name I have called this type the straight-line crankshaft because a simple straight shaft can pass right through the assembly.

The basic idea is to provide the offset for the big end by using an eccentric disk. If the disk is correctly dimensioned (read 'big') the main shaft can pass through the disk so the alignment problem is resolved without effort. A series of disks can be fixed onto the main shaft, one per cylinder for example, and the main shaft remains as a simple straight piece of metal.

Photograph 4 overleaf shows a straight-line crankshaft. The crankshaft looks somewhat unusual and the big ends have to be really big but there are considerable advantages in the design which I think are worth listing:

- 1: Simple construction.
- 2: Easy to assemble and dismantle.
- 3: No offset turning.
- 4: No alignment problems. The same shaft goes right through.
- 5: Low weight.
- 6: Very short length because there are no webs
- 7: Big end bearings can be of one-piece design. The shaft can be built up as the big ends are added.
- 8: Power take off from either or both ends.

On the down side:

- 1: The diameters of the big ends and their bearings have to be bigger.
- 2: As a consequence of the big end dimensions, the crankshaft needs more space in the sideways sense so the cylinder pivot must move out a bit compared to an engine that uses a normal crankshaft.
- 3: A lot of waste is involved if the piston, connecting rod and big end are all made in one piece.
- 4: Provision is necessary for a means to lock the disks to the shaft to ensure that they cannot rotate on the shaft.

### 2: Back to back cylinders

The V-four was still the ultimate goal, so the next step was to take another look at moving the cylinder pivot because unless this could be done the project

was dead. Nothing I had read on oscillating cylinder engines discussed the principles of these engines and why some things were done in the way that they were. Why, for example is the pivot always in or close to the middle of the cylinder? This only makes sense for a double acting engine. Only one of the models that I had seen described was double acting.

When the pivot is at the centre of the cylinder it cannot pass through the cylinder, so the only way to hold the cylinder against the backplate, using the pivot, is for the pivot to pass through the backplate. The input steam pressure tries to push the cylinder away from the face and the load transmitted up the connecting rod also tries to lift the cylinder off the port face. Some sort of spring system has to be applied to the pivot on the far side of the back plate to bring the cylinder up tight to the port face on the backplate.

For a single cylinder engine, or a multi-cylinder engine where the cylinders are arranged radially in one bank, this pivot system works well enough. However it makes my ultimate machine difficult to achieve because it is not possible to arrange the cylinders back to back on the same backplate.

If the cylinder pivot can be placed outside the stroke of the piston, it still has to be attached to the backplate but does not need to go through. A simple pivot cannot be at the end closest to the crankshaft because it would get in the way of the connecting rod, but it could be put at the other end. In this case we could extend the cylinder block and the pivot could pass right through it. Then, the spring system could be applied directly to the cylinder. No part of the pivot system needs to go through the backplate and the cylinders could be mounted back to back.

### 3: The end-pivot cylinder

Putting the pivot at the end means that a very substantial pivot can be used. The pivot can be solidly attached to the backplate and it can stand up to the lift-off forces much better than the somewhat fragile centre pivots.

All is not completely well however; there is a snag. The snag is that the pivot is further away from the crankshaft so the cylinder turns through a smaller angle. This means that the separation between the inlet and exhaust passageways becomes smaller and at a certain point, a good overlap of the ports is no longer possible.

It was necessary to take a close look at the engine, and specifically the cylinder geometry, because of the reduced cylinder travel when the pivot is moved away from the crankshaft.



**4:** A straight-line crankshaft for a twin cylinder engine. The big end offset is obtained using eccentric disks.



**5:** End pivoted cylinder with its matching port face disk. The radial port slots described in the text are clearly evident.

#### 4: Cylinder geometry

The critical part in the cylinder design is the port layout. A number of factors need to be taken care of in designing the port layout for an oscillating cylinder, and I will discuss the most important.

#### 5: Symmetrical ports

In the simple oscillator engine there is a single port in the cylinder and two ports on the port face, which is part of the engine backplate. One of these stationary ports is for the steam supply and the other is for the exhaust.

The port into the cylinder must be near the closed end of the cylinder. For a double acting cylinder there must be ports at both ends. As the cylinder rotates on its pivot the single port moves over the port face and alternately covers and uncovers the inlet and exhaust port holes in the port face. The angle turned by the cylinder is quite small, generally less than about 25 degrees.

The cylinder port must start to uncover the inlet hole in the port face soon after top dead centre (TDC). If it begins to uncover the inlet port before TDC, the engine will be very difficult to start. The cylinder port will have to cover the inlet again just before bottom dead centre (BDC). The angular difference between starting to close the inlet port and BDC will be the same as the angular difference between TDC and the fully open point. Similarly for uncovering and covering the exhaust port. The angular difference between the exhaust port and TDC does not have to be the same as the angular difference between TDC and the inlet port unless the engine is designed to be reversible. Most oscillator engines are reversible and a reversible engine that is supposed to have the same performance in both directions has to have symmetrical ports.

#### 6: Size of the port holes

As a general rule the size should not be so big that bridging of the input and output ports occurs. The oscillating cylinder engine does not require the steam to enter at high speed so the inlet port does not need to be especially big. After all, the inlet port is more or less open for nearly 180 degrees. It is more interesting to try and get the used steam out as fast as possible but if the engine is to be reversible the exhaust port must be the same size as the inlet port.

#### 7: Separation of the port holes

The minimum separation between the inlet and exhausts must be at least equal to the diameter of the port into the cylinder. If it is less, a path will

certainly be available for the inlet steam to pass directly to atmosphere for part of the cycle. This is a bad thing in my view yet I have seen this bridging possibility in several designs. I assume the engines work well so I may be over-emphasising the problem.

Not to be neglected is the space problem on the other side of the backplate. The steam arrives and leaves in holes that are surrounded by copper so there must be enough space to lodge the copper.

#### 8: Influence of the pivot position

The angle turned by the cylinder, as the crankshaft rotates, is the angle between the two tangents drawn from the cylinder pivot point to the circle swept out by the axis of the big end. As the cylinder pivot point is moved away from the crankshaft centre the angle turned by the cylinder becomes smaller. This means that the spacing and hole size of the ports become more critical. At a certain point it means that the cylinder port can no longer completely uncover the port face holes.

So we end up with two problems if we move the pivot point out from the crankshaft and these problems occur with the end pivot design.

#### 9: Two cylinder ports are better than one

There is no reason why the cylinder should have only one port. If the cylinder has two ports then, for a given direction of rotation, one can be assigned to inlet control and one to exhaust control. The space between these two ports is only limited by the diameter of the cylinder. We still have just two openings in the port face but the openings in the cylinder can be further apart or closer together than these openings. What matters is only that the angular separation between a cylinder port and its matching opening on the port face is the same or close to what it would be in the single port approach.

There is another advantage. With one port in the cylinder it must be at the end of the cylinder and in the centre. This means that it is at the closest point to the pivot. With two ports we can space them apart up to the diameter of the cylinder. They are now further away from the pivot so for the same angular displacement they move further. Bigger holes can be used without risk of bridging.

#### 10: Uncovering the ports

The angular movement of the end pivot cylinder is smaller than it is for the centre pivot cylinder. By using the double port design we can put the port holes anywhere we want but we have to live with the small angle. This means either that the

ports have to be small or that they do not get completely uncovered if we start with the basis of no bridging.

We need to ensure that when the port is supposed to be open, the cross section of the path into the cylinder is at least as big as the cross section of the hole even though the hole is not completely uncovered.

Since I had decided on a minimum cross section of passageways into the cylinder of 2mm I found that I could not uncover the hole. The solution was to use radial slots. Even though only half the slot gets uncovered it still provides the minimum cross section and the spacing is not affected.

Photograph 5 shows the cylinder face of an end pivot cylinder and its matching port face. It clearly shows the radial slots that compensate for the failure to achieve full overlap.

#### 11: Internal plumbing

My initial sketches had shown that the backplate could provide the passageways but a sandwich type construction would be needed. Unfortunately it also showed that with traditional engine designs there would be a lot of cross drilling and a lot of ends would have to be plugged. This was not satisfactory. I wanted to have a reasonably simple solution to this plumbing problem so I gave myself three rules:

**Rule 1:** No more than three layers of passageways permitted.

**Rule 2:** All three layers had to be in the backplate, which could be no more than 8mm thick because I had no plate that was thicker. There could only be one connecting layer inside the main backplate because of its thickness. There could be a surface layer of slots on the front of the backplate and a surface layer on the rear face of the backplate.

**Rule 3:** These surface layer slots would need to be covered when the engine was assembled but special covers would not be permitted. The covering had to be done by other normally required parts.

#### 12: Sorting out the passageways

Two basic problems complicated the passageway design:

- 1: The ports were too close together.
- 2: There were too many changes of direction and often these were necessary because one passageway had to cross another without cutting into it.

●To be continued.

# THE STEAM ENGINE INDICATOR

**J. F. Willock**

explores the origin, types and use of these important instruments.

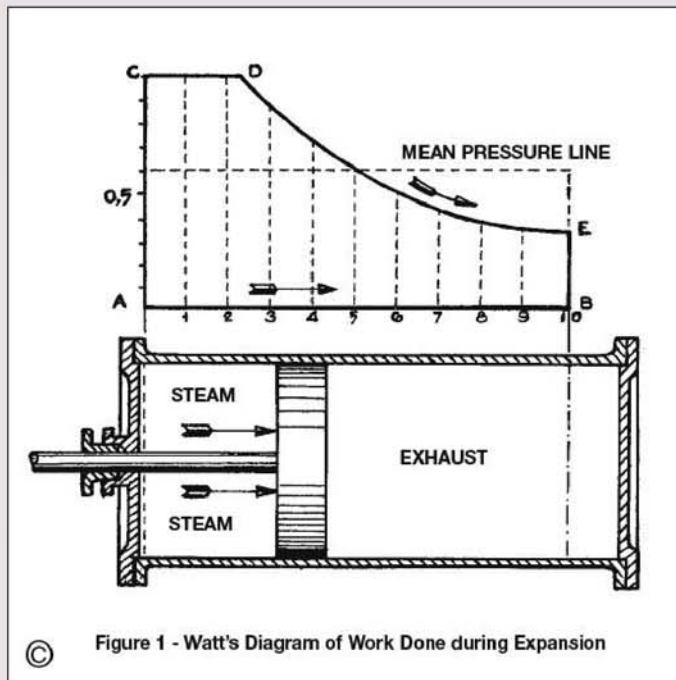
The Steam Engine Indicator, in the age when the steam engine was the unrivalled prime mover, was a very important instrument that enabled the engineer to ascertain the power produced in the cylinder of any normal reciprocating steam engine. In addition, and perhaps more importantly from an operational standpoint, the Indicator was also an invaluable diagnostic device. It was able to provide a considerable amount of data on the efficiency of the engine, its condition, the accuracy of the valve-setting, the degree of compression and 'cut-off', as well as a whole host of information on other features.

As the steam engine developed so did the Indicator. A wide variety of types of Indicator were manufactured, many by prestigious instrument makers. The ever increasing rotational speeds of steam engines demanded corresponding changes to the indicators themselves, and instruments of great ingenuity were designed to meet these requirements. Indicators designed in the era of James Watt were completely unsatisfactory a hundred years later, when high-speed, all-enclosed, force-lubricated engines, of the Belliss and Morcom and Willans variety were the order of the day!

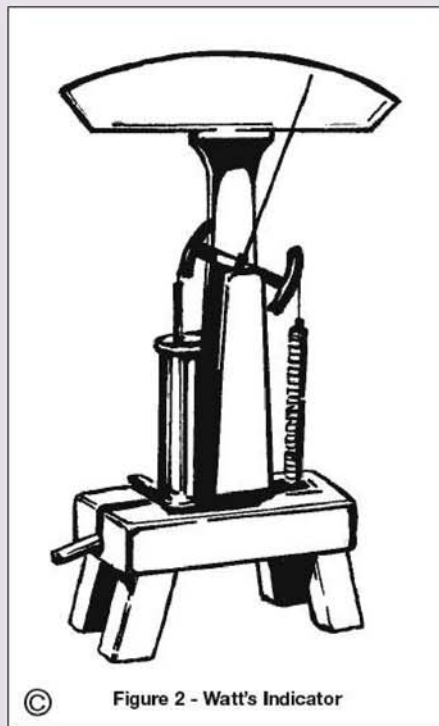
## Watt's Indicator

James Watt was among the first, if not the first, to fully appreciate the properties of heat and what actually happened when steam was admitted to the cylinder of a piston engine. This analytical approach, which he adopted with so many of his discoveries and inventions, was present in his researches into the properties of heat, and its action when performing useful work. Figure 1 will be familiar to many, as it is featured in numerous text books on the theory of heat engines, and illustrates 'Watt's Diagram of Work Done during Expansion.' As a corollary to his experiments with heat, Watt, ever the true scientist, decided that this useful work must be measured.

The earliest references to an Indicator are clearly to a device that today we would call a pressure gauge, an example of which is preserved in the Science Museum, London. Figure 2 shows Watt's Indicator. In operation, steam from the engine cylinder was directed to act upon a piston and rod in the indicator cylinder. The piston-rod actuated a spring loaded lever, to which a long pointer was attached. As the pointer moved over the fixed scale it gave an indication of the different pressures appertaining, as the piston of the engine travelled simultaneously along its cylinder. The instrument did not actually record on paper the varying pressures in the cylinder, as the pointer fleetingly moved across the scale.



© Figure 1 - Watt's Diagram of Work Done during Expansion



© Figure 2 - Watt's Indicator

## Southern's Indicator

The substitution of a pencil together with a moving board carrying the indicator card, in place of Watt's pointer and fixed scale, does not sound a particularly significant development but it brought together all the essential features of subsequent indicators. The movement of the board, or tablet, was related directly to the engine's piston stroke, and thus for the first time a steam distribution diagram was produced.

This development of the Indicator has been attributed by some authorities to Watt, but in his monumental work on the great engineer, H. W. Dickinson states that the instrument according to tradition, was probably conceived by John Southern, in 1796. On March 14 of that year Southern, an employee of Boulton and Watt, wrote to James Lawson, one of the firm's outside engine-erectors: "Tell Mr. Lee I have contrived an instrument that shall tell accurately what power any engine exerts."

In August 1796, Southern, in a further letter addressed to Lawson, refers to an unsatisfactory diagram that he had received from him. Southern writes: "I have received the indicator's letter or rather scrawl which is not to be decyphered (sic) but by conjecture, without some further information. It is absolutely necessary to know at what part of the line the indicator points to when the piston is exactly either at the top or bottom. Great accuracy should be

observed at the moment the piston is at the top or bottom, and a person should be stationed opposite the connecting rod to call out the instant it passes the centre of the sun wheel, another person being stationed to observe the indicator pencil at the same moment. The indicator should be placed above and below to see whether any and what difference there is. Please to repeat the experiment with all the attention you and Mr. Lee can command, and send sketches and full description." Southern then went on to describe how a satisfactory closed loop diagram was to be achieved with a few modifications to the Indicator.

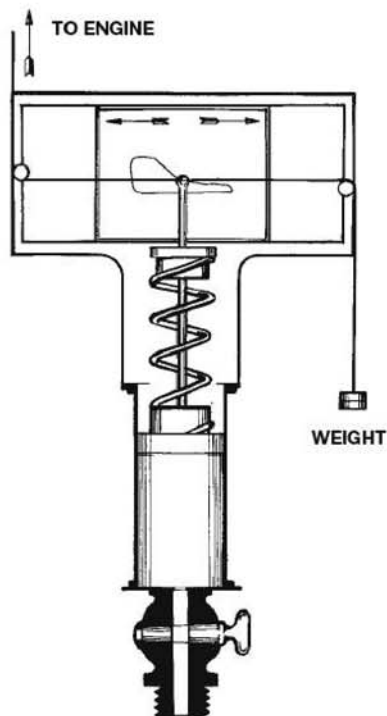
Here then was the genesis of a practical indicator capable of providing useful data. A diagrammatic representation of Southern's Indicator is shown in fig 3 overleaf.

## McNaught's Indicator

Between the years 1825 to 1830, the prolific and talented engineer John McNaught of Bury, Lancashire, produced a simplified Indicator capable of creating diagrams at higher speeds and steam pressures than had been possible hitherto.

In McNaught's design the indicator cylinder, containing a spring controlled piston, was surrounded by a drum to which the Indicator Card was attached. A pencil suspended from the piston-rod moved over the card to produce the diagram.

McNaught is perhaps better known today for his simple but effective method of increasing the power and extending the potential life of existing rotative beam engines. This was usually achieved by the addition of a high-pressure cylinder positioned between the beam trunnions and the crankshaft bearings. 'McNaughting', as the generic term for the practice became known, was very widespread and many engineers, in addition to John McNaught, carried it out.



© Figure 3 - Southern's Indicator (Diagrammatic only)

### Richard's Patent Indicator (Patent No. 15640)

In 1861, Charles B. Richards, as a result of a request from his fellow American associate, Charles T. Porter, designed a new type of Indicator capable of producing diagrams from higher-speed engines, then just coming into general use.

The first use of the Richard's Indicator was probably on the new Porter-Allen engines, which operated at speeds in excess of double that of their contemporaries. Without this instrument the accurate setting of the valves would have been almost impossible. The Indicator utilised graduated springs to cater for different working steam pressures. Another feature of the instrument was the relatively small indicator piston movement, without commensurate loss in diagram size.

The Indicator Diagram was made on an Indicator Card attached to the circumference of the drum. The drum rotated freely on its axis, but a torsion spring ensured it rapid return. A length of cord, together with a pulley-sheave attached to the base of the drum, formed the link between the indicator and the engine.

Recently the writer acquired one of these beautiful instruments in its original mahogany box, complete with six graduated springs, matching scale-rules (of which more later), taper-thread tap, and steam cocks. This Indicator was manufactured by the highly regarded instrument making firm of Elliott Brothers, whose works were situated in St. Martin's Lane, London. A Richard's Patent Indicator is shown at fig 4.

### Thompson's Indicator

This Indicator was very similar in layout to the Richard's instrument, the only significant difference being in the parallel-motion to guide the

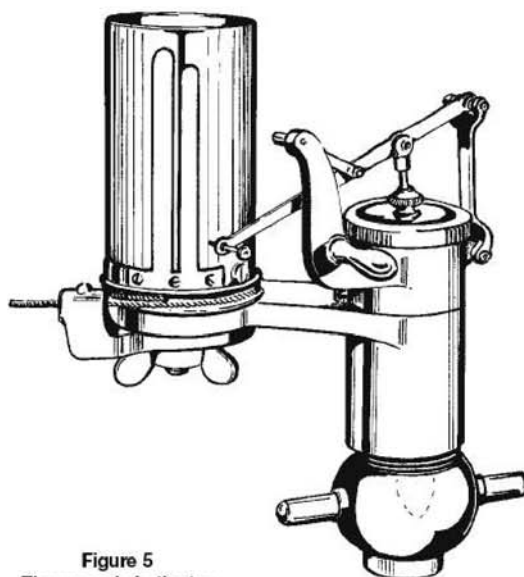
stylus; this being a far more compact and rigid arrangement than the Richard's type, and thus was capable of accommodating higher engine speeds. A Thompson type instrument, manufactured by Schaffer and Budenberg, is illustrated at fig 5.

### The Dobbie-McInnes Indicator (Outside Spring Type)

The last and perhaps most useful of all the mechanical indicators, the Dobbie-McInnes instrument, was designed for use on both steam and oil engines.

The major difference between this indicator and its predecessors was the location of the springs. These components were not positioned in the indicator operating cylinder itself, but located in a separate cylinder superimposed above the first.

Thus the springs were isolated from the fairly high temperatures associated with superheated steam, and the very high temperatures found in oil engines, where cylinder temperatures in excess of 2,000deg. F were possible. Engine speeds of up to 400rpm could be accommodated by this type of indicator. A Dobbie-McInnes Indicator is illustrated at fig 6.

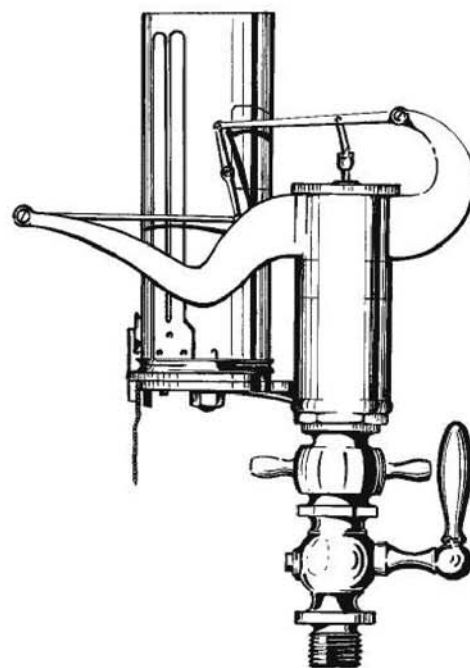


© Figure 5  
Thompson's Indicator

### Taking a Diagram

Having briefly traced the history and main types of Indicator, we now perhaps should consider how an Indicator Diagram might be taken from an engine, using for example a Richard's type indicator.

The Indicator is set up on the test engine adjacent to the working cylinder. Usually on stationary engines there is some form of steam tapping at both ends of the cylinder. A common pipe, communicating with both of these tappings,

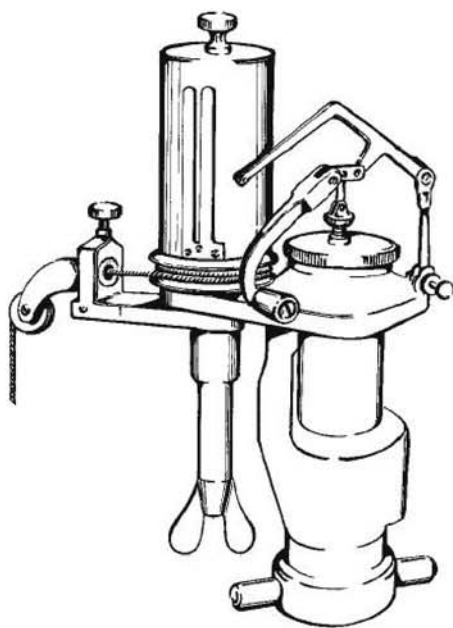


© Figure 4 - Richard's Patent Indicator  
(Patent No. 15640)

usually has at its midpoint, a three-way steam-cock. The Indicator is connected to the three-way cock. A length of cord, from the Indicator drum, is attached to some suitable point on the engine, whose motion *simulates* the engine's stroke. As the circumference of the Indicator drum is only approximately 6in. (150mm), the simulated engine stroke must not exceed this figure. The cord should *not* be attached to any item of valve gear, or any other piece of mechanism that does not faithfully simulate the engine's stroke. Valve gear movements will not in fact replicate the engine stroke and may, in any event, be incorrectly set! A useful point of cord attachment on an engine might be an air-pump lever, for example, see fig 7.

Contained within the box holding the Indicator, if it is complete, are six graduated springs. Each spring is identified by two numbers; the first being the working steam pressure (in psi) and the second the pressure necessary to displace the pencil, or stylus through one inch (25.4mm). This second value is known as the *scale* of the spring and is *not* to be confused with the rate of the spring. Having selected the appropriate spring, it is then threaded onto a machined shoulder on the Indicator piston, before being assembled into the cylinder. The primary function of the spring is to act as a damper on the piston, and to prevent wild oscillations of the stylus on the Indicator Card.

With the instrument correctly set up on the test engine, and with one end of the engine's cylinder connected to the Indicator cylinder by means of a three-way steam cock, the 'Atmospheric Line' is drawn on the Indicator Card. This is achieved by turning the three-way steam cock so that the Indicator piston is put into direct contact with the atmosphere, via a small hole in the wall of the Indicator cylinder. The stylus is brought



© Figure 6 - Dobbie-McInnes Indicator

centre of the ten spaces into which the Indicator Diagram is divided, is noted and they are added together. The sum is multiplied by the 'scale' of the spring being used in the indicator, and the product is divided by the number of divisions, 10 in the case of this example, to obtain the Mean Effective Pressure. Thus:

$$MEP = \frac{L \times S}{10}$$

Where:

L = Total length of 10 Ordinates in inches  
S = Scale of Spring

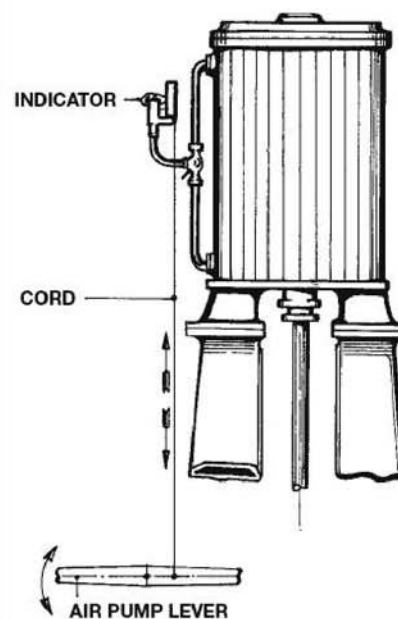
However, contained within the box holding the instrument, again if it is complete, are six special rules, each having different scales directly corresponding to each of the six springs previously mentioned. The use of the appropriate

scale-rule, corresponding to the spring selected, to measure the lengths of the ordinates, obviates the need to multiply the dimensions obtained by the scale of the spring, as would be the case if the dimensions were taken with just a standard inch rule. By giving the pressures directly for each of the ordinate positions, the special scale-rules, therefore, simplify the calculations, see fig 8.

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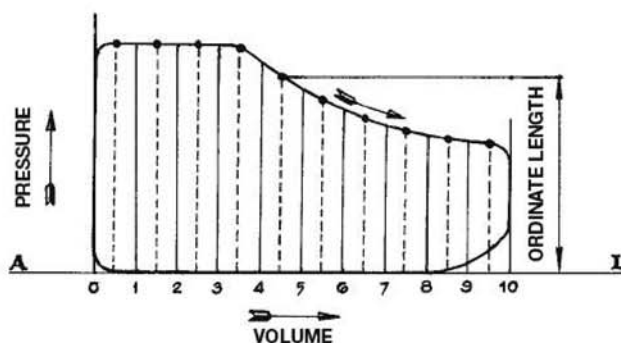


© Figure 7 Indicator Set-Up on an Inverted Vertical Engine

\*In all cases, the area of the piston-rod has to be taken into account. In the case where the piston rod comes out at the crank end of the cylinder only, then A should be the area of the piston less half the area of the piston rod.

Having calculated the power being developed in the cylinder, the Indicator Diagram can be examined further to ascertain the cut-off-point, the efficiency of valve operation, cushioning at the end of stroke, as well as other characteristics involved in steam engine operation. The ability to 'look inside the cylinder', while the engine was operating, made the Indicator a very valuable tool in the design, construction, maintenance and operation of all heat engines.

It is not proposed to go more deeply into the subject, nevertheless it is hoped that this brief discussion on Indicators, their origins, development and use, will have been of some interest to readers. The Engine Indicators themselves are fine pieces of engineering, made by highly reputed makers from a largely forgotten age, and as such should be treated accordingly. They will certainly not be manufactured again.



© Figure 8 - Indicator Diagram with Ordinates Projected to Calculate Mean Effective Pressure (MEP)

Having calculated the MEP from the Indicator Diagram, the Indicated Horsepower (IHP) can be obtained by multiplying the Total MEP on the piston (in pounds) by the distance travelled by the piston (in feet) and dividing the product by 33,000. Thus:

$$IHP = \frac{ApLN}{33000}$$

Where:

A = The Area of the Piston in square inches\*  
p = The Mean Effective Pressure (MEP) in pounds per square inch.  
L = Length of Stroke in feet  
N = Number of Strokes per Minute = Revolutions x 2

## References

- Dickinson, H. W.  
*A Short History of the Steam Engine*  
Cambridge University Press, Cambridge, 1938.  
Dickinson, H. W., and Jenkins R.  
*James Watt and the Steam Engine*  
First published 1927 and reprinted by Moorland Publishing, Ashbourne, Derbyshire, 1981.  
Hills, R. L.  
*Power from Steam*  
Cambridge University Press, 1989.  
Jamieson, A.  
*A Text Book on Steam and Steam Engines*  
Charles Griffin and Co. London, 1892.

## Ed Cloutman

brings his short series to a close with an affectionate view of one of the institutions of the Welsh valleys: the Italian Cafés.

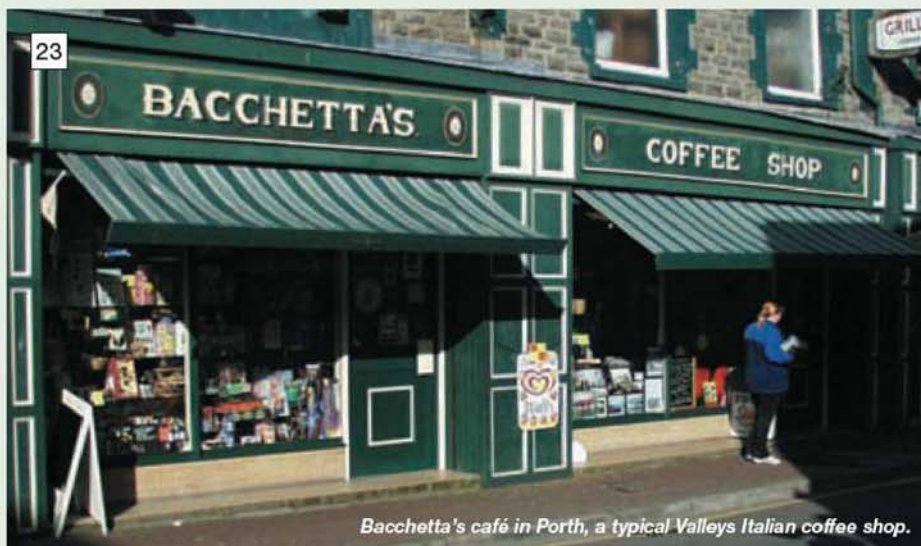
●Part III continued from page 653 (M.E. 4185, 27 December 2002)

The first Italians to settle in Britain came in the 1820s. They came mostly from poor farming areas of Northern Italy and began working in cafés all over Europe. The owner of one of these cafés, Mr. Tortini, is credited with the invention of ice-cream and this led to the tradition of Italian cafés and the ice-cream business.

Initially the immigrants lived in overcrowded conditions but managed to make their ice-cream in their kitchens and back yards. The ice-cream was sold from barrows and pushed around the streets — no mean feat if you have visited The Valleys and seen how steeply the streets rise up the sides of the valleys.

Among the first immigrants to South Wales via London were Angelo and Giacomo Bracchi who opened their first café in Newport in the 1890s, followed by a shop in Aberdare. The first Italian café in the Rhondda was opened by Julio Bracchi in Tonypandy, who expanded his business and was joined by other immigrants until the number of cafés in the Rhondda rose to over 50. Names like Rabbaiotti, Viazzani and Bacchetta were commonly known as Bracchi's, after their founder.

Bacchetta's café in Porth (photo 23) just north



Bacchetta's café in Porth, a typical Valleys Italian coffee shop.

# THE HETTY WINDING ENGINE

of Pontypridd, was opened in 1932 by Serafino Bacchetta, who returned to South Wales after serving in the Great War. His sons, Aldo and Renato continue to run the café and have lovingly put together a collection of Art-Deco artefacts from days gone by (photos 24 and 25); note the milkshake stirring machine in the foreground of photo 24. The flags, photo 25, were made for the coronation of King Edward VIII, but of course, were never used. The accordion provided live entertainment in the café. Knickerbocker Glory glasses and various glass bottles for sweets etc.

can be seen in the window. The photograph shows the Royal Train arriving at Porth Station in June 1912, which brought King George V and Queen Mary on their visit to the Rhondda.

The ice-cream barrow (photo 26) is a replica, but painted in a similar manner to the original. Various implements used in the trade are seen in photo 27. On the left is an ice-cream wafer tool. This has three settings, either for 2d. ('tuppenny'), 3d. or 6d. wafers. A wafer biscuit was placed in the tool and the depth set by moving the handle to the relevant notch. Ice-cream was then put into



Above left: general view of collection with milkshake stirrer in foreground and coffee machine to rear.

Above right: contemporary photos, glassware and accordion.



The ice-cream barrow is a replica, but painted in a similar manner to the original.



Ice-cream utensils; can you guess what they are before you read the text?



Horlicks and Ovaltine mixing jugs with instructions on the reverse.



Display cabinet of contemporary advertising artefacts.



Quality Street chocolates and delicious Green Label tea.



Pure nostalgia! A 'Five Boys' chocolate bar. With real chocolate inside!



Railway dominoes, snuff and Rolls razor with various types of tobacco.

the tool and scraped off level with the top. A second wafer biscuit was placed on top and the completed wafer pushed out of the tool and handed to the customer. Next to this is the ice-cream 'North Pole' maker, which was opened up and two curved sheets of chocolate placed in each half of the cylinder. Ice-cream was placed in the centre and the tool closed and the end cleaned off. The tool was then opened and the chocolate-coated ice-cream served to the customer — an early form of choc-ice. To the rear is an ice-cream scoop.

The Horlicks and Ovaltine mixing jugs (photo 28) have metal plungers (a disc with holes attached to a rod) that just fit the jugs and

are pumped up and down for thorough mixing. Instructions are written on the sides of the jugs.

There are several display cases of contemporary advertisements (photos 29, 30, 31 and 32) the first containing various collectors cards, King Edward VII chocolates, Smiths potato crisps and tobacco. Quality Street and Lyons Green Label tea, photo 30, are displayed alongside 'Five Boys' chocolate, photo 31 at 3d. a bar; the original chocolate is still inside this packet! Each boy has a different expression which from left to right is Desperation, Pacification, Expectation, Acclamation, and Realisation. Note the Rolls razor and Railway dominoes in photo 32. Many of these advertisements were commonplace at railway stations, often painted on 'tin'.

Perhaps the piece of equipment that most sums up an Italian café is the coffee-making machine, (photo 33); 'La Victoria Arduino Torino - Italia' is embossed on the beautifully cast label (photo 34).

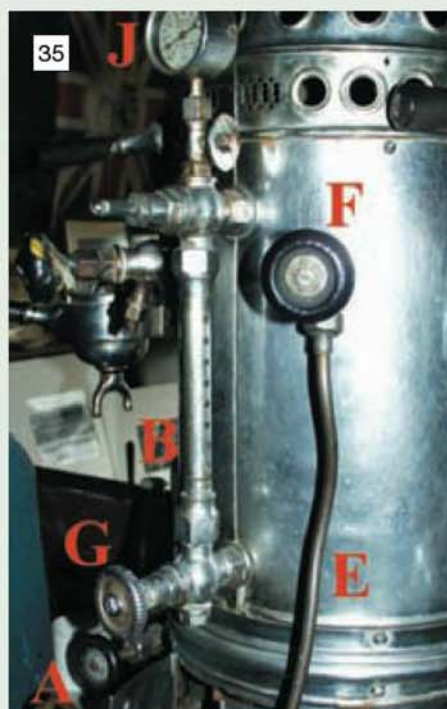
The operation is described with reference to photos 35 and 36. The boiler is filled and kept topped up with water through the valve (A). The water level can be viewed through the sight-glass (B). Fresh ground coffee is placed in the filter (C) and hot water passed through it via the hand-valve (D) so that the filtered coffee runs into the cup beneath. The milk is heated by placing the jug under the nozzle (E) and passing steam through it by opening the valve (F). The steam was also used to heat pies; a sort of forerunner of the microwave! The valves (D) and (F) and coffee filters are repeated on each side of the sight-glass so that two people can operate the machine at once. Valve (G) is a shut-off valve in case the sight-glass needed replacing. Hot water for tea, etc., can be drawn by opening valve (H). The pressure in the boiler is shown on the gauge (J), and there is a safety valve under the eagle to prevent explosion! The water in the boiler is heated by gas.



Coffee making machine.



Beautiful cast label on coffee machine.



Detail of coffee making machine; refer to text for an explanation of its method of operation.





37



38



39

Above left: Aldo with his wife and staff just before he retired.

Above right: display showing the development of the miner's safety lamp and carbide lamps.

Left: model of underground haulage engine.

Right: pit-head gear and cage - Albion Colliery.

Below: the stone bridge by William Edwards, built in 1756. Many clocks bear its name, Newbridge.



40



41

The collection will hopefully be on display at the Museum of Welsh Life, St. Fagans, Cardiff CF5 6XB (web site: [www.nmgw.ac.uk/mwl/index.en](http://www.nmgw.ac.uk/mwl/index.en)).

### Pontypridd Museum

This small museum contains a wealth of

I asked Aldo if the machines were dangerous, being manually operated. He said that (rather like steam locomotives) there was a greater danger if the machines were over-filled with water than if they were allowed to boil dry, as in the latter case the safety valve would come into operation. And then he told me a story about his father, Serafino.

Above the shop, Serafino's wife was giving birth to twins (Aldo and Mario) and Serafino was working at the coffee-making machine. Suddenly there was a shout from upstairs, "Serafino, Serafino, come quickly, your wife has had twins." Serafino bounded up the stairs and a few seconds later — almost as a sign from above — there was a loud 'SWOOSH' and an eruption from every orifice of the coffee-making machine. Water cascaded from the ceiling down every object in the café. Serafino bounded down the stairs with a babe in each arm and duly baptised them in the maelstrom! "And," said Aldo, "my family has continued making coffee to this day!"

Sadly, by the time this article is published, Aldo and his elder brother Ronato will have retired, and so ends another era in the Welsh mining valleys. The group photograph (photo 37) shows Aldo with his wife and some of his staff, who often act as 'agony aunts' to local inhabitants as well as greeting you with a friendly smile and making you feel welcome when you order your meal, tobacco, ice-cream and, of course some of that delicious coffee!

knowledge on coal mining in the Rhondda. There are various models including a steam engine driving a 'waddle' ventilation fan, and a large working model section through a pit head and coal workings, made mostly by miners. Most models and can be seen in motion, either driven by electric motor, or by compressed air. The museum has an excellent display of carbide and miners' safety lamps (photo 38) showing their development. There is also a large and very well made working 00-gauge railway depicting the centre of Pontypridd with its railway viaducts. The winding engine (photo 39) runs on compressed-air.

I have included a photograph of the Albion Colliery, Cilfynydd (photo 40) because of the interesting story attached. The model is very large, showing above and below ground workings in great detail, plus the engine winding house. Unfortunately, due to reflections from the glass case, I was unable to get a satisfactory picture of the complete model. The model was built in about 1900, after the terrible explosion at the pit in 1894. It was built by Henry Barnes, who was signalman near Barry station in Pontypridd. He worked on the model at night to keep himself awake whilst attending to the signals! He first made a small model for Mr. Mogg who was blinded at the pit disaster. Mr. Mogg carried the model on an old pram and stood outside the Peniel Lane entrance to Pontypridd market. In this way, he was able to earn a little money from shoppers as there was no

compensation in those days from the coal masters.

Finally, adjacent to the museum is the wonderful bridge (photo 41) designed by William Edwards in 1756. Built of stone, it has a span of 140ft. and remained the longest single span bridge in Europe for three quarters of a century. The three holes in each end are for weight reduction. A full description of the bridge and some interesting stress analyses can be seen in the Museum. Many early clocks have the place name Newbridge on their dials, but after 1856 the Postmaster changed the name of the town to Pontypridd to end the confusion with Newbridge in Gwent. Thus later clocks usually have Pontypridd as the place name on their dials.

Brian would be pleased to receive visitors to the Museum — Pontypridd Museum, Bridge Street, Pontypridd CF37 4PE; tel: 01443-490748.

### References

- Bacchetta, A. and Rudd, G., (1998) *Porth and Rhondda Fach - Archive Photograph Series*. Chalford Publishing Co.
- Egan, D., (1987) *Coal Society - A History of the South Wales Mining Valleys 1840 - 1980*. Gomer Press.

### Acknowledgements

I should like to thank Brian Davies for providing me with the information on the Hetty Winding Engine, and allowing me to photograph the engine and items in Pontypridd Museum, of which he is curator. My thanks also to Aldo Bacchetta for showing me and allowing me to photograph his private collection and telling me so much about the history of the Bracchi's. I wish the Bacchetta family well in their retirement.



# MONTH GOING REGULATOR CLOCK

**Peter Heimann**

describes the combined wheel  
collets and lantern pinions.

●Part III continued from page 649  
(M.E. 4185, 27 December 2002)

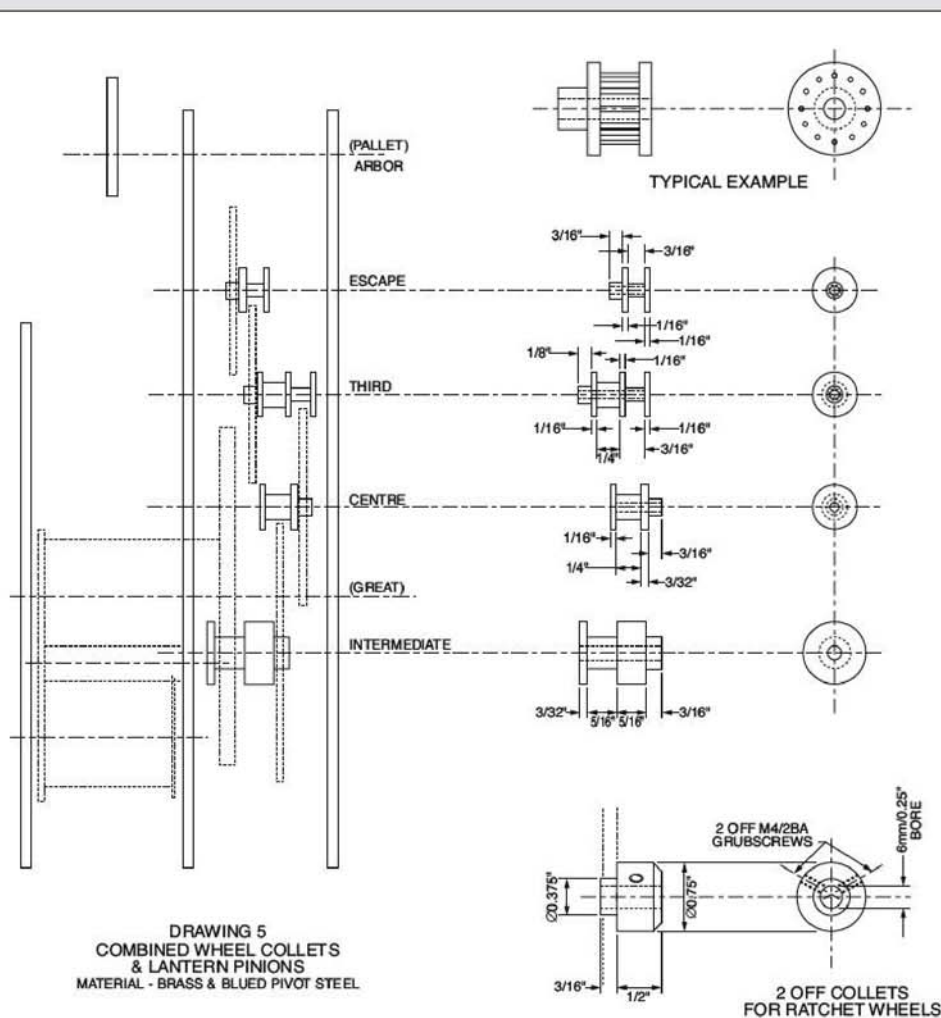
The next task is the manufacture of the combined wheel collets and lantern pinions (drawing 5). Remember my previous comments concerning ball races in metric or imperial size. This will affect the bore of the intermediate spool and possibly also the centre arbor bore if there is a problem with the specified 0.125in. dimension.

The recommended sequence for machining the pinion spools is to first prepare accurate outside diameter stubs. These should be sufficiently long to hold firmly in the lathe chuck when machining the inner diameter of the spools. Use a square end parting tool of, say  $\frac{3}{32}$ in. width. The two  $\frac{3}{16}$ in. gap items (escape and third) can be finished, as per drawing, to 0.170in. spool diameter. On the centre and intermediate items, it helps to leave a thin 'land' in the centre of the gap for the time being to act as a drilling guide. It is quite simple to machine this away after drilling is completed.

The drilled holes for the trunnions at pitch circle diameter pass right through the outer 'flanges' and, where applicable, through the 'land' but are blind in the flange adjoining the wheel seat. However, make them as deep here as you can without actually breaking through. I find it best to drill in stages, by only showing sufficient drill beyond the chuck to penetrate the first flange. I then go round again with the drill extended to full depth when the first flange (and land, if there is one) will act as a drill guide.

The setup for dividing and drilling, previously mentioned, is shown in photo 5. Adjust the height of what is now your drilling spindle to be at the centre height of workpiece, and lock. Then, carefully bring to dimension of half the pitch circle diameter, specified by using the cross-slide, and lock. Clearly, one must ensure that there is no backlash error by winding in one direction only to centre and on to the required point. I am assuming that the cross-slide index dial will be accurate. They usually are, even on an old lathe when wound outwards.

Plates and back cock  
of the Author's clock  
with all drilling,  
milling and trepanning  
operations completed.



|              | SPOOL<br>OUTER Ø | SPOOL<br>INNER Ø | TRUNNION<br>P.C.D. | NUMBER OF<br>TRUNNIONS | TRUNNION<br>DIAMETER | WHEEL<br>SEAT Ø | BORE FOR<br>ARBOR |
|--------------|------------------|------------------|--------------------|------------------------|----------------------|-----------------|-------------------|
| ESCAPE       | 0.470"           | 0.170"           | 0.2835"            | 12                     | 0.030"/0.031"        | 0.1875"         | 0.125"            |
| THIRD        | 0.470"           | 0.170"           | 0.2835"            | 12                     | 0.030"/0.031"        | 0.1875"         | 0.125"            |
| CENTRE       | 0.5625"          | 0.186"           | 0.378"             | 16                     | 0.030"/0.031"        | 0.1875"         | 0.125"            |
| INTERMEDIATE | 0.6875"          | 0.300"           | 0.504"             | 16                     | 0.039"/0.040"        | 0.3750"         | 6mm/0.25"         |

Drilling can now proceed by movement of the saddle to a fixed stop. One has to experiment with drill size to suit the blue pivot steel. The fit in the holes should be a 'tight push' but a tiny spot of Loctite will also be used. For the 0.030/0.031in. trunnions, I suggest trying a No. 69 drill and for the 0.039/0.040in. try a No. 61 for starters. John Wilding's 'wishbone' drill sharpening jig, described in *Model Engineer* some time ago, is fantastic for sharpening these very small drills. When all the drilling is finished, clean off the burrs on the inside of the first flange, remove the drill guide lands and generally finish the inner spool to size. Do not proceed with any other turning at this stage, but prepare the trunnions into lengths.

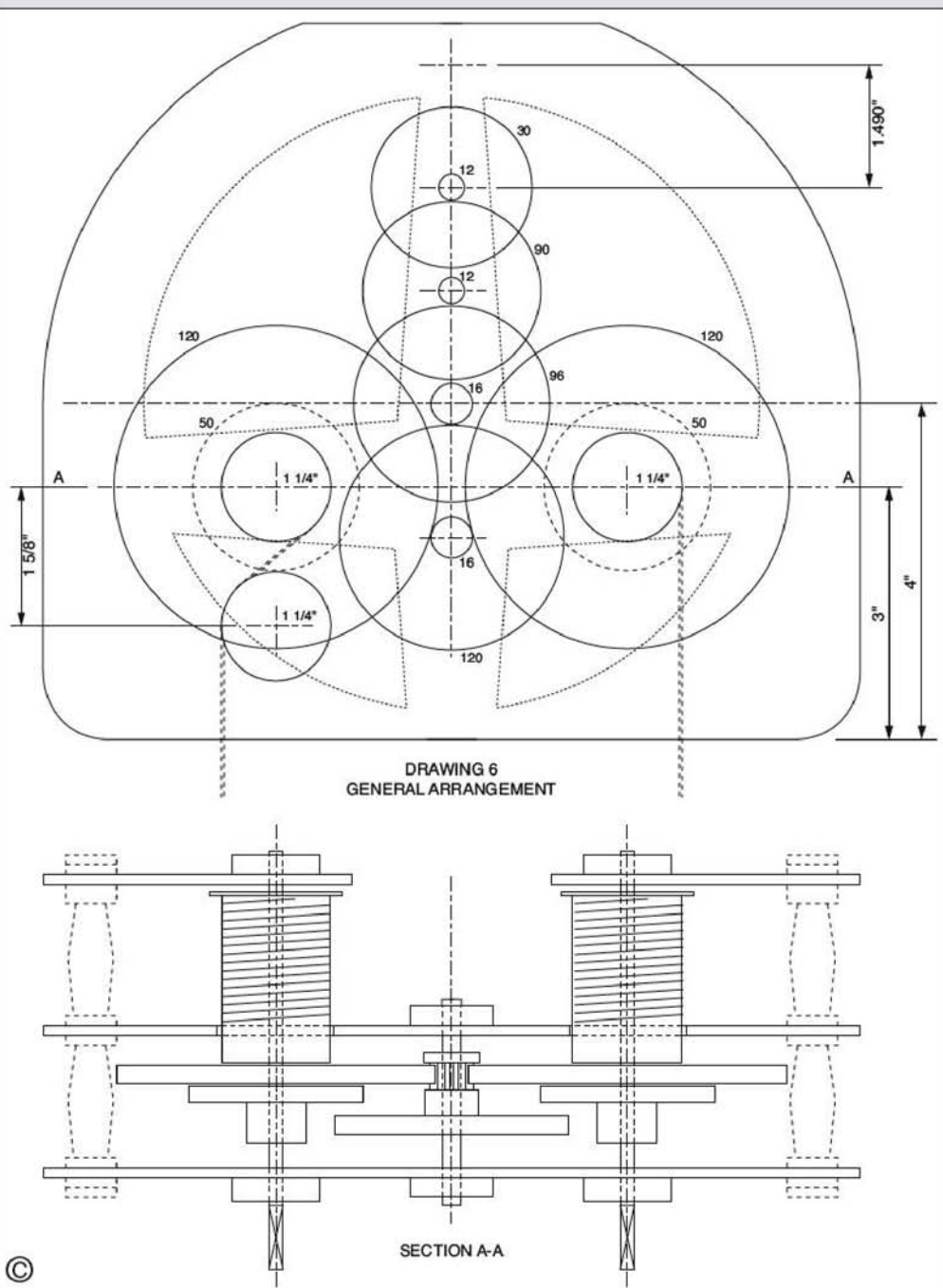
Blue pivot steel, which is hardened and tempered, cannot be sawn or filed. Cut it into pieces very much longer than final length by grinding a nick with the corner of the grinding wheel and snapping the pieces off. Grind the ends more or less square as one end will seat in a blind hole and the other can be most unkind to your fingers if left sharp!

Remove the embryo pinion from the lathe and mount it in the vice by its plain stub. Insert the trunnions until the bottom end is just about to enter the blind hole. With a needle point, apply a spot of Loctite to the top of the trunnion next to the outside of the first flange and then drive home into its blind hole. I use a cabinet maker's hollow panel-pin punch for this task but it is very easy to make such a tool from silver-steel with a centre drill indentation in one end.

The next stage is to grind off the surplus ends nearly, but not quite flush. Finally, mount the piece back in the lathe chuck so that only the outer face just protrudes from the jaws. As previously mentioned, blue pivot steel cannot be sawn or filed but, with care, one can clean off the ends by turning in the lathe providing the protrusions have been ground off practically to the brass face. A tungsten carbide tool would be best for this job. Another and better way is to use a very small abrasive grinding disc such as supplied with a mini-power tool but mounted in our drilling spindle. This can then be gently traversed across the face of the workpiece, cutting off all protruding surplus.

The trunnion end of the pinions is now finished. There remains the wheel seat to machine and the bore to drill and ream. Mount the pinion in the chuck as deeply as possible gripping both flanges and cut off to slightly over finished length by sawing. I feel that parting-off would exert too much pressure at this stage.

Face and form the wheel seat; you will note that the third wheel pinion has an extension. The diameter of the seat should create a light press fit for its wheel, which will also be Loctited eventually but not yet. Naturally, the pinion is bored and reamed to arbor size as the final operation while still in the chuck.



Assembly of the wheels and combined wheel collets/pinions, is best carried out after the depthing stage and will be described later.

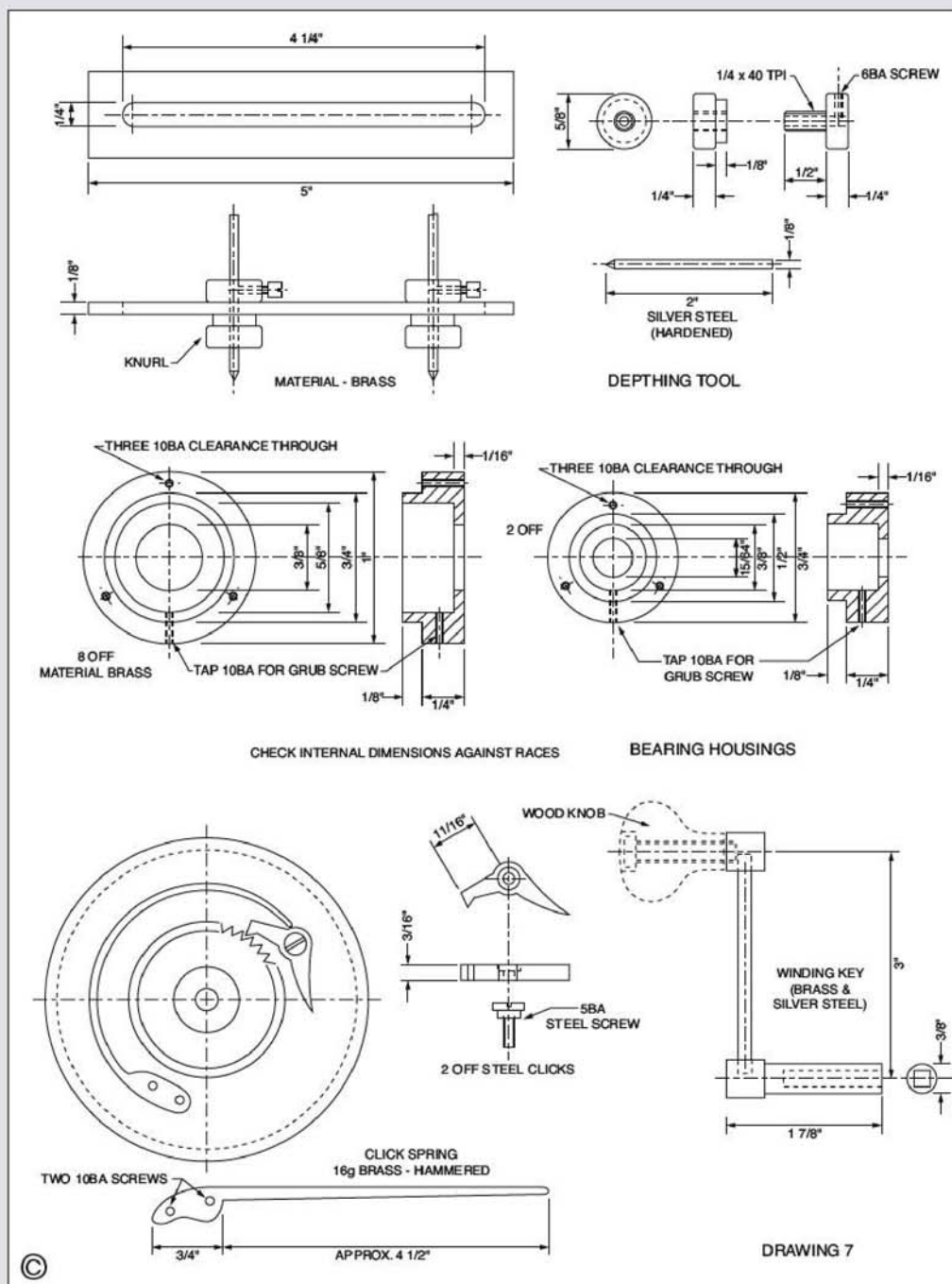
The last items also shown on drawing 5 are two collets for the ratchet wheels. The bore of these, either 1/4in. or 6mm, depends on the internal diameter of the ball races chosen. The seats must be a very good fit and the wheels can be Loctited or soft-soldered. The outer face will bear against the surface of the great wheel, so is best slightly undercut in the lathe for, say 1 1/4in. diameter. Two M4 or 2BA grub screws are fitted. The entire driving force to the movement is transmitted through these components.

### Depthing the wheel train

The next milestone of the project has now been achieved and so we must consider the 'depthing' of the wheel train. Only when this is completed, will we be able to finish the machining operations on the plates. The side section shown on drawing 5 and the general arrangement on drawing 6 shows the layout of the movement. To clarify further, the clock works as follows.

Motive power from the weights is transmitted via the 1 1/4in. dia. barrels, the ratchet wheels and the M0.8, 120 tooth great wheels to the 16-trunnion intermediate pinion. The M0.6, 120 tooth wheel attached to this transfers power to the 16-trunnion centre pinion. This rotates one revolution per hour. Fixed to the centre pinion is the 96-tooth centre wheel which engages with the 12-trunnion 'third' pinion. The 90-tooth wheel attached to this meshes with the 12-trunnion escape wheel pinion and this rotates once per minute in one second 'beats'. The escape wheel is of course, regulated by the pallets (controlled by the pendulum) locking alternately on to its 30 teeth. In case you are wondering, seen at bottom left is a third idler barrel, which only acts as a guide to get the weight line out of the way of the pendulum.

The wheels and pinions of a clock, in an ideal world, will mesh at their pitch circle diameters. Therefore, half the combined pitch circle diameter of the two gives the exact theoretical centre distance for the arbors. However, we clock makers



are realists and therefore use a 'depthing tool'. This not only makes marking out easy but actually also lets us run the wheels and pinions together at their optimum mesh before committing ourselves. Such a tool is shown on **drawing 7**. Although it is very simple it must, like all tooling, be well and accurately done. A number of bushes and spacers will have to be made in order to accommodate the various bore sizes of your wheels and pinions.

When you are satisfied that the scribes have been set to the appropriate distance to give smooth running of the components at proper engagement, strike an arc from the appropriate, previous centre pop across the relevant horizontal or vertical centre line. As a double check, and to boost confidence, there is no reason why a vernier measurement should not be taken across the scribes beforehand. In my experience, common errors tend to be too deep an engagement rather than the other way round. Do not be concerned about backlash. Everything only runs in one direction and there is constant loading.

The starting point is the centre wheel centre pop on the front plate  $4\text{in.}$  up from the bottom which you will have previously dealt with. The vertical line is obvious and the horizontal line for the great wheel centres is  $3\text{in.}$  up from the bottom, see drawings 1 and 6. Work upwards from the centre wheel point towards the escape wheel. Work down to the intermediate wheel centre. Then, work across and upwards both left and right to the barrel centres. The position of the idler barrel can be marked by measurement, this is  $\frac{15}{8}\text{in.}$  vertically downwards from the left hand main barrel. The mark will, in fact, come on the mid plate.

A further position can, with advantage, be popped in now, although it will be detailed much later with the motion work information. Again, we start with the centre wheel pop taking a line downwards to the right at  $45\text{deg.}$  to both centre and vertical for a distance of  $0.945\text{in.}$  by measurement. At this point, a 2BA clearance hole will be formed in the front plate only. Finally, the position of the pallet frame arbor should be marked by measurement of  $1.490\text{in.}$  above the escape wheel

arbor centre. Please, in addition, mark a second position  $\frac{1}{16}\text{in.}$  to the right, at the same vertical distances.

## Drilling, milling and trepanning the plates

Marking out completed for the time being, reassemble the sandwich including the back cock. I suggest using a new  $1\text{mm}$  dia. drill running at high speed to drill right through the stack at all positions centre popped, except the one for the 2BA tapped hole. This latter can be dealt with when the stack is taken to pieces again, as it only applies to the front plate. The centre wheel position, and all others below it, can now be opened up in stages to a reamed  $\frac{1}{4}\text{in.}$  diameter. There should be five altogether. On no account touch the  $1\text{mm}$  dia. holes above. Now take the sandwich to pieces again and deal with the 2BA tapped hole in the front plate to clear this out of the way.

We now concentrate on the mid plate and open out to  $\frac{1}{2}\text{in.}$  dia. the two main barrel passages on the horizontal line  $3\text{in.}$  up from the bottom. I use a homemade trepanning tool for this but see no reason why a good hole saw should not be used if more convenient. These are usually fitted with a  $\frac{1}{4}\text{in.}$  dia. guide drill. There is some tolerance here but avoid making the holes much larger; **photo 6** shows the openings.

The centre wheel position, in both the top and the mid plate, should be opened to  $\frac{1}{2}\text{in.}$  diameter. All the remaining  $\frac{1}{4}\text{in.}$  dia. reamed holes (clearly *not* the pillar holes) in all the plates require enlarging to  $\frac{3}{4}\text{in.}$  diameter. I have made a special  $\frac{1}{4}\text{in.}$  dia. accurate 'milling cutter' without cutting edges. The work piece is clamped to the machine table and the table adjusted until my plain 'cutter' will nicely enter the  $\frac{1}{4}\text{in.}$  dia. reamed hole on raising the table. I then lower the table, substitute an end mill of

the right diameter and machine through. The resulting holes tend to be very slightly oversize but this does not matter. Consistency is more important. These openings are for the ball race housings and show up clearly on **photo 6**.

I now refer to **drawing 2**. The  $\frac{3}{8}\text{in.}$  wide hatched area at the top of the mid plate can now be removed. Start with a  $\frac{3}{8}\text{in.}$  dia. hole at the true vertical centre line already drilled  $1\text{mm}$  diameter. On the front plate and on the back cock drill and ream  $\frac{5}{16}\text{in.}$  dia. on the centre line marked  $\frac{1}{16}\text{in.}$  to the right of true centre. These two holes will later accept eccentric bushes for the pallet frame arbor to allow fine-tuning. The plates and back cock should now be at the state pictured in **photo 6**.

The only remaining work on the frame, apart from final cleaning up and polishing, is lots of 10BA tapped holes for retaining the bearing housings and end stones plus some 5BA holes for retaining the eccentric bushes. These items will be described in the next part of this series.

●To be continued.

# MESSING ABOUT WITH INJECTORS

**Chris Leggo,**

in California, discusses the results of his experiments concerning the operation of these accessories.

**M**y manufacture of a batch of ten injectors was met with a modicum of success following my discovery of Laurie's series on these live steam accessories. Most of them worked but they only started at a minimum of 80psi, and none of them lifted. A second attempt (photo 1), made a few years later, turned out better. By opening up the overflow, lifting was of the order of 8-10in. Hg and the starting pressure was brought down to about 50psi on some.

A test rig which had been put together to design whistles was converted to test injectors (photo 2). The boiler was made about 30 years ago for a boat and is equipped with fire control which attenuates the propane flame when 120psi boiler pressure is reached. An artificial load was made to Bill Carter's design and delivers into a graduated canister. The feed pump is electrically driven through a variable speed gearbox. Except for mains supply, it is self-contained. The gauges indicate steam pressure, output pressure, and vacuum at two places within the injector.

The test on these 'Laurie' injectors involved attempts to start them at every 10psi as boiler pressure built up. After the starting pressure had been reached, starting was reliable up to maximum pressure of 120psi. They were then re-started at the maximum pressure and the dry range noted as the pressure dropped by shutting off the gas and turning on the feedwater. Dry working was over a range of about 50psi, generally from about 100psi to 50-60psi. Feeding continued until 20-30psi. Bill Carter's artificial load was used; this was quite necessary because I didn't want to keep blowing down the boiler.

Quite recently, a batch of injectors came into my possession which had been made some 30

*Laurie's injectors (lower right) are rated at 26oz./min. and are about 1 1/4in. long. The Japanese injectors turned out to be about 60oz./min. and are considerably larger.*

years ago in Japan to the design of a man here in California; this is also shown in photo 1. None of them worked and they sat on a shelf for many years, passed through a few hands, and by the time they reached me, there were enough parts for about 80 injectors. The combining cone had only one No. 53 (0.059in.) hole; orifice sizes were No. 56 (0.046in.), No. 53 (0.059in.), and No. 57

(0.043in.) for steam, combining and delivery cone; not a formula for success.

Five more No. 53 holes were added to the combining cones (photo 3) and new steam cones were made (photo 4), with a No. 50 (0.070in.) orifice sized by examination of popular ratios. Because there were no drawings, one of the bodies was sectioned to ascertain the correct size of the large end of the steam cone and the insertion (photo 5). The large end was sized for about a 0.006in. annulus. Either I was very smart, or very lucky, because they all now worked although they would not lift. But this is all beside the point. The purpose of this article is not to lay out instructions on how to manufacture injectors, nor can I claim to be able to reveal any secrets, but I can pass on some of what I learned in the process of making Laurie's injectors and getting some of the Japanese ones to work.

## Body

The central hole must be drilled small enough for the reamer to take a good cut (0.015in. or so) after brazing. Brazing can distort the body and if there is not enough material left, paths could be left for steam or air to get around the combining cone.

## Steam cone

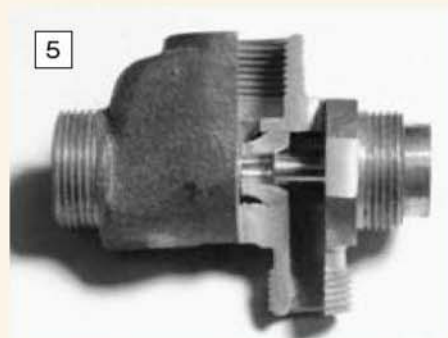
It is not necessary to taper the entrance to the orifice. A drilled hole up to the small end of the taper works fine and a straight land up to 0.030in. at the small end of the taper doesn't seem to hurt. Made to the proper dimensions, there is very little that can go wrong with a steam cone, but it can be tested with steam by mounting it on a dummy body and observing the pattern of steam. Photographs 6-8 show this for the cones I made for the Japanese made injectors.



*The original combining cone had only one hole. A drilling jig was made and five more of the same size were drilled.*



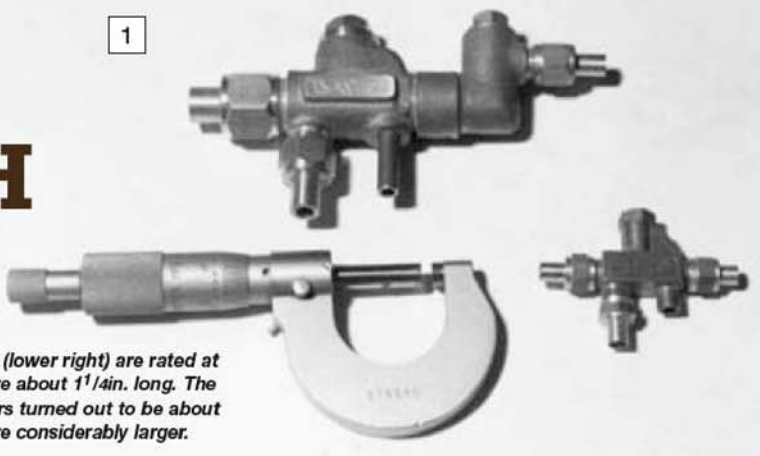
*The original steam cone (left) was considerably undersized. The injectors worked with a larger 9deg. cone.*



*A body with combining cone was sectioned to determine the diameter and insertion of the new steam cones.*



*The test stand is on a roller bench and is self-contained. The boiler is propane fired and the feed pump is electrically driven.*





**6**  
The new steam cone in a dummy body shows a good pattern, but with considerable water content when first opened.



**7**  
After a few seconds, the water starts to clear and the emanating stream of steam still has a good clean form.



**8**  
After 5 seconds, most of the water is cleared from the jet. Steam lines don't have to be lagged, but it helps to start an injector slowly to clear out water.



**9**  
With an injector complete except for the delivery cone, the output of the combining cone can be observed. This on a good injector at 25psi.



**10**  
At 50psi, the stream is looking better. There is considerable divergence, but this is a good operating stream.



**11**  
Nothing could get better than this. If you've got this, go ahead and put it together. This stream will go about 30ft. before hitting the floor.



**12**  
This 25psi stream is from an injector which did not work at any pressure. It is no more than a dribble.



**13**  
At 50psi, it is not much better. If you get this, remove the combining cone and start over again.



**14**  
At 75psi, this stream would be good for steam cleaning. It is just water and steam from a fire hose.

All the cones I made show the same pattern. It will be noted that at first the steam is quite wet and clears up after about five seconds. This wet steam does not seem to interfere with operation for all the injectors started immediately. There was one occasion, however, where I let the boiler overflow, the boiler was priming, and I could do nothing to make it start.

### Combining cone

If made in two pieces, it pays to mark both halves before parting them and to insert them into the body in the same orientation as they were cut so as to assure the alignment of the holes in the two halves. The combining cone is the critical part of the injector and can be tested before the injector is fully assembled.

Set it up in your test rig without the delivery cone and pointing out into a clear space. Watch what happens as you slowly open the steam valve. At first water will rather dribble out (photo 9). With more pressure a stream develops (photo 10) and at full pressure (photo 11), a very narrow coherent stream will emanate and with the injector set level, this stream will go for 30ft. before

hitting the floor. If you don't get this stream, the injector is not going to work and the fault is almost certainly in the combining cone.

### Output

There was no trouble with any of the output cones, but there is one feature of the output which is startling. Sentinel dump beds were operated by an hydraulic (water) cylinder and the pressure flow was supplied by an injector! I tried this and,



**15**  
Windows were cut in a body to reveal what was happening. It pumped, and the combining cone output could be seen entering the delivery cone, but things were very wet while starting.

sure enough, the output of an injector can be shut off completely and then opened up again without disrupting the operation of the injector. It will even pick up and start with the output valve closed, all of the injector's output going to overflow (more about that when we get to the *Dry Range*). The pressure on shut-off goes to about 1.5 times the boiler pressure.

A cut-away body was put together to study the action of the jet on the delivery cone (photo 15), but it was not a good combining cone and mostly all it did was to get me wet. Remember that these areas which were cut away are always at atmospheric pressure and the holes in no way interfere with the operation of the injector.

### Water:steam ratio

By knowledge of the states of the steam, feed water and the boiler feed, and the use of a heat balance, the ratio of feed water to steam can be determined. The following figures were taken from a typical run made with one of the injectors from the second run of Laurie's design.

Incoming steam:

Pressure = 80psi

Enthalpy = 1186 BTU/lb.

Weight =  $W_s$

Feed water:

Temperature = 60deg.F

Enthalpy = 28BTU/lb.

Weight =  $W_i$

Output:

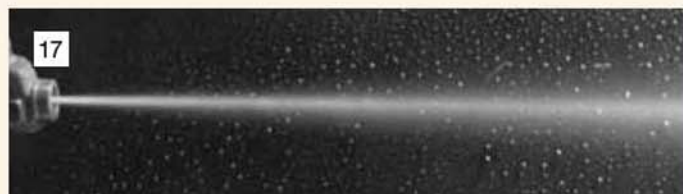
Temperature = 150deg.F

Enthalpy = 118 BTU/lb.

Weight =  $W_o$



With a proper working injector, the combining cone stream between 120 and 100psi is a mixture of steam and water. The injector still pumps, although there is overflow.



Between 100 and 40psi, the injector pumps dry; that is without overflow. This stream is not as good as that of photo 11, but is still satisfactory.



Between 40 and 20psi, the stream is somewhat ragged but the injector is still pumping, although with overflow.



Below 20psi, the injector has quit pumping. The stream is almost a dribble.

From the continuity equation:

$$W_s + W_i = W_o$$

heat balance without losses:

$$W_s H_s + W_i H_i = W_o H_o$$

and using the determined enthalpies:

$$1186W_s + 28W_i = 118W_o$$

Substituting  $W_s + W_i$  for  $W_o$  and gathering terms:

$$1068W_s = 90W_i$$

Solving for ratio of feed water to steam:

$$W_i / W_s = 1068 / 90 = 11.8$$

This figure will not vary much for any injector and the assumption of no losses seems pretty good, for the only losses are radiation from the steam and output lines.

### Dry range

In the process of looking at the output of the combining cone, it was striking that the changes of pattern were at about the same pressures as the end points of the dry range. Where there was high pressure spray, the injector ran wet, i.e., there was water overflow. Where the injector was in its dry range, there was a good narrow jet. At pressures below the dry range, there was a low pressure splatter. At the point where the injector quit working, the output was more of a dribble.

To test this, one of the better working injectors was first tested and found to have a dry range between 100psi and 40psi and a pumping range of between 120psi (boiler maximum) and 20psi. The delivery cone was then removed and the combining cone output observed throughout the pressure range by letting the boiler pressure fall from 120 to 20psi. The configurations of the stream were as shown in photos 16-19, the break points being at the places where a change in the operation of the injector occurred.

Between 120 and 100psi (with overflow), there seemed to be more steam than could be condensed by the available water (photo 16). Between 100

and 40psi. (the dry range), the stream was a good narrow output (photo 17). At 40psi the stream started to break up (photo 18), and at 20psi it was just a splattering of water, (photo 19). The pattern of output streams conformed exactly to the important points of change in the operation of the injector.

If you have a valve at the output of the injector, shutting it will cause the injector to overflow at any pressure. Conversely, releasing the pressure at the output will allow the injector run dry, regardless of the steam pressure. In the real world, an injector connected to a boiler will have a dry range according to the steam pressure in the boiler and the convolutions and restrictions in the output line.

### Injector capacities

Testing the pumping capacity of the same injector output between 40 and 100psi was of the order of 55-60oz./minute. Over 100psi (with overflow) it was about 35oz./min. and under 40psi, it was again about 35oz./min. until the injector quit at 20psi.

### Vacuum at the water inlet

If the injector is capable of lifting, vacuum can be measured at the water inlet fitting. Vacuum at the water inlet of the second batch of Laurie's injectors was on the order of 8-10in. Hg. If the injector does not lift, as is the case of the Japanese injectors, it is somewhat problematical. My first idea was to put a valve in the feed line, cut down the flow and measure the vacuum between the valve and the injector. The injector would not start! The hoses for water feed were 1/4in. inside diameter with restrictions of about 3/16in. inside diameter at the water tank and the injector input. The valve I used had an inside diameter of 5/32 inch. Removing the valve, the injector again started.

My second attempt was to merely squeeze the hose with flat nosed pliers. With a full diameter hose there was no vacuum reading. Squeezing the hose resulted in increasing vacuum up to about 12in. Hg where the injector quit.

Vacuum at the water inlet is of course necessary for lifting, i.e., for the injector to draw water up from a source which is lower than itself. Jim Ewins made injectors which would lift under the

most adverse of circumstances. He claimed to know the secret, but would not reveal it. I certainly don't know the secret but I can supply a good hint. The check valve must have good lift and the passage through the body must be free and clear to the overflow.

Try taking the ball check and cap out of the injector and see how much the lifting is improved. If it will still not lift, the problem is somewhere else, and I don't know the answers.

### Vacuum around the combining cone

After thinking about it a bit, this turned out to be very easy to measure. A proper sized nylon ball was drilled through and a brass tube fitted which extends through the overflow cap (photo 20).

The injector worked just as with the steel ball, (photo 21), and with the tube extending into the cavity around the combining cone, vacuum was measured directly at 26in. Hg! So you can see how important it is to have the combining cone a good snug fit in the bore.

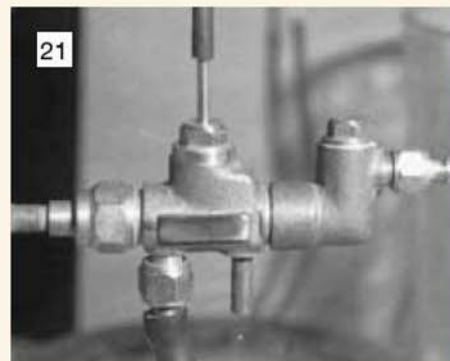
### Water line

At this point, the water line was taken off the injector, drained into a graduated flask at about 1ft. head and the flow measured at 40oz./minute. With the valve in place, the flow was 12oz./minute!

It has been said that free flow of water should be the same capacity as the injector, and it seems to be true. I do not mean to imply that all the injectors I put together were successful. Indeed, some were difficult to get to working, and I can't really tell what I did to get them to work; others were just failures. With the tools described by Laurie, Palmer, Carter, and Brown, injectors can be made by the amateur, but from my experience, at what pressures they work dry and how is a matter of the phase of the moon and how you hold your tongue.



The vacuum around the combining cone was measured with a brass tube pressed into a nylon ball (left). This probe did not interfere with the normal action of the injector. On test (right), the injector behaved just as if it had a steel check valve. The vacuum was measured at 26in. Hg!





**Keith Wilson**

describes the valve gear cradle and takes another look at boiler design.

●Part XIII continued from page 660 (M.E. 4185, 27 December 2002)

**When computers are good,  
They are very, very good,  
But when they are bad,  
They are horrid.**

I had just about finished the next set of Slogger/Logger drawings and printed all but the last one, when something happened; I know not what, but no way would that last one print. 'Twas all clear up to the last-but-one button press, the one that gives full print preview, but it showed up blank and although printer went through the motions, nowt appeared on paper. I spent about an hour trying just about every button, no other results. Previous drawings re-printed perfectly, thereby adding to the general confusion, but never the required one. Just about dead on my feet by then, I went to bed. Next day, things seemed no better, so I re-drew that last one and behold — perfect results!

Having been away for Christmas, no further drawing work was possible, so the cradle drawings should be treated as 'assembly' drawings only. I have not had time to look over the 5in. Logger drawings as well as I would have liked (and usually do) correcting for ridiculous plate thicknesses, etc., so please re-read the little poem at top of this page. The Christmas post has not helped either. I'm sorry to appear to keep on making excuses, but it is certainly not from choice.



Bearing end.



Right hand side of cradle.

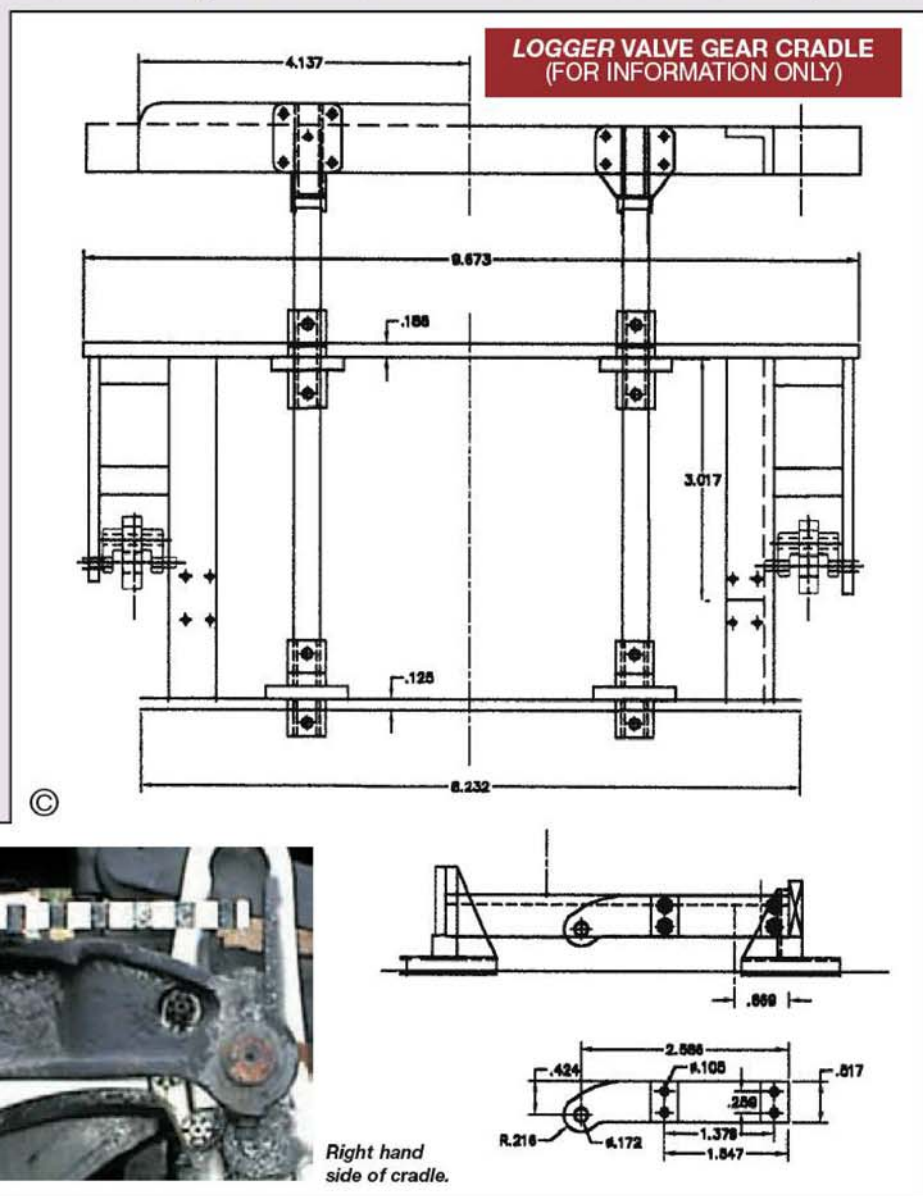
# LOGGER & SLOGGER AMERICAN TYPE 2-8-2 LOCOMOTIVES for 5in. and 7<sup>1</sup>/<sub>4</sub>in. gauges

I have tried to follow full-size construction as far as I can, and the lesson about wisdom after the event being firmly rammed home (ouch!), I cannot understand just how this cradle (I have to call it something) took me about two weeks to fathom, but it did.

Beginning with the brackets that mount it onto the frames, good parts to start with are the bases which form the basis of the brackets. It may not be obvious at first, but start with a 7<sup>1</sup>/<sub>2</sub>in. length of 5/16 x 5/8in. bright mild steel mounted in

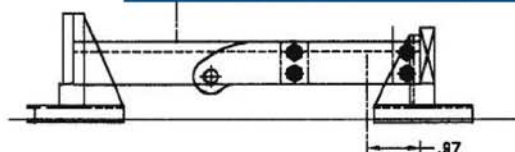
milling machine and cut two long slots in it 1/16in. wide and to the same depth, with a 0.341in. gap between if you are dead fussy, 11/32in. if not.

Then cut four cross-wise slots 7/16in. wide x 1/16in. deep, spaced out to get them in the right places at the finish. These slots are not essential, but will sure lighten your load later, so are recommended. Cut the big slot in the bottom, the better you match this to your frame thickness the better. To reduce the widths of these bases, do not take the lot off one side beforehand (which looks

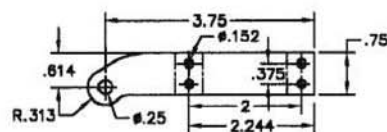




**SLOGGER VALVE GEAR CRADLE  
(FOR INFORMATION ONLY)**



Left hand  
side of cradle.



the easy way but ain't) but take half from each side. This will markedly reduce distortion of the strip as internal stresses are released.

If you don't believe me, take a piece of bright mild steel (BMS) about  $1/2 \times 1/8$  in. section and saw it along its length, then argue with me if you wish.

Make the vertical parts from  $1/4$  in. steel; it is not so necessary to cut  $1/16$  in. slots in these, but it helps. The larger of the two pairs of gussets are firmly recommended (now you know what the  $1/16$  in. slots were for), but the smaller ones are not so important; these brackets were castings on the original locomotives. Silver-braze the brackets together, and (but for the Christmas post) make up the rest of the cradle/carriage/mounting frames.

Note that nuts on studs fix the two outer parts of each assembly. If these are fitted carefully they might well hold together under the stresses of moving valve gear parts, but if in doubt fit a pair of dowel pins each side.

From the drawings, it looks as though plates were used, fabricating the cradle therefrom. From photographs it is clear that castings were used extensively. All well and good, but we have to recall the difficulties of spanner access, plus the difficulty of wangling the expansion links into place. You will see from the photographs that full-size were mounted differently anyway; the same argument applies. In our sizes they would be right pigs to clean up if cast; quite apart from getting them cast in the first place. So have a look at my drawings.

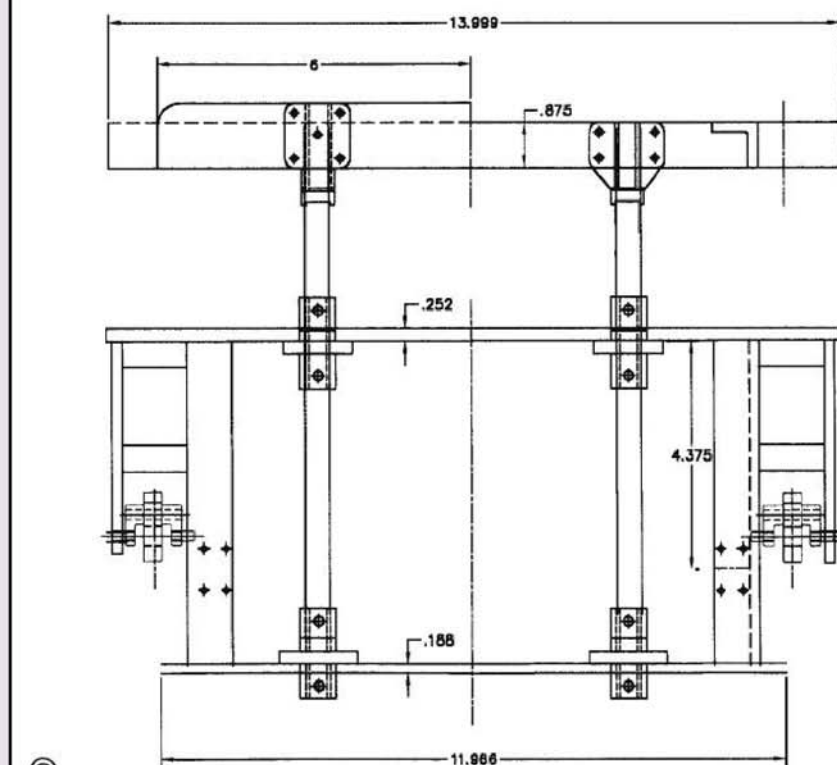
Note that the next beams inwards (those parallel to the frames) are made from angle which is not only stronger, but more able to take the bearings for the weighshaft.

I think that arc-welding or silver-brazing is best for assembling these girders/beams; either way, clamping them down flat first is needful. They are attached to the brackets by nuts and bolts for some other bits are to be added in due course.

There are two more brackets to be mounted by these bolts, these are bent-up rather than fabricated and support the boiler although they are most certainly superfluous in our size and I very much doubt that they were really necessary in full-size either. There is also a bracket at each end of the wider crossbeam to support the outer end of the guidebars.

The assembly of this lot on the frames is quite simple, although good accuracy will be required as well. If the mounting brackets be clamped to the assembly, the whole lot can be placed on top of the frames and adjusted until the brackets all semi-lock into place on the frame tops.

Clamp them down, drill and fit bolts for the brackets. Then, on slackening the clamps to the tops of the frames, the whole shebang can be juggled fore-and aft until it is in the right place relative to the drive centre. When you are satisfied with its location then drill and tap for studs into



the engine frames.

The weighshaft bearings may now be fitted, taking care to get the bores in line by using a piece of silver-steel to align them. You will probably — nay, almost certainly — find that as you tighten the bearings down, the weighshaft will stiffen. Badly. The easiest way round this problem is to determine which bearing is most at fault and by judicious use of a hand reamer, the erring bore can be 're-directed' appropriately. Shims also come to mind, the choice is yours.

### Boilers

The recent short series of boiler analysis has proved most interesting. It has been thorough, and as far I am aware has not been done before in these pages, although I could not absolutely swear to the second half of the year 1919!

I doubt if it was the author's intention, but it has given weight to the fact that boiler design, for us, can be reduced to a handful of general rules. For locomotive boilers, together with traction engine boilers are all very similar, it being generally nothing more than a matter of proportion between them. I am not for one moment suggesting that you re-work published design just for the hell of it, but if you are modelling a locomotive for which a design has not yet been published then

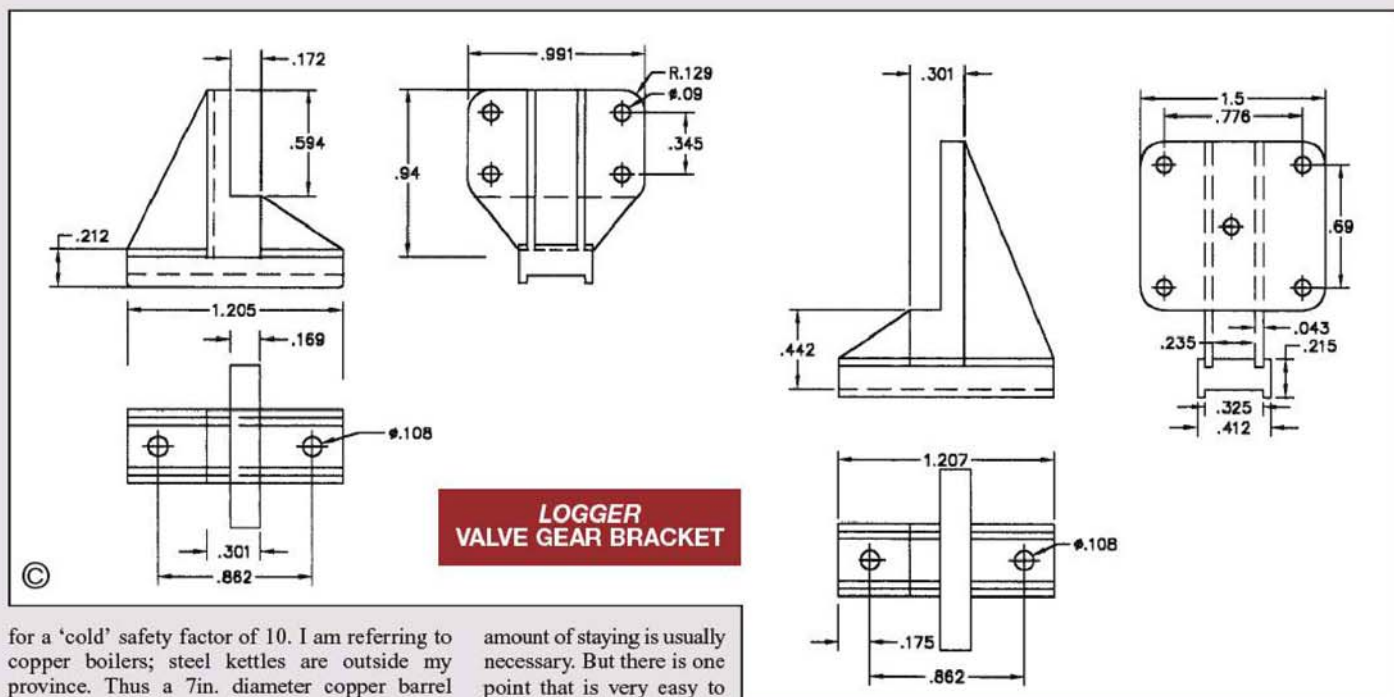
there is not much choice. It is of course highly likely that a boiler design very similar has been published, in which case a mere outline change is probably all that is required.

The first, and by far the most important decision concerns barrel thickness, for not only are the stresses on this item the greatest, but if it were to go off pop it would be the only way real damage is likely to be done; for the release is certain to be sudden. In fact, it is about the only way an explosion can result, for nowhere else are the stresses so high.

A boiler could fail by a stay pulling loose or breaking, in which case a good jet of water and/or steam could result, but this is most likely to be downwards into the fire, or possibly out of the backhead. In which case, certain portions of the driver's anatomy could be at risk (ouch!) or possibly extra steam and smokebox grit could be ejected violently up the chimnuck. But these failures could hardly be considered explosive.

Now, there's no way the boiler barrel could break in two, because the radial stress is exactly double the longitudinal stress, and the firetubes help in this direction, plus of course the long stays.

Calculation of the plate thickness for a given barrel is remarkably simple. Pressure times diameter divided by 700 gives the required thickness



for a 'cold' safety factor of 10. I am referring to copper boilers; steel kettles are outside my province. Thus a 7in. diameter copper barrel aimed at 100psi. working pressure should be  $\frac{1}{10}$ in. thick. The proportions are all linear, so 60psi. working pressure would mean a 0.06in. barrel thickness. But I sincerely hope that no-one will be so bigoted as to deliberately design, build, and operate a boiler to the lowest possible parameters, for what would be the use?

Obviously (I hope!), no sane person would purchase the next larger commercial thickness and hammer it down, so round off this figure upwards to the next commercial size and use that. In the UK it is far easier to get metric than imperial sizes, so 3mm is the order of the day; this works out to 0.118in., which is as close as you are likely to get. For the average  $\frac{7}{16}$ in. gauge boiler, 4mm is just about right, within a thou or so, it is  $\frac{5}{32}$ in. and just about perfect.

Under no circumstances should the outer shell of the boiler be thinner than the barrel. So most of your plate thicknesses are settled once and for all. It is a matter of personal choice whether the firebox 'inner' should be one size 'thinner', I can see no great advantage or obstacle one way or t'other.

The other problem is stay spacing. Now, flat surfaces under pressure are fairly weak and a certain

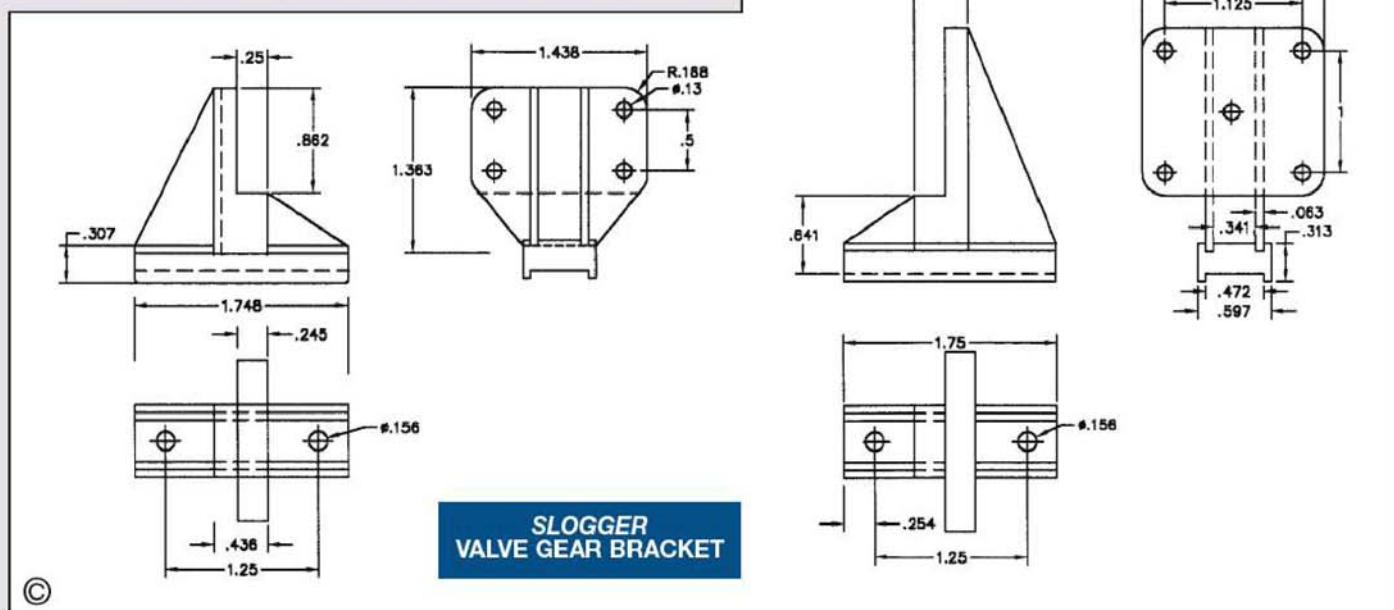
amount of staying is usually necessary. But there is one point that is very easy to miss, in fact I did not realise it until a few years ago, when in an article Ted Martin mentioned that he had witnessed a 4 x 4 x 6ft. steel oil tank withstanding an internal pressure of well over 100psi. This caught me off guard at first; I thought he was either joking with a major leg-pull or right off his rocker. However, on thoughtful cogitation I realised that directly a pressure is applied to a flat plate it will distort. No longer flat, the whole scene changes for it obviously bulges away from the applied pressure and is then a curved plate, mostly in tension rather than bending stress. It is thus far stronger, by quite a large factor.

I doubt if anyone would suggest stay diameters less than either plate thickness, so stay spacing promptly reduces to a function of plate thickness, although it is safest take stay diameter into account. Stay spacing reduces to  $11t$  or  $5D$ , where  $t$  is minor plate thickness and  $D$  is stay diameter, whichever figure turns out to be the least. For a 5in. gauge boiler, short  $\frac{1}{8}$  or  $\frac{5}{32}$ in. stays, the latter being better. Go for  $\frac{3}{16}$ in., for a small  $\frac{7}{16}$ in. boiler and straight to  $\frac{1}{4}$ in. for larger boilers.

Do remember that compared to a plain stay, a screwed stay is markedly weakened by the thread it carries, whose core diameter is relatively small. I suggest there is no better short stay than a round-head rivet, head inside the firebox, through a clearance size hole to allow for penetration of the silver-brazing; thus No. 27 for  $\frac{1}{8}$ in. stays, No. 17 for  $\frac{5}{32}$ in., No. 8 for  $\frac{3}{16}$ in., and  $\frac{17}{64}$ in. for  $\frac{1}{4}$ in. stays.

If you do have to produce your own design, then it is better than a good idea to get it vetted by someone with experience. Even if you have to cough up a fee, the money will be well spent and a very sound investment indeed. I recall a case where John Short and myself were asked to quote for a fairly hefty  $\frac{7}{16}$ in. boiler which had been beautifully drawn up by an obviously professional draughtsman. There was just one flaw; it had girder crownstays, but they were specified as 20swg. i.e.  $\frac{1}{32}$ in. thick. Any questions?

●To be continued.



1 Based at the Ifrain Alfonso sugar mill is the largest locomotive working on the island, a 1925 Alco 2-8-2.



# AMERICAN STEAM IN CUBA

**Andy Probyn**

of Maxitrak takes us on a trip to the sugar mills and plantations in Central America.

Having seen the American *Logger* locomotive currently being described in *Model Engineer* by Keith Wilson I thought readers might be interested in some background information on these engines, many of their features being rather alien to normal British practice.

I am not a great expert in things American but have had the pleasure of visiting one of the last strongholds of working US steam in Cuba. Here, in the sugar cane cutting season, one can experience authentic railroading in all its glory, from diminutive shunters to giant heavy freight engines. **Photograph 1** shows the largest engine working in the island, at Ifrain Alfonso sugar mill. She is an Alco 2-8-2 of 1925 and is just slightly larger than *Logger*; note the missing dome cover. This photo was taken in March 2000, as she prepares for a day's work on this steeply graded line. Another interesting feature of this location is a level crossing over the motorway

controlled by a person with a very small red flag!

One of the first things I found totally different from our usual way of operating is the oil firing. This is not the quiet clean operation to be found on the oil fired Ffestiniog Railway engines in Wales. In Cuba the engines burn local crude oil, which is thick, black and sticky. It has to be warmed with steam from the engine to get it to flow to the burner. The engines become covered in a good coating of oil as does everything and everybody, including those in the cab! One of the strangest things to come across is an engine in steam but with the fire completely out when the crew have gone for a coffee break.

On their return a piece of old cloth is lit and shoved into the firebox and the burner turned on with some degree of trepidation! When oil and fire meet there is an almighty 'woof' of flame in the firebox, black smoke erupts from the chimney and rapidly covers the scenery in a thick pea soup fog. The oil is then turned full on with a chest rumbling roar as flame plays around the fire door and ash pan, vibrating in unison with the burner. This is really something to see and quite unlike anything to be found on a coal fired engine.

If the engine is working hard, then the burner will be kept full on, but usually it is just used in short bursts to maintain pressure. A keen photographer can usually persuade the crew to put on a good show of 'clag' by twiddling an imaginary oil valve and waving the camera about! **Photograph 2** shows loco number 1829 giving a good idea of the general mayhem as she heads empty cane cars back to the fields. Note the oil tank in the front of the tender. She is a Baldwin built 2-8-0, one of eight similar engines working at the large Ciro Redondo mill in central Cuba.

The chassis and suspension are quite different on these engines, cast bar frames are used with fully equalised suspension. Even the pony trucks are equalised, in the case of the front one this involves a single large bar pivoted under the cylinder block and cranked up over the pony truck axle. When you look at the state of some of the track you can see why this is necessary, any self respecting British engine would be off the track in an instant! The springs only work as a shock absorber, almost all the movement being taken up in the equalisation linkage as the engine rides the humps and hollows in the track.

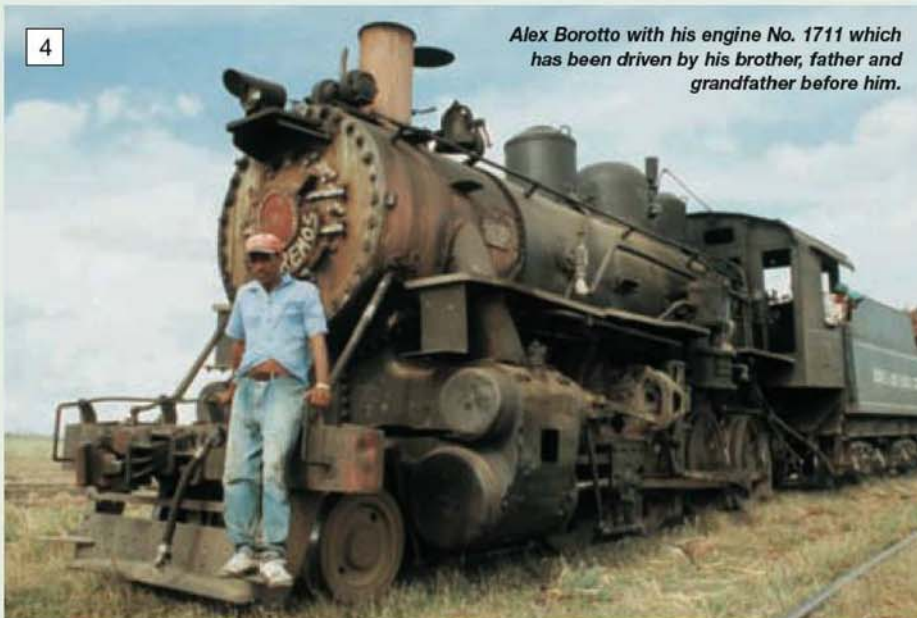


The crew of No.1829 put on a spectacular display for the photographers.



A discarded cylinder assembly lies derelict at Grandma mills.

Alex Borotto with his engine No. 1711 which has been driven by his brother, father and grandfather before him.



Another interesting design feature is the way the cylinders are cast in with half the saddle as shown in photo 3. This is a scrap set of cylinders seen at the quaintly named 'Grandma' mill. Here we have an impressive piece of casting incorporating all the steam and exhaust ways as well as the valve, cylinder and saddle. Only on piston valve engines do we have the separate steam pipe running down from the smokebox. This gives a much more direct run for the steam rather than circuitous route to be found cast into the slide valve cylinders. It is not uncommon to get cracks or damage to the base of this casting, one particular narrow gauge engine has its saddle held together with large iron straps and long bolts!

Photograph 4 shows Alex Borotto, with his engine number 1711, an Alco 2-8-0 built in 1920. This engine was driven at the Boris Luis Santa Coloma mill by his brother, father and grandfather before him. Despite the engine's rather run down look I can vouch for the fact that she goes well as I have driven her myself on a couple of occasions. Many of the features

previously outlined are seen on this locomotive along with the usual headlight, smokebox door plate and maker's plate. The shape of the maker's plate mounted on the side of the smokebox gives a clue as to the builder. Baldwin plates are round while Alco use rectangular plates, this is not foolproof as engines from other makers such as Porter, Vulcan and Davenport are also to be seen.

Photograph 5 shows a slightly smaller engine than *Logger*, a 2-6-2 also built in 1920 by Baldwin. It is unusual to see side valve cylinders being used on an engine of this date. She is seen at Ciudad Caracus mill in 1998.

I hope that this brief excursion to Cuba will give readers an insight into the workings of these engines and encourage them to have a go at something a little different!



A 1920 Baldwin 2-6-2 with side valve cylinders, photographed at Ciudad Caracus mill in 1998.



## TRADE TOPICS

### 'Big Screen' Digital Calipers from JBG (J. & B. Groves Ltd.)

Many model engineers have already discovered the convenience and versatility of using digital calipers. There can be little doubt that the facility to determine external and internal diameters/widths over the range of the caliper is quick, easy and if done carefully, very accurate. New owners soon discover the additional convenience of being able to use these calipers for depth and step measurements, the former by using the narrow blade which extends from the end of the beam during use, the latter by using the step behind the measuring head.

The ability to switch between metric and

imperial measurements with a direct and accurate conversion allows the user to work in either system on a machine tool calibrated in the other.

The facility to zero the caliper reading at any chosen setting is particularly useful when determining the amount of material remaining for removal during machining operations.

The ON/OFF switch ensures optimum battery life.

Measurement is facilitated by a convenient knurled thumbwheel and the head can be locked in any desired position by means of a handy clamp screw.

For many users, the large size digits of the LCD display will be a major attraction of these particular digital calipers. No less than 7/16in. high, they are particularly easy to read.

Supplied complete with instruction sheet, sealed in a polythene bag and presented in a moulded plastic fitted foam-lined case with



desiccant pack and spare battery (1.5V SR44 or equivalent), these 150mm calipers are available for £44.95 inclusive of VAT, carriage and packing (UK) from JBG (J. & B. Groves), 226 Whitehorse Road, Croydon, Surrey CR0 2LB; tel: 0208-665-1041; fax: 0208-684-2523; e-mail: enquiries@jbgroves.freemove.co.uk

# A HEINRICI HOT AIR ENGINE

**Mike Thurgood,** in South Africa, finishes work on the power piston and its yoke before checking out a second trial assembly.

●Part VII continued from page 655 (M.E. 4185, 27 December 2002)

The power piston and its yoke were supplied as a one-piece CI casting, waisted between them. These parts involved quite unexceptional lathe machining tasks. They were machined more or less to the original drawing, but I didn't pare down the yoke nearly as much as is indicated on the drawing.

The dimension which requires special attention is the piston diameter and I took to heart advice given in the instruction sheets for constructing the Robinson hot air engine as supplied some years ago by the Alyn Foundry in Wales. The recommendation was to machine the power piston such that, on inserting it in its cylinder and closing one end, the dry piston slides down only very slowly. Get that right and you have got the optimum fit for a hot air engine! This is the third I have constructed that has proved the point. However, it is as well to carry out the test where, in case of any error, the piston can fall on to something soft!

I could well imagine that if this fit isn't right then the engine will not run at all well, if indeed it will run at all. Finally, I machined three oil grooves in the piston. To determine that these oil grooves are really effective would require lots of experimenting. I wonder if any readers have positive proof of their advantages?

With quite a lot of components now finished, and with the 'A'-frame mounting studs in position, it was time for a second trial assembly, which is shown in photo 38. This photograph was taken before I had drilled the air holes shown in photo 31 (M.E. 4185, 27 December 2002) so the photos are not in strict chronological sequence. So, at last my project was beginning to look something like the Heinrici hot air engine it is meant to be! The work to this point had taken me some 3-4 weeks to complete, and I certainly do not regard myself as a super-fast worker.

At this point I shall discuss in more detail the material I used for the displacer cylinder and its piston. As mentioned earlier, and with reasons, I decided to use thin walled (approximately 1.5mm) 316 stainless steel tubing with a longitudinal internal seam weld.

There is a local supplier and although seamless tubing is available,



*The third assembly of the components which now include the flywheels and 'A'-frame raising blocks. The tapped hole with the shallow counterbore for the outlet fitting from the water jacket can be clearly seen, and also the extended stainless steel crank pin, made deliberately longer than necessary in anticipation of using it somehow to drive a water pump, an idea which was later abandoned for an alternative drive mechanism.*

it is made to a considerably greater precision and is therefore more costly. Such precision is not necessary for the Heinrici displacer cylinder and its piston.

Metric sizes only are nominally available, so I chose two sizes which matched the diameters and diametral difference to give the required annular displacer clearance — at least what I thought was the case according to Westbury's drawing.

The average I/D of the larger tube I used is 47.9mm, and the average O/D of the smaller tube is 44.8mm. The average difference of 3.1mm gives an average annular gap of 1.6mm.

Westbury's *actual drawing* specifies copper tubing with the displacer cylinder I/D given as 1<sup>3</sup>/<sub>4</sub>in. (46mm), and the displacer piston O/D as 1<sup>9</sup>/<sub>16</sub>in. (40mm), giving a 3.00mm annular gap based on these *quoted* dimensions. The millimetre equivalents are as given on the drawing.

But I wonder: when I recalculated the millimetre equivalents of the imperial dimensions, 1<sup>3</sup>/<sub>4</sub>in. = 44.5mm and 1<sup>9</sup>/<sub>16</sub>in. = 39.7mm which give an average annular gap of 2.4mm. I give up! I'm very glad that I didn't go too deeply into these dimensions right at the beginning or I may have been struggling in my attempts to obtain the right size tubing when, in the event, the engine ran perfectly well with those I did choose. But, as stated elsewhere in this series, with no control against which to make a comparison under running conditions, I do not know what annular gap would optimise the efficiency of the engine.

That there is an optimum for a particular situation is clear and presumably it can be determined mathematically knowing the diameters of the displacer cylinder and piston, the distance through which the air moves, its viscosity at the normal operating

temperature, the differential temperature between the hot and cold ends of the displacer cylinder, air movement hysteresis effects, and so on. This is likely to involve a complex calculation which would require the services of an expert to define an appropriate equation for the system.

My next task was to finish off the displacer cylinder and piston by silver-soldering stainless steel end caps in place. I had a source of flat

bottomed dished pieces of thin (about 1mm) stainless steel from a local stainless steel automotive silencer manufacturer, slightly larger than the final diameter required. I turned male and female matching formers from imbuia, an exotic hardwood commonly used for furniture in South Africa, to finish off two of these flat bottomed dishes to produce rounded dish-shape discs. The wooden formers and a finished disc are shown in photo 39. The excess metal was cut from around the discs, leaving a slight excess on their diameters for silver-soldering to the two tubes.

Photograph 40 shows the displacer piston tube with its dished end alongside. Since the disc had to be reduced to the O/D of the tube after silver-soldering, I first externally chamfered the end of the tube to provide an external fillet of silver-solder. I reckoned that if I had made



*Male and female wooden formers used to press the stainless steel end caps for the displacer cylinder. Squeezing a stainless steel disc between these formers in a vice produced the required curved dish shape, one of which is shown at lower left (see text).*

40



*The displacer piston tube with its end cap ready for silver-soldering. The latter was reduced to the tube O/D after silver-soldering so as not to obstruct gas flow in the annular space between the displacer cylinder and piston, this end of the tube was therefore externally chamfered to provide a good fillet of silver-solder (see text).*

an internal chamfer I couldn't have guaranteed a good fillet of silver-solder on the inside — but I could be quite wrong about that, of course.

Photograph 41 shows the displacer piston with its silver-soldered end disc machined to match the tube O/D. The contrasting bronze-coloured fillet of silver-solder shows up clearly.

Prior to silver-soldering the second disc onto the end of the displacer cylinder tube, the required length of the latter had to be determined to give a gap of about 2-3mm from the bottom end of the displacer piston when at the lowest point of its stroke.

However, the gap between the top of the displacer piston and the top inside the insert when the former is at the top of its stroke had first to be adjusted to between 2-3mm. There was no big deal in doing this because it merely involved checking the exact position for drilling the hole through the end of the piston rod for the crosshead pin in the connecting rod.

Once this had been determined and the relevant parts reassembled, determining the length of the displacer cylinder tube to give the required gap at its bottom end was not difficult. The various books

on the subject of hot air engines make the point that both gaps need to be kept small to minimise any unnecessary unswept volume of gas in the system, which reduces efficiency.

The last job on this tube before silver-soldering it to its concave capping disc was to machine the tube end to approximately the angle at which it rests on the disk.

Because the capping disc for the displacer cylinder doesn't foul or obstruct anything, its finished diameter wasn't critical, all that was necessary was to true it up in the lathe after silver-soldering. There was therefore no need to machine any external chamfer to house a fillet of silver-solder on the end of the tube because there would be an external fillet in any case.

Excess disc material was turned off after silver-soldering, leaving the disc diameter about 4mm greater than the tube O/D. Unfortunately, I forgot to photograph the finished cylinder.

### Soldering stainless steel

Making a further digression at this point, it may be of interest to consider the matter of silver-soldering stainless steel, whether to itself or to other metals including mild steel, brass or bronze, I have been told on more than one occasion that this task can be very difficult. Whether this applies to specific grades of stainless steel I don't know. I still have some stainless steel grade silver-soldering flux left from a batch purchased from Whiston's a very long time ago — how that name sticks in one's mind!

Whenever practicable, I put pieces of silver-solder on the joint, with the flux, of course, to ensure that I don't overheat the work. Alternatively, I will place lengths of silver-solder along or around the joint. As soon as the silver-solder melts at one spot I know that I have reached the appropriate temperature. But a clue that you are getting there is indicated by the flux being the first to melt to a mobile liquid. At this point, either more silver-solder can then be applied to the joint, or the flame from the blowtorch run

41



*The displacer piston tube with its dished end silver-soldered and trimmed. The displacer end cap received similar treatment but without the need to be reduced to the tube diameter as it didn't obstruct anything and an external silver-soldered fillet could therefore be left in place (see text).*

along the joint to melt the pieces of silver-solder already in place.

Doing the job in the way that I have described above hasn't failed me yet, but maybe there are grades of stainless steel I haven't yet come across which don't behave so well.

Stainless steel scores considerably over copper when silver-soldering with a propane/air torch since the former doesn't require so much heating to reach the required temperature because of its relatively poor heat conducting properties.

Although Whiston's are no longer in business, I can obtain supplies of the right grade of flux from my local BOC Depot in Paarden Island. Fortunately for me sources of all sorts of model engineering type materials are abundant around Cape Town and its environs. I really don't know how a model engineer copes if he lives, say in the middle of the Great Karoo in South Africa, maybe 4-500km from the nearest large industrial city. The worst British equivalent I can think of would be a model engineer living in the Shetland Islands where each and every need becomes the subject of a major expedition.

●To be continued.

## LETTERS TO A GRANDSON

**M. J. H. Ellis**

**describes the operation of the double-current differential-duplex telegraphic system.**

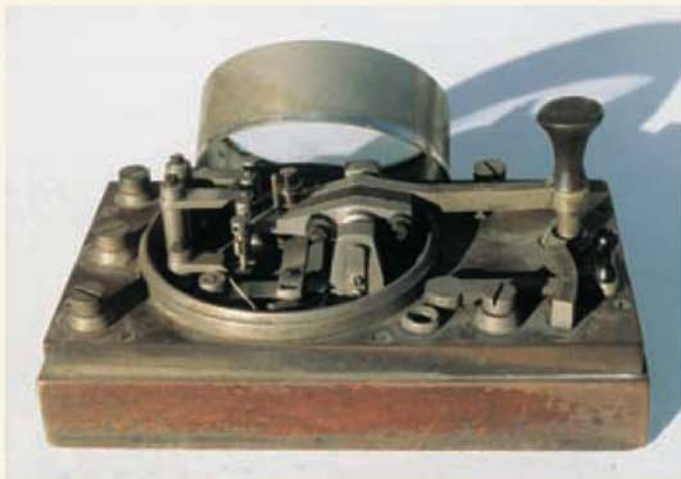
●Part XLVII continued from page 651 (M.E. 4185, 27 December 2002)

Dear Adrian, in this letter I intend to explain what to some people must be the mystery of how the Quadruplex telegraph works. To begin with, we shall consider the 'A side', ('side' means 'channel') which, duplexed to work in both directions, works by reversing the direction of the current. It is an example of 'double current' working, which we have not encountered before, in which the spacing signal is current in one direc-

tion, and the marking signal is current of equal magnitude, but in the opposite direction. Double current working is not unique to the Quadruplex, and in fact it could be used to advantage over a line which worked simplex (one direction at a time) or duplex. In the case of a long land line, or a submarine cable, having a considerable electrical capacity, the reversal of current at the end of a marking element helps the line to discharge rapidly in readiness for the next marking signal, and so enables the speed of signalling to be increased very substantially. Because keys which reverse the direction of the current, instead of merely interrupting it, are required in double current working, they became known as double current keys.

There is a possible source of confusion which it would be as well to clarify at this point. I shall use the designations 'A' and 'B' in three different

contexts, and I don't want you to get confused between them. First, Station A and B, merely the two offices between which the line runs. Secondly, relay A and relay B, which form part of the apparatus at both terminal station of a Quadruplex system. The A relay has two separate and identical windings, and it is of the polarised type, which means that the stronger current in one of its windings (the effect of which may be diminished by an opposing weaker current in the other winding) must be in one particular direction for the relay to operate. The B relay, on the other hand, will similarly operate to the resultant current, i.e., the single current which would have the same effect as those flowing in the two windings together, no matter what its direction is, but only if it is sufficiently strong. Finally, there are the A and B 'sides' or channels, both duplexed in the



Double-current key with glass top removed.



Double-current key with glass top in place. (Author's collection)

Quadruplex, the A side using the A relays and the B side the B relays.

How do you simplify something complicated? Answer, by dividing it into a number of smaller pieces. That piece of Grandpa-wisdom has innumerable applications. Let us apply it to the study of the Quadruplex by considering first the A side in isolation. In fig 1 I have shown the elements of a double-current differential duplex circuit, which is all that the A side amounts to. As in all these diagrams, for the sake of simplicity, I have only shown the relays; it is to be understood that relays operate contacts, which in this case close a local circuit to operate the sounder. And don't forget, the key to understanding double-current operation lies in the direction of the currents in the coils of the differential relays.

We can now turn our attention to the operation of the circuit, and I was about to do so on the basis of the batteries at the two stations being of equal voltage. However, I realised that while such an explanation was all that was needed in the case of the duplex *per se*, it could be objected that in the case of the quadruplex, the battery power might very well differ at the two stations in the ratio of as much as 1:3 either way by the operation of the B side, so that the explanation would no longer be valid. As a matter of fact, it does not matter at all if the voltage is different between the two ends, and if you get the feel of how the double-current differential works, you will see that it depends on the balance of the relays being altered, and it does not really matter by how much.

I have therefore made no assumption about the ratio of the voltages of the two batteries, apart from it being a positive number; positive, because the batteries are connected the same way round, i.e., in opposition. As a matter of fact, the system will work just as well if one of the batteries is reversed, provided that the relay at the other end is reversed also, and that was actually how the British Post Office worked it, although for the moment I can't figure out why.

So let us assume that the battery voltage at Station B is  $n$  times greater than at Station A, and that at Station A, the local battery produces a current of  $i$  mA in the compensation circuit, which includes coil 1 of the relay. (I don't intend to be a purist and repeat 'milli-amps' each time, but I do want you to know that I know better). Then at Station B the current in the compensation circuit will likewise be  $n \times i$ . These currents will always be the same in magnitude, but will be reversed in direction when, and only when, the key at the same station is depressed.

We have four different cases to consider. Suppose we start with both keys normal. At Station A, current  $i$  flows in coil 1 of the relay. In the line circuit, which includes coil 2, the batteries are in opposition, so the effective voltage is  $(n - 1) / 1 = (n - 1)$  times as great as that produced by Station A battery alone, that is,  $(n - 1) \times i$ . Both currents are in the non-operate or 'spacing' direction, so the relay does not operate.

At the B Station, the same current in relay coil 2 flows in the operate or 'marking' direction, but the current in coil 1 in the spacing direction,  $n \times i$ , over-powers it, and so this relay also remains unoperated.

Now let both keys be depressed. All the currents are reversed, with the result that the relays now both operate. If that seems a bit too facile, the detail is: at Station A, current  $i$  now flows in coil 1 in the marking direction. In coil 2, the current of  $(n - 1) \times i$  also tends to mark, so the relay operates. At Station B, the current  $(n - 1) \times i$  in coil 2 now tends to space, but the current  $n \times i$  in coil 1, now in the marking direction, has the upper hand and causes the relay to operate.

What if K1 at Station A is depressed while at Station B K2 remains normal? As the battery at Station A is reversed, the two batteries now unite to produce a current  $(n + 1) \times i$  in the direction Station B to Station A in the line, which, flowing through coil 2 at Station A in the spacing direction,

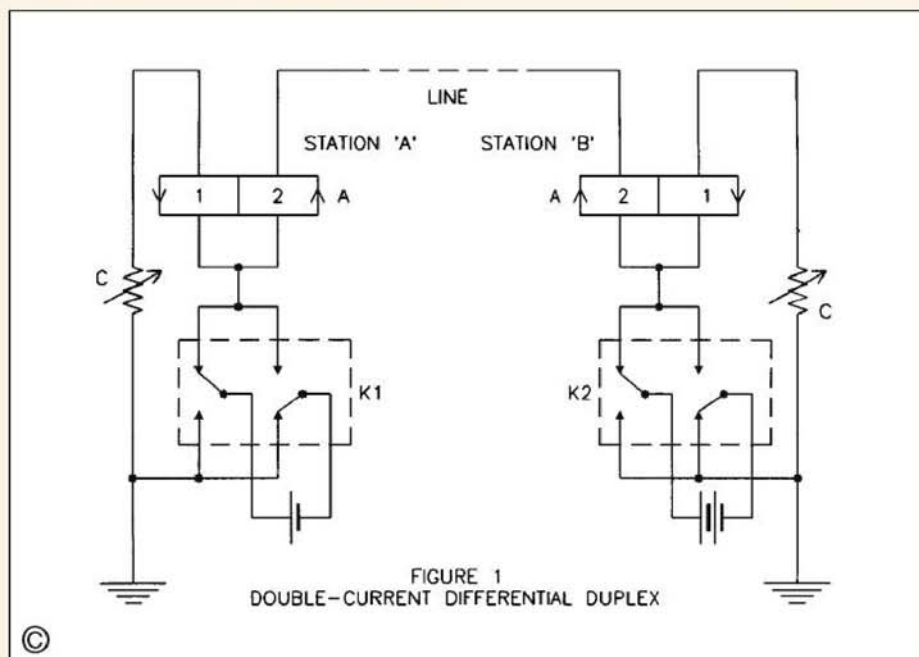
overcomes the current  $i$  in coil 1 (now in the marking direction). Station A relay therefore remains unoperated. At Station B, the marking current in coil 2 exceeds the spacing current in coil 1, so this relay now operates.

Finally, there remains the case where Station A's K1 is normal and K2 is depressed at Station B. Actually, it is covered by the last paragraph, since the value of  $n$  was left undefined, and it could just as well be a fraction, such as  $1/3$ , less than 1. (This is supposing that in what has gone before,  $n$  was greater than 1). Anyway, I will spell it out for you. Station B's battery reversed is now aided by Station A battery, where the line current is  $(n + 1) \times i$ , and flows in relay coil 2 in the marking direction. It exceeds the spacing current in coil 1, and so the relay operates. At Station B, the greater current,  $(n + 1) \times i$ , flows in coil 2 in the spacing direction, and, exceeding the marking current ( $n \times i$ ) in coil 1, prevents operation of the relay.

After that marathon exposition, I should think that you feel that you deserve a rest. Whatever you may think, I feel that I do! There isn't much space left, and I will use it to tease your Dad. Tell him that I have just had a letter from a chap I was in the army with. He tells me that he is the proud owner of two Nortons, a 'Featherbed' and a 16H. Watch pop's face!

Your affectionate, if mischievous, Grandpa.

●To be continued.



*A train headed by John Romanes' big Santa Fe diesel heads out towards the badlands from the green and gives an idea of the sort of terrain the railway traverses.*

# NEW ZEALAND UPDATE

**Alan Bibby**  
visits some other centres of model engineering interest and previews the 2004 MEANZ Convention.

●Part II continued from page 657  
(M.E. 4185, 27 December 2002)

In the previous article we covered the biennial convention of the Model Engineers' Association of New Zealand (MEANZ). We now move further afield to a few of the many other centres of model engineering and railway interest in the country, and give a preview of the next MEANZ Convention, to be held at Hamilton in the North Island in January 2004.

Our first port of call is to Manu Ariki Marae, home of a Maori community in central North

Island. A marae, pronounced 'ma-rye', is strictly speaking the open area in front of a 'whare hui' or Maori meeting house, and has great spiritual and cultural significance for the Maori peoples. In practice the term is often used to refer to the whole of the village including buildings and other facilities, and we use the term in this sense here. Manu Ariki occupies an area of about 200 acres of very rugged terrain surrounding a flat central area in which the elders decided some years ago to build a railway, as a further diversion and interest for those living there.

The Ikon Locomotive Works in Auckland was contracted to build a small 'figure of eight' layout in 7 1/4 in. gauge in the central flat area of the marae, the village green in effect. So pleased were the residents with this development that even before it was finished the elders commissioned a much bigger extension climbing out to the

boundaries of the site at an elevation of 50ft. above the starting level and with a total length eventually of three kilometres!

Cultural gatherings are held at the marae from time to time, and on these occasions the model engineers are usually invited along with their steam locomotives to augment the two diesel electric prime movers based there.

David Giles, owner of the Ikon Locomotive Works, had arranged for a number of model engineers to have the use of the track as a prelude to the MEANZ Convention, and the author was privileged to be a member of this group.

## Spotlight on Christchurch

One of the finest club houses anywhere is the proud domain of the Canterbury Society of Model and Experimental Engineers in Christchurch, half way down the east coast of South Island. ►



Ben Corney and Ian McKay prepare the Yellow Phantom in the steaming bays at Manu Ariki.



Rowan Little drives the gas-fired Shay through a cutting near the top of the route.



A view from the boundary fence looking down on one of two major bridges.



The interior of The Canterbury Society of Model & Experimental Engineers' club house; note the photocopyer, AV equipment, model display and Roll of Honour.



The Canterbury SMEE's library, or rather part of it: the stairwell and mezzanine floor out of view to the right of the photograph are lined with yet more books and magazines!



Left: Canterbury SMEE's plans for a new ground level track on a much bigger site at the Agricultural and Pastoral Showgrounds site are at an advanced stage.



Above: a mock-up of the bendy points planned for the Canterbury SMEE's new track at the Agricultural and Pastoral Showgrounds.

The club possesses several complete, or almost complete, sets of *Model Engineer* as well as a huge collection of books and videos on every possible topic related to model engineering. Members log their own borrowings in a card index, and the system works well.

Canterbury SMEE currently operate an elevated track and boating pond at Andrews Crescent in Christchurch, but there is little scope for further expansion, and plans are well developed for a new ground level track on a much bigger site at

the Agricultural and Pastoral Showgrounds site a few blocks away. It is hoped that this exciting and ambitious new development, will be completed in time to host the 2006 MEANZ Convention, tentatively titled CANMOD 2006. Further details may be found on their website [www.rcmodels.com/clubs/csmee/index/html](http://www.rcmodels.com/clubs/csmee/index/html)

### Building bridges

Manu Ariki is not the only place in New Zealand where you will find impressive bridges on

miniature railways. In our earlier series on the country we showed pictures of equally impressive structures at Keirunga Park and Blenheim, and accompanying this feature are two more; one at the Raumati Beach track of the Kapiti club, and another at Manakau Live Steamers near Auckland.

### Things to come

The next MEANZ Convention will be held at the Forest Lake tracksite of the Hamilton Model Engineers Inc. between 8-12 January 2004 and will be launched under the banner 'Steam and Steel'. The site contains two tracks with a total length of 1,600 metres catering for 3 1/2, 5 and 7 1/4 in. gauges at ground level. The track follows an interesting scenic route including a number of tunnels and bridges and a crossing of the lake, and work is still going on developing the project in preparation for the convention.

Points are controlled by the driver and the



This nice log construction is at the Raumati Beach track of the Kapiti club.



The viaduct at Manakau Live Steamers near Auckland.



The next MEANZ Convention is to be held at the Forest Lake tracksite of the Hamilton Model Engineers Inc. and here is an aerial photograph of their track.



This 'big' engine is a New Zealand Railways Ka class No. 942, 4-8-4 wheel arrangement, built in the NZR Hutt workshops near Wellington.

site is well equipped with the usual supporting infrastructure of club house, toilets, steaming bays, off-loading facilities, power and water supplies. For the convention a full catering service will be available and the usual range of tours and excursions to places of interest in the locality will be arranged, and the usual range of merchandise will be available.

Further details are available from the organisers on (0064)-7-8551927, or by e-mail from [bandv.clark@xtra.co.nz](mailto:bandv.clark@xtra.co.nz)

### And finally, a 'biggy'

Nigel Bruce is a New Zealand Railways Ka class, No. 942, 4-8-4 wheel arrangement, built in the NZR Hutt workshops near Wellington and entering service in November 1940. Originally built as a coal burner the locomotive was converted to run on heavy oil at Hutt in 1948, and up to her recent withdrawal for a ten year inspection she had completed 944,532 miles in service. The front cowling serves to hide the ACFI feed water heaters which

proved costly to maintain and were removed in the late 1940s.

It was not the practice of New Zealand Railways at the time she was built to name locomotives, and she was given the name *Nigel Bruce* by her present owner, Ian Welch of Mainline Steam, in memory of his son who was tragically killed in a motor accident. Ian, through Mainline Steam, owns the largest private collection of steam locomotives in the world, and has depots at Auckland, Wellington, Christchurch and Dunedin.



### Available again! Fine Art Prints by Geoffrey Wheeler

With his magnificent range of steam locomotive and traction engine portraits in full colour, Geoffrey Wheeler set standards that have yet to be surpassed. Based on research using official works drawings and photographs, each subject is "... detailed

down to the last rivet." Following service in the GWR drawing office at Paddington and subsequent training as a wireless engineer in the Royal Navy, he went on to develop a career as a Technical Illustrator. In the 1960s he produced the intricate cut-away drawings in the much lamented boys paper *EAGLE*. Working in a small studio in his back garden, Geoffrey pioneered techniques with an airbrush, and as a result he produced a magnificent range of steam locomotive

and traction engine portraits from which prints were taken and marketed worldwide during the 1970s and 80s. Geoff became a Member of the Guild of Railway Artists, when he was pleased to be referred to as a 'Master of Locomotive Art'.

Following their retirement, Geoffrey and his wife Enid moved to a working windmill

in rural Suffolk where they were devastated by the destruction of the mill's sails during the great storm of October 1987. Geoffrey died after a short illness on 15 October 1995, coincidentally the anniversary of the great storm.

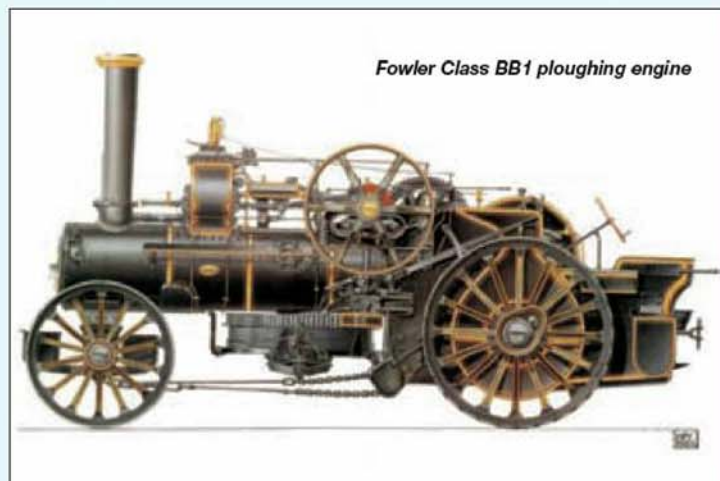
The Wheeler family is proud to re-launch Geoff's prints once again, with a new web site [www.wheeler-prints.co.uk](http://www.wheeler-prints.co.uk) Prints will also be available by mail order with a full list and brochure obtainable by telephoning 01379-687780 (24 hour answer service). It is hope to extend the range of prints further during 2003 with locomotive subjects including *Flying Scotsman*, *Duchess of Sutherland* and GWR 4-6-0 *County of Middlesex*. Complementing these, further road steam subjects could include Aveling and Porter steam tractor and Burrell scenic showman's road locomotive *Quo Vadis*.

The Wheeler family is proud to own most of Geoff's original artwork and the collection is available for exhibition and display in museums and galleries. Geoffrey possessed a wonderful sense of humour and produced numerous cartoons which were published in daily papers in the 1960s, which would make an amusing volume in their own right.

Write to Wheeler-Prints, The Windmill, School Lane, Bardwell, Bury St Edmunds, Suffolk IP22 2JX.



LMS No. 6201 Princess Elizabeth



Fowler Class BB1 ploughing engine



A batch of sturdy VM-B milling machines ready for final inspection in the Myford plant and subsequent delivery to their lucky owners.



An example of the latest version of the MG12 precision cylindrical grinding machine. Beautifully made and finished.

# A VISIT TO MYFORD LTD.

## Neil Read

reviews the current range of machine tools available from this very long established and popular machine tool manufacturer.

If you were to make a survey of the various makes of lathe in use in model engineer's workshops around the UK, and maybe even the world, then the chances are that one name would tend to crop up more than any other: Myford. This is not surprising as Myford lathes, in their various forms, have been in production since September 1934. Christopher Moore, the current managing director of Myford Ltd. and grandson of the founder, the late Cecil Moore, estimates that approximately 300,000 model ML7 and Super 7 lathes have been produced. The Super 7, with various regular updates, has been in production for nearly 50 years, which is a remarkable achievement for any commercial product and must rank as a true test of the soundness of the basic design as well as the materials and workmanship put into it.

The world has changed considerably since the 1930s and Myford Ltd. has had to change with it. To get up to date with the company, David Fenner (Editor, *Model Engineers' Workshop*) and I took advantage of Myford's Open Week (19-25 October 2002) and travelled to Beeston to tour the works and chat to the management and staff.

Myford's current range of products is as follows.

### Super 7 Sigma Plus

This machine is the simplest variant of the Super 7 concept currently offered by the company and features a headstock equipped with the latest 1in. dia. bore spindle, poly-V drive and countershaft clutch but is supplied without power cross-feed arrangements or provision to fit it. A quick-change screw-cutting gearbox is available as an extra, together with other options like flame hardened bedways.

The spindle nose design features a locking device to allow the machine to be run safely in reverse without the chuck unscrewing. The top slide can be swung through 360deg. and adjustable indexes are fitted to the top-slide and cross-slide feed screws. Machines are sent out with  $\frac{3}{4}$ hp motors and the necessary switchgear to meet current safety regulations. The machine can be supplied with imperial or metric top-slide and cross-slide feed screws.



The substantial VM-E milling machine is equally suitable for both hobby and light industrial use.

### New Super 7 Plus

This machine has the same basic specification and options as the Sigma Plus but is fitted with power cross feed as standard.

### Super 7B Connoisseur Vari-Speed

This top-of-the-range machine is supplied with the equipment of the Super 7 Plus model but has the added refinements of variable speed spindle drive and flame hardened bedways as standard. The electrical variable speed device, together with the back gear and countershaft step pulleys, provides variable speeds between 26-3000rpm and operates from a standard 230 volt, single phase power supply.

### VM-B Mill Drill

This bench type vertical boring and milling machine is shown in photo 1 and is available in standard and vari-speed formats. The main feature of this machine is the substantial cast upright that carries the milling head. This form of construction is considered stiffer and superior to the

tubular column usually offered on this class of machine tool. The table size is  $19\frac{1}{2} \times 57\frac{7}{8}$ in. and the spindle is offered with either a R8 (standard) or No. 3 Morse taper. Power feed to the longitudinal table axis is available as an extra.

### MG12 cylindrical grinder

Shown in photo 2, this is the latest in a long line of grinding machines made by Myford. The government asked Myford to build grinding machines, designed by Churchill and Wolf and for valve re-facing operations, during World War Two. This experience led them to build their own grinding machine in 1947 called the MG9. This small, light machine evolved into the MG12 in 1954. The latest version of this machine is offered in several forms ranging from manually operated to full CNC control and can be supplied as a cylindrical grinder for external surfaces, a bore grinder or as a machine capable of both types of operation.

The provision of the Fanuc CNC provides simplified control and permits operations like the grinding of tapers and radii without additional equipment. Wheel dressing operations are automatically compensated for in the machine control. Workpiece accuracy and precision can be further enhanced by fitting optional Marposh in-process and/or post-process gauges. This is, perhaps, not a machine of immediate interest to the model engineer but one that appeals to all branches of industry and, over the years, has brought Myford valuable export earnings.

### VM-E milling machine

This much larger, floor-standing, milling machine (photo 3) is also offered in standard or vari-speed formats. The  $30 \times 71\frac{1}{8}$ in. table offers substantially more capacity than its smaller stable mate while the 1hp drive motor provides sufficient power for the model engineer working on larger models, or the small industrial user. The spindle in this machine is only offered with an R8 taper. Power feed to the longitudinal table axis and a digital read-out system are also available on this machine.

### Mystro II woodworking lathe

This machine may be of less interest to the readers of this magazine but is a dedicated, simple wood turning lathe offered without the range of accessories that characterised its predecessor, the ML8. This has been brought about by the advent of low cost, specialised planers and saws that



**Hand scraped saddle casting for a Super 7 lathe. The distinctive scraper marks are unique to the fitter who made them.**



**Tools used by Myford machine tool fitters, at the top left is the master surface for checking fit, at bottom right are examples of the scrapers used.**

have rendered such accessories largely obsolete.

Of the above metal working machine tool line up, only the milling machines are imported. The metal working lathes and the grinders are made in the Myford factory in Beeston. The milling machines are made in Taiwan under conditions of strict quality control. Batches of machines are inspected upon arrival and are rejected if they do not meet the required standards.

Some readers will, I am sure, mourn the passing of other models of machine previously in the range. There must be many ML7s, ML10s and 254s serving their owners as well as they ever did. These good folk should take comfort from the fact that a parts service exists for these machines. Indeed, as part of their business Myford Ltd. rebuild second hand ML7 and Super 7 lathes for resale in their showroom.

### Open Week

So, those are the products and services currently offered by the company. As part of the Open Week activities, visitors are invited to tour the factory to see the machines being made. Chatting to the employees is encouraged so that the prospective purchaser, or simply curious visitor, can understand the skills and techniques that go into making these machine tools. Myford Ltd. is aware that any one of their current range of machine tools represents a considerable investment for the average model engineer. Those that spend their money on a Myford machine need to know that the machine they get will be fit for the work intended.

The manufacturing process starts with the selection of the castings. Castings for Myford lathes and grinders are made in the UK from materials of known chemical composition veri-

fied by regular analysis. The castings are aged prior to machining to minimise problems with distortion. The machining is then carried out on the premises by skilled personnel. However, even the most carefully machined or ground surface will have minor imperfections that will tend to prevent correct contact between a spindle and its bearing or the mating halves of a slideway.

In common with most builders of quality machine tools, this situation is remedied at Myford by skilled fitters who hand scrape the relevant surfaces (photo 4). This process not only provides a perfect fit but also permits the correction of any small errors in the alignment of the machine tool introduced during machining. An added bonus is that the scraped surfaces tend to spread and retain oil so they help lubrication too.

The hand scraping method of fitting bearing surfaces together is an extremely old method of bringing two surfaces to a fit but it is still the best and commonest method (photos 5 and 6). It is in use all over the world and individual fitters can recognise their own work, or even that of their colleagues, by the final pattern imparted. This is still possible even after the machine has seen some use, provided the scraper marks are still visible. In skilled hands the process can, if necessary, provide a contact between two touching surfaces that is gas tight. It is, however, very labour intensive and is therefore costly in this day and age.

The excellent stiffness of the new headstock design was demonstrated by means of a parting off demonstration using an Iscar 'throw away' tip parting off blade in an adjustable rear tool post (photo 7).

One of the features of Myford machines for many years is the excellent paint finish. As most

of you who have made equipment for use in your own workshops will know, finishing castings to a good, durable finish is not as easy as might be supposed. Myford's approach has developed in line with improvements in paint technology. Stove enamel and cellulose based paints have come and gone and today's paint is an acrylic preparation applied in a special paint shop. Of course, the topcoat is only the end of the story.

Before the castings receive that they are carefully filled and flatted down so that when the topcoat is sprayed on it flows out to provide that lovely glossy finish. What's that? What is the story behind the new colour scheme (photo 6)? Well, the aquamarine colour was chosen to differentiate the new range of machines. It is not to everyone's taste but is here to stay for the foreseeable future. When Myford switched from battleship grey to green in the 1970s questions were almost raised in the House of Commons. These days, brightly coloured machines are more common and most companies strive to find a colour that sets them apart from their competitors. I personally rather like it and I am sure it will grow on those less convinced. If you really cannot live with it, for an additional charge Myford will paint your new machine what colour you like.

Our thanks to Christopher Moore and his team for making this visit possible. We certainly enjoyed it and judging by the reaction of the other visitors, they did too. Full details of the equipment mentioned in this article are available from Myford Limited, Wilmot Lane, Chilwell Road, Beeston, Nottingham NG9 1ER; tel: 0115-925-4222, fax: 0115-943-1299, website: [www.myford.com](http://www.myford.com), e-mail: [sales@myford.com](mailto:sales@myford.com) 



**Scraping the bearing bush in a Myford Super 7 headstock to ensure a perfect fit with the front tapered spindle bearing surface.**



**A high speed parting-off demonstration to show the stiffness of the new Myford headstock design and ancillary tooling.**

# CLUB CHAT

With Stan Bray

## UK News

A number of committee changes were approved at the AGM of the Model Steam Road Vehicle Society when some of the longer serving members declared their wish to stand down and take a break from their duties. Among these were Chairman Tony Putterill and President Frank Pockett. Charles Symons and Barry Coyston are the new Chairman and President, respectively. With no volunteer to replace Ross Thompson who has had to stand down for personal reasons, the post of Safety Officer remains unfilled. It was proposed that the position be delegated to any member willing to undertake this arduous and important role, and it is hoped that a suitable volunteer will come forward. One of the Safety Officer's major tasks is safety at the Annual Rally which this year will be on 28/29 June and is already at the planning stage. To augment the many attractions for the public at this event, the organisation of some form of entertainment is proposed for members staying overnight, or perhaps just very late on Saturday evening.

Members of **Basingstoke DMES** are facing uncertainty regarding the future of their track and headquarters. We would hasten to confirm that the society is fine but that with three years to run on their present lease, the future is unclear and is further complicated by the fact that the land they use is rented through what amounts to a third party agreement. Proposals to expand facilities by building a 7 1/4in. gauge track and possibly a boating pond have to remain on hold. Any renewal of their lease will be for a relatively short period, making such construction work impractical, for on completion it will no doubt be necessary to attempt to renew their lease for another comparatively short period. We all know only too well how quickly three years pass, and can understand why serious consideration is being given to alternative accommodation either for purchase or for which a long term lease is available. Similar problems are confronting other societies and even some at present on long term leases are approaching renewal with uncertainty about their future. **Peterborough SME**, for example, is now only able to renew for two years at a time, despite having occupied the ground for two or three decades. They are not unique and as time goes on, unless societies can purchase the land they require, the situation is likely to become more diffi-

cult than ever and present a major threat to this aspect of our hobby.

On a much happier note we can inform readers that the 2003 *Sweet Pea Rally* will be hosted by **Lancaster & Morecambe SME** on 14/15 June, with the track and facilities open on the afternoon of 13 June for the benefit of those with a long way to travel. Situated at the Cinderbarrow Picnic Site 3 miles north of junction 35 of the M6 Motorway, the site with its track and clubhouse is signposted. Light refreshments will be available with a barbecue on Saturday evening, while a nearby hostelry can supply more substantial meals if and as required. The society's lease does not permit caravanning or camping on site, but a suitable site is available only 50 yards from the entrance. In order to make the necessary arrangements, the club asks prospective visitors to make contact, if possible by the end of January. Would-be visitors are asked to contact club Chairman, Malcolm Ford at 12 Windermere Park, Windermere, Cumbria LA23 2NB; tel: 015394-44726; e-mail [mandtford@btopenworld.com](mailto:mandtford@btopenworld.com)

The latest **Bournemouth DSME** newsletter features many photographs showing the excellent progress which has been made with work on the new track and facilities. Most impressive are a new building, complete with toilets and a large patio area for picnics and other activities. There is also a walkway and unloading facilities for models; the track too is rapidly taking shape. The local authority arranged temporary storage facilities for club equipment, including the contents of the library, all of which have now been moved to the new site.

A recent evening meeting of **Wigan DMES** was devoted to tool sharpening. It was particularly interesting and instructional, especially for members with no engineering background. Topics included the sharpening of drills and all sorts of milling cutters, presented by members who described their own methods. It is easy to forget that many of us engaged in the hobby have no formal engineering background and for whom the sharpening of an ordinary twist drill can be a complete mystery. A time-served engineer may be able to tickle up the tip of a drill without thinking about it, but without the use of a jig, the uninitiated would approach the task with some trepidation. The meeting provided an opportunity for the mysteries to be revealed by experienced members, some

having brought along cutter grinders of various types, most of which were home made. There were so many jigs and machines on show than it was impossible to discuss them all, but the evening certainly proved most enlightening for a great many members.

The annual **Stamford MES** competition for the *Ralph Ley Rose Bowl* involved the exhibits on the club stand at the Midlands Model Engineering Exhibition, was judged by Dennis Monk and won by John May with his 5in. gauge Beyer Garrett locomotive. A worthy winner, this model has attracted a great deal of attention whenever John has shown or run it at any event. The society recently enjoyed an illustrated talk by Mary Matts on the subject of traditional painting of canal boats and associated artefacts, a very specialised form of decoration which is in danger of becoming a dying art form. During a most enlightening evening, she also dealt briefly with canal history and the life of the barges.

The 2002 running season ended on a high note for **Hereford SME** when they hosted the **Southern Federation MES** autumn rally. A total of 44 locomotives attended from over 30 different societies across the UK from Sunderland in the North to Romney Marsh in the south and Devon in the west. The locomotives ranged from a tiny 3 1/2in. gauge 0-2-2 to a 7 1/4in. gauge GWR King, and only 5 were non-steam, which rather bucks the present trend. Clive Young, Southern Federation Vice Chairman, together with Graham Rayner, last year's winner, and Pete Fenn from the host society, judged the participants for the annual award of the trophy presented by the **Australian Association of Live Steamers**. Tony Newberry from Devon with a 7 1/4in. gauge model of *Thirlestane Hall* was adjudged the winner and was presented with the trophy by Warren Williams, an AALS committee member in the UK on a visit who seized the opportunity to attend the rally. Prior to the big day, members had worked to separate the arrival and departure areas at the station, which was most useful during the rally and no doubt will also prove its worth during the coming passenger hauling season when it is anticipated that a new signalling system will also be in operation. Two further projects planned for the near future include the construction of a garden gauge railway track while the second, details for which have not yet been finalised, is the building of a non-steam club locomotive.

Members of **Reading SME**

marvelled at the way 90 year old Joe Challis was able to intertwine two lengths of stranded wire without increasing the overall diameter at the splice during his talk and demonstration on rope splicing. Joe acquired the skill in the days of steam ploughing when, unlike the splicing of ropes where it is permissible to increase the overall diameter at the splice, this is not practical, as the wire has to lie accurately in the winding drum. The whole evening was recorded on video and will be available for members to view as required. Despite the weather, activity on the outside track has progressed; two members have been working to reinstate the 2 1/2in. gauge rail, one having donated the steel to do so, work which has to be co-ordinated with the replacement of concrete beams that support the track.

In his end of year report, John Baker, Chairman of **Chingford DMEC**, detailed a number of improvements which mainly relate to what might be considered as civil engineering work, including levelling a carriage shed floor, re-laying paths, improving the disposal of waste water, and installing several new water points. Two club locomotives are being built, as well as some special lightweight rolling stock for the ground level track.

**Bedford MES** has purchased a tail lift as fitted to large vans for conversion to a rise and fall platform to facilitate loading and unloading of models, a purpose to which it will rapidly convert when cleaned up. In recent months, the society has suffered three break-ins and although little was stolen the intruders left the place in a mess and did considerable damage, all of which had to be cleared up by the members. Security lights and alarms have now been fitted to all the buildings and Bedfordshire Police have been invited to use the site for training and exercising their dogs which it is hoped will deter would-be intruders. On a positive note, the club has signed a new lease giving them security of tenure for the next 10 years.

Vandals have been known to gain access to the **Rotherham DMES** track site by climbing onto the roofs of the clubhouse and workshop. In an attempt to prevent this, the local council erected barriers which regrettably did not do the trick for in no time the culprits had demolished them and things were back to square one. More substantial barriers have been erected which, it is hoped, will do the trick and some of the graffiti which defaced the walls has been removed. Members are hoping to be able to extend the ground level track

## In Memoriam

It is with the greatest 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.

Charles Goodwin

Stan Massey

Ernie Moore

Bob Polge

Tony Reason

Neville Sanderson

Donald Taylor

Ted Wade

Hereford SME

Sutton MEC

Chingford DMEC

St Albans DMES

Birmingham SME

Kinver & West Midlands SME

Rotherham DMES

Hereford SME

and have devised a possible route before engaging the services of a surveyor. If the survey is satisfactory, approaches will be made to the council and others for permission to proceed. The new venue for club meetings is the Atlas Hotel, Bawtry Road, Brimsforth and the annual exhibition will be held at the Rawmarsh Leisure centre.

To celebrate their 40th anniversary in 2002 **Kinver & West Midlands SME** published a booklet detailing highlights in the history of the society. A special 24 hour run organised last year in aid of Guide Dogs for the Blind raised enough money to buy two dogs. One of the prime movers behind the event was Reg Berry who sadly passed away shortly afterwards, but one of the dogs is to be named Reg in his honour, while the other will appropriately be called Loco. A suggestion by one member that the second dog be called Engineer so that in the event of it hearing a plover it could make a bolt for the door, appears to have been turned down out of hand!

Members of **Mid Wales SME** will be using their portable track in support of the annual Tom Rolt Rally organised by the **Tallyllyn Railway Preservation Society** on 25/26 May. This year, the event has been expanded and will include a steam rally with a display of models and room to run model road vehicles. There will also be a large collection of vintage road vehicles, including a number of Crossville buses. Anyone wishing to exhibit should contact Anthony Coulls, 31 Horseshoe Lane, Bromley Cross, Bolton BL7 9RR;

tel: 0161-606-0116 (daytime); e-mail [a.coulls@msim.co.uk](mailto:a.coulls@msim.co.uk).

A good attendance characterises **Birmingham SME's** annual National Locomotive Rally; this year 40 or so locomotives were present at some time during the two day event. We understand that a large number of non-steam powered models ran, which confirms a modern trend within the hobby as noted earlier. The usual excellent supply of refreshments was again available and those who stopped overnight in a tent or caravan were also able to enjoy Saturday evening's socialising. All part of an ongoing drive to enhance safety on site, to prevent children from pushing the two turntables round at speed, it has been suggested that they be fitted with inertia brakes (the turntables, not the children, but ...). It is also proposed to fit protective screens to the hydraulic lifts, and stops to prevent them from descending to the ground to trap the toes of the unwary.

## World News

### Canada

An extensive display of models by the **Ottawa Valley Live Steamers** was well received by visitors to Railfair 2002 and although there was inevitably an emphasis on steam locomotives, a good selection of

other model engineering items was present. The display was supplemented by a number of films and videos showing past and present society activities.

Any reader contemplating a visit to Canada this year may wish to note that **British Columbia SME** has advised us of some items of special interest. The annual Ramble 7 June - 8 July is a series of outings from Train Mountain to visit a number of preserved railways, model engineering societies and privately owned tracks. During the annual Train Festival 8-10 August **British Columbia SME's** extensive track will be available for the use of visitors. The society will also have an Easter meeting 18-21 April to which visiting model engineers are welcome. These all complement normal Saturday and Sunday running when members are delighted to meet and entertain model engineers who call in and make themselves known. A raised 3 1/2 and 5in. gauge track under construction is unlikely to be available in 2003. Anyone seeking further information should contact Lindsay McDonnell by e-mail at [lindsaydmc@telus.net](mailto:lindsaydmc@telus.net)

### New Zealand

An event organised by **Southland SME** in aid of the Foster Care

Association proved popular with visitors who were entertained, not only to rides on the trains but also by marine enthusiasts who operated their models on the pond. The boating enthusiasts also put on a good show during the Great Little Train Show and arranged for spare boats to be available for visitors to operate. This proved to be so popular that queues formed, with people keen to try their hand. Members paid a visit to **Gore MEC** in November and were delighted when Gore member Lyall Simpson arrived at the meeting on his full sized Burrell Traction Engine. Although basically a social evening, the opportunity was taken to discuss the latest health and safety regulations at which it emerged that **Gore MEC** had been visited by an inspector when operating their portable track, and that their set up had passed his scrutiny with flying colours.

Health and Safety Regulations appear to be absorbing much time and attention from societies in New Zealand in a situation where clubs are subject to rules designed for large companies. Members of **Otago MES** have spent much time and energy working through the Regulations to find numerous anomalies and have sought clarification from the Inspectors. As they stand, the Regulations appear to require any incident involving a mechanical failure to be reported to the Health and Safety Inspectors within 48 hours; there seem to be many similar items to be resolved and hopefully some common sense can be written into the Regulations.

## CLUB DIARY

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

### JANUARY

- 24 **Colchester SMEE**. A. Grose: *History of Hertford Locomotive Depot 1843-1960*. Contact L. G. Hammond: 01376-511686.
- 24 **Hereford SME**. AGM. Contact John Arrowsmith: 01432-265151.
- 24-26 **Meridienne Exhibitions**. *The London Model Engineering Exhibition at the Wembley Exhibition Centre*. 10.30am-6pm (Fri/Sat) 10.30am-5pm (Sun). Adults £8, Senior Citizens £7, Children £5, Family (2+3) £21. Enquiries: 01926-614101.
- 25 **Chesterfield MES**. Running Day. Contact Mike Rhodes: 01623-648676.
- 25 **Hornby ME**. Family Day - Boiler Inspection. Contact Ted Gray: 9484-7583.
- 26 **MELSA**. Australia Day Run. Contact Graham Chadbone: 07-4121-4341.
- 26 **Steam LS of Victoria**. Working Bee and Barbecue. Contact Graham Plaskett: (03) 9750-5022.
- 27 **Bedford MES**. Oddball Tooling. Contact Ted Jolliffe: 01234-327791.
- 27 **Hornby ME**. Meeting - Social - Australia Day. Contact Ted Gray: 9484-7583.
- 28 **Chelmsford SME**. Video Night. Contact D. Blake: 01376-324205.
- 28 **Sutton Goldfield MES**. Meeting. Contact Roger Timings: 0121-308-5875.
- 28 **Wigan DMES**. AGM. Contact John Chamberlain: 01744-882255.
- 29 **Birmingham SME**. Peter Jackson & Friends. Contact John Walker: 01789-266065.
- 29 **Chingford DMEC**. Small Working Models. Contact Martin Masterson: 0208-989-5552.
- 29 **Teesside Small Gauge Rly**. Meeting. Contact Bill Foster: 01642-710198.
- 30 **Cardiff MES**. Bits & Pieces. Contact Trevor Jenkins: 029-2075-5568.
- 30 **Sutton MEC**. Natter Night. Contact Mike Dean: 0208-657-5401.

### FEBRUARY

- 1 **Isle of Wight MES**. Track & Pond. Contact Ken Stratton: 01983-760762.

- 1 **SM&EE**. Brian Andrews: *The Sandbanks Chain Ferry*. Contact David Boote: 01202-745862.
- 1 **Steam LS of Victoria**. Running. Contact Graham Plaskett: (03) 9750-5022.
- 2 **Hornby ME**. Sailing Day - Fagan Park. Contact Ted Gray: 9484-7583.
- 2 **Rugby MES**. Christmas Dinner. Contact David Eadon: 01788-576956.
- 2 **Rugby MES**. Running. Contact David Eadon: 01788-576956.
- 2 **South Durham SME**. Running. Contact B. Owens: 01325-721503.
- 2 **Southland SME**. Running Day. Contact Peter Stark: 03-21-89702.
- 2 **Surrey SME**. Members' Steam-Up. Contact John Cook: 020-8397-3932.
- 2 **Teesside Small Gauge Rly**. Meeting. Contact Bill Foster: 01642-710198.
- 3 **Leicester SME**. J. R. Yeomans: *Narrow Gauge & Miniature Railways Slides*. Contact Raymond Wallis: 0116-285-8824.
- 4 **Oxford (City of) SME**. Fred Pugh: *2ft. Gauge Around the World*. Contact Chris Kelland: 01235-770836.
- 4 **Romney Marsh MES**. Tony Crowhurst: *Millennium Slide Show*. Contact John Wimble: 01797-362295.
- 4 **South Durham SME**. Meeting. Contact B. Owens: 01325-721503.
- 4 **West Wiltshire SME**. 16mm Steam-Up. Contact R. Nev. Boulton: 01380-828101.
- 5 **Birmingham SME**. Auction. Contact John Walker: 01789-266065.
- 5 **Bradford MES**. Jim Batchelor: *Ornamental Turning*. Contact Gordon Eddison: 01943-864217.
- 5 **Bristol SMEE**. AGM. Contact Trevor Chambers: 01454-415085.
- 5 **Chingford DMEC**. Bits and Pieces. Contact Martin Masterson: 0208-989-5552.
- 5 **Gildford MES**. Graham White: *The Virtual Railway*. Contact Dave Longhurst: 01428-605424.
- 5 **Hull DSME**. Derek Brown: *Injectors*. Contact Brian Ryland: 01482-647032.

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- 5 Leeds SMEE. Visit to Jarvis Training. Contact Colin Abrey: 01132-649630.  
6 Cardiff MES. Carl Pickstone: Engineering Topics. Contact Trevor Jenkins: 029-2075-5568.  
6 Stamford MES. Doug Hewson: Lost Wax Casting. Contact David Ash: 01780-751211.  
6 Sutton MEC. Bits & Pieces. Contact Mike Dean: 0208-657-5401.  
7 Vale of Aylesbury MES. Chairman's Cup Competition. Contact Clive Ellam: 01296-623433.  
7 Maidstone MES. Quiz Night. Contact Martin Parham: 01622-630298.  
7 North London SME. An Evening with the Slot Car Section. Contact Tony Dunbar: 01992-465625.  
7 North Norfolk MEC. G. Gurney: Clocks. Contact Gordon Ford: 01263-512350.  
7 Portsmouth MES. AGM. Contact Bob Aldred: 023-92-523366.  
7 Rochdale SMEE. Meeting. Contact Mike Foster: 01706-360849.  
7 Romford MEC. Competition Night. Contact Colin Hunt: 01708-709302.  
8 Hornsby ME. Preparation Day for ILS 24hr Live Steam Run. Contact Ted Gray: 9484-7583.  
8 Reading SME. Club Running. Contact Graham Bustin: 01189-615450.  
8/9 Festival of British Railway Modelling at Doncaster Exhibition Centre, Doncaster Racecourse. Advance booking (to 27 January 2003): Adults: £4.50, Children: £3, OAP: £4, Family (2+3): £15. Information and Ticket Hotline: 01776-391134.  
9 Hornsby ME. Running Day. Contact Ted Gray: 9484-7583.  
9 Sutton MEC. Track Day. Contact Mike Dean: 0208-657-5401.  
10 Bedford MES. Arctic Engineering. Contact Ted Jolliffe: 01234-327791.  
10 Erewash Valley MES. Bits & Bobs. Contact Jim Matthews: 01332-705259.  
10 Frimley & Ascot LC. Meeting. Contact Bob Dowman: 01252-835042.  
10 Melton Mowbray DMES. Video Night. Contact Phil Tansley: 0116-2673646.  
11 Cardiff MES. Steam-Up & Family Day. Contact Trevor Jenkins: 029-2075-5568.  
11 Dockland & E. London MES. Bits & Pieces. Contact P. M. Jonas: 01708-228510.  
11 Sutton Coldfield MES. Meeting. Contact Roger Timings: 0121-308-5875.  
12 Chingford DMEC. Len Pearson: Visit to America. Contact Martin Masterson: 0208-989-5552.  
12 St. Albans DMES. Frank Banfield: Film Show. Contact Roy Verden: 01923-220590.  
13 Cardiff MES. Forum. Contact Trevor Jenkins: 029-2075-5568.  
13 N. W. Leicester SME. AGM. Contact John Elliott: 01455-847040.  
13 Sutton MEC. Pressure Gauges Testing. Contact Mike Dean: 0208-657-5401.  
14 Colchester SMEE. Auction. Contact L. G. Hammond: 01376-511686.  
14 Hereford SME. Peter Judge: Jewellery - What it means to your wife and your pocket. Contact John Arrowsmith: 01432-265151.  
14-16 Brighton ModelWorld at the Brighton Centre. 10am-5.30pm; Adult: £6, Child/Senior Citizen: £3, Family: £16. Contact Tim Steven: 01444-254057.  
16 Frimley & Ascot LC. Club Run. Contact Bob Dowman: 01252-835042.  
16 Hornsby ME. Sailing Day - Fagan Park. Contact Ted Gray: 9484-7583.  
16 N. W. Leicester SME. Running Sunday. Contact John Elliott: 01455-847040.

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Elliott 181 Vertical/Horizontal Mill, 3ph. £1500.00  
Sigma Jones Bench Jig Borer, 1ph (Like BGA). £850.00  
Ruhla Type 59 Universal Mill, Plain & Swivel Tables, Arbors, Adaptors, DR0, 3ph. £2650.00  
Emco FI CNC Bench Mill, Manuals, Used 2 Hours Only, 1ph, Immaculate. £2750.00  
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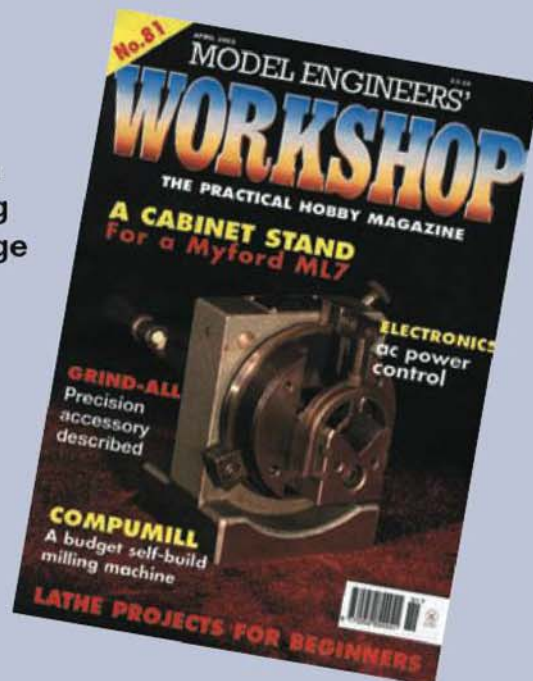
Change Gears (Also Fit Southbends)  
16T-21T, 18T-21T, 20T-21T, 21T-21T, 22T-21T, 23T-21T, 24T-21T, 26T-21T, 27T-21T, 28T-21T, 30T-21T, 31T-21T, 32T-21T, 35T-21T, 36T-21T, 37T-21T, 40T-21T, 42T-21T, 44T-21T, 45T-21T, 46T-21T, 48T-21T, 50T-21T, 52T-21T, 54T-21T, 55T-21T, 56T-21T, 58T-21T, 60T-21T, 64T-21T, 67T-21T, 70T-21T, 75T-21T, 80T-21T, 84T-21T, 88T-21T, 90T-21T, 96T-21T, 100T-21T, 104T-21T, 108T-21T, 112T-21T, 120T-21T, 125T-21T, 127T-21T, 130T-21T, 135T-21T, 140T-21T, 144T-21T, 147T-21T, 150T-21T, 156T-21T, 160T-21T, 168T-21T, 170T-21T, 175T-21T, 180T-21T, 184T-21T, 188T-21T, 192T-21T, 196T-21T, 200T-21T, 204T-21T, 210T-21T, 216T-21T, 220T-21T, 224T-21T, 228T-21T, 232T-21T, 240T-21T, 244T-21T, 248T-21T, 252T-21T, 256T-21T, 260T-21T, 264T-21T, 270T-21T, 276T-21T, 280T-21T, 284T-21T, 288T-21T, 292T-21T, 296T-21T, 300T-21T, 304T-21T, 312T-21T, 320T-21T, 324T-21T, 328T-21T, 336T-21T, 344T-21T, 352T-21T, 360T-21T, 364T-21T, 368T-21T, 372T-21T, 376T-21T, 384T-21T, 392T-21T, 400T-21T, 404T-21T, 408T-21T, 412T-21T, 416T-21T, 420T-21T, 424T-21T, 428T-21T, 432T-21T, 436T-21T, 440T-21T, 444T-21T, 448T-21T, 452T-21T, 456T-21T, 460T-21T, 464T-21T, 468T-21T, 472T-21T, 476T-21T, 480T-21T, 484T-21T, 488T-21T, 492T-21T, 496T-21T, 500T-21T, 504T-21T, 508T-21T, 512T-21T, 516T-21T, 520T-21T, 524T-21T, 528T-21T, 532T-21T, 536T-21T, 540T-21T, 544T-21T, 548T-21T, 552T-21T, 556T-21T, 560T-21T, 564T-21T, 568T-21T, 572T-21T, 576T-21T, 580T-21T, 584T-21T, 588T-21T, 592T-21T, 596T-21T, 600T-21T, 604T-21T, 608T-21T, 612T-21T, 616T-21T, 620T-21T, 624T-21T, 628T-21T, 632T-21T, 636T-21T, 640T-21T, 644T-21T, 648T-21T, 652T-21T, 656T-21T, 660T-21T, 664T-21T, 668T-21T, 672T-21T, 676T-21T, 680T-21T, 684T-21T, 688T-21T, 692T-21T, 696T-21T, 700T-21T, 704T-21T, 708T-21T, 712T-21T, 716T-21T, 720T-21T, 724T-21T, 728T-21T, 732T-21T, 736T-21T, 740T-21T, 744T-21T, 748T-21T, 752T-21T, 756T-21T, 760T-21T, 764T-21T, 768T-21T, 772T-21T, 776T-21T, 780T-21T, 784T-21T, 788T-21T, 792T-21T, 796T-21T, 800T-21T, 804T-21T, 808T-21T, 812T-21T, 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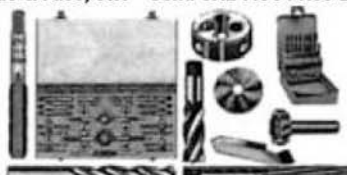
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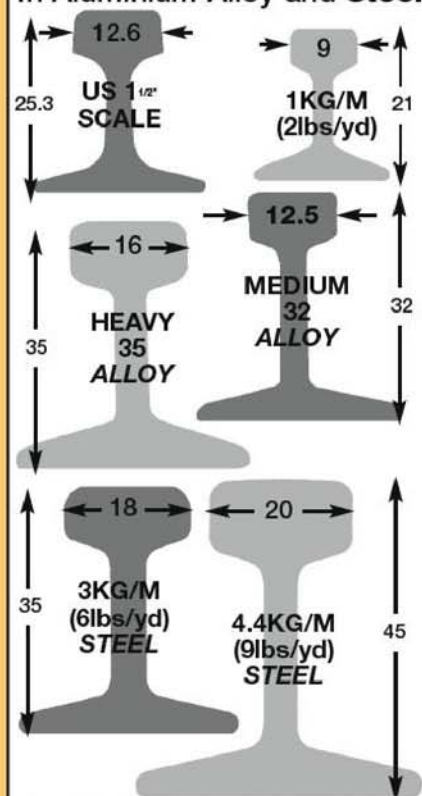
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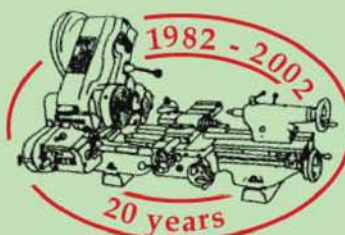
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| MYFORD ML7B 3 1/2" x 19", gearbox, 3 jaw chuck and tooling                                                                                                                        | £1,250                                               |
| MYFORD ML7RB 3 1/2" x 31", change wheels, 3 jaw chuck, tooling                                                                                                                    | In almost excellent condition £1950                  |
| MYFORD SUPER 7 3 1/2" x 19", gearbox, 3 jaw chuck and tooling                                                                                                                     | Choice £950 – £1,150                                 |
| MYFORD SUPER 7 3 1/2" x 19", 3 jaw chuck, power cross-feed                                                                                                                        | Late model Choice                                    |
| MYFORD SUPER 7 3 1/2" x 31", change wheels, 3 jaw chuck and tooling                                                                                                               | Choice £1,400                                        |
| MYFORD SUPER 7 3 1/2" x 31", (long bed) power cross-feed, induction hardened bed, industrial stand and doors, green machine                                                       | £2,950                                               |
| MYFORD SUPER 7B 3 1/2" x 19", gearbox, 3 jaw chuck and tooling                                                                                                                    | £1,250                                               |
| MYFORD SUPER 7B, 3 1/2" x 19", gearbox, Power Cross Feed, cabinet stand, tooling                                                                                                  | £2,750                                               |
| MYFORD SUPER 7B, 3 1/2" x 19", gearbox, Power Cross Feed, Hardened bed, 3 jaw chuck and tooling on stand excellent condition from new and NOT re-conditioned                      | £3,400                                               |
| RAGLAN CAPSTAN 10" x 24" 6 Station Turret, cut of slide, collet chuck (lever) & collets, bar feed, variable speed, coolant                                                        | £975                                                 |
| SMART AND BROWN 1024 Tool-room lathe, full screwcutting gearbox and power feeds complete with 3 & 4 jaw chucks, collet set, steadies and equipment                                | In very good condition £1500                         |
| SOUTHBEND 4 1/2" x 22" centres, 3 jaw chuck, some tool bits, motor ideal 1 1/2" lathe                                                                                             | £265                                                 |
| VICEROY TDS 1 GBL 5" x 24", gearbox, power slides, 3 MT tailstock complete with fixed steady                                                                                      | £1,400                                               |
| VICEROY TDS 1 GBL 5" x 24", gearbox, power cross feed complete with 3 1/4 jaw chucks, steadies, Dickson tool post, tooling, cabinet stand and a very rare imperial model at only  | £1950                                                |

TOO MANY LATHES TO LIST!!

### MILLING MACHINES V – Vertical, H – Horizontal

|                                                                                                             |                           |
|-------------------------------------------------------------------------------------------------------------|---------------------------|
| ADCOCK AND SHIPLEY IES Horizontal/Vertical Head, 30" x 8" powered table and feed gears, coolant             | £1,625                    |
| ADCOCK VM30 variable speed / 30 INT head, table 21 1/2" x 6" + Abwood vice and collet chuck                 | £1,500                    |
| BRIDGEPORT Series 1 – 2 HP Variable speed R8 head, powered (gearbox) table, 42" x 9"                        | £2,250                    |
| BRIDGEPORT Belt head 2 speed (short motor) head, R8 powered head, variable speed 42" x 9" table             | Very nice £2,250          |
| CENTEC 2B Horizontal, 1" arbor, table powered, 3 ph motor, single phase main motor                          | £725                      |
| CENTEC 2B Vertical/Horizontal, quill feed 2MT head, 25" x 5" table, pedestal model                          | £1,400                    |
| DORE WESTBURY vertical bench top mill                                                                       | as is £325                |
| ELLIOT DOWNHAM mini-borer, very late machine complete with collets and chuck (power down feed)              | £2,250                    |
| ELLIOT '00' OMNIMILL 3 Morse taper quill universal head, 28" x 7 1/2" powered table                         | Just In £1,850            |
| ELLIOT Turret mill R8-10 speed 70-3000 rpm, table 45" x 10" (powered)                                       | £1,500                    |
| EMCO FB2 Vertical 6 speed quill feed head 2 MT, powered 24" x 6" table, full coolant tray and cabinet stand | £1950                     |
| HARRISON horizontal, 31" x 8" powered table                                                                 | Now £625                  |
| HARRISON HV 30 INT swivel head & clutch, 30" x 8" table/powered                                             | £1950                     |
| HARRISON VERTICAL 30 INT swivel head & clutch, 30" x 8" table/powered                                       | £1625                     |
| RAGLAN VERTICAL MILL 2 Morse taper, 2 speed motor, variable selector 175-2220 rpm, stand                    | £950                      |
| SIP RF30, milling/drilling machine complete with accessories                                                | New £799                  |
| TOM SENIOR JUNIOR horizontal mill with a vertical head (sleeve to be made), table; 20" x 4 1/2" powered     | £1200                     |
| TOM SENIOR M1 horizontal, 25" x 6" powered table, 1" arbor                                                  | £575                      |
| TOM SENIOR M1 V/H, 25" x 6", 2 morse taper, 1" arbor                                                        | Selection £1,200 – £1,450 |
| TOM SENIOR 'S' Type vertical only, quill head, 28" x 6 1/2" table and complete with New Eurotherm inverter  | £2375                     |
| TOM SENIOR ELT MAJOR, 2 morse taper quill feed head, powered 37" x 8 1/2" table in extremely nice condition | £3,200                    |
| TOS F03 AV vertical turret mill, 40 INT, 54" x 10" table, power all-ways. Please ring to view               | £1,950                    |
| VICEROY AEW vertical mill, 30 INT swivel head, powered table 34" x 8"                                       | Very clean £1,625         |

### DRILLS

|                                                                                        |                    |
|----------------------------------------------------------------------------------------|--------------------|
| ARBOSA ER 25 / 25" Radial Drill speeds (8) 100-2900 RPM                                | clean table £1,425 |
| ASQUITH 14-54 001 Mk2 (5mt) Radial Drill                                               | £3,950             |
| FORCO 1/2" Bench, tilting table                                                        | £325               |
| FORCO 1/2" Pedestal drill                                                              | £345               |
| MEDDINGS 1/2" pedestal drill                                                           | £245               |
| MEDDINGS 2 Morse taper pedestal drills                                                 | Choice £275        |
| MEDDINGS MP2 10 Speed 2MT Bench 240 volts drill                                        | £350               |
| POLLARD CORONA Pedestal 1 1/2" morse                                                   | From £100          |
| SIP HDP 600B 3/8" 2MT Bench Drill, table operated by rack, speeds; (16) 162 – 3000 rpm | New £175           |
| STARTRITE Mercury 1/2" 4 speed bench drill                                             | £225               |
| STARTRITE Mercury 1/2" pedestal drill, 240 volts                                       | As New £300        |
| WARCO 3MT Pedestal 3 speed drill, speeds; 150-2200rpm, table operated by rack          | £495               |

### GRINDING / BUFFING

|                                                                                  |           |
|----------------------------------------------------------------------------------|-----------|
| CLARKSON MKI Tool and cutter grinder                                             | £550      |
| JONES AND SHIPMAN 540 Surface Grinder & Magnetic Chuck Ex College / Seen no work | £1850     |
| MLFORD 12" Pedestal Grinder                                                      | £325      |
| R.J.H. Buffing Machine, pedestal model Buffalo                                   | £325      |
| VICEROY Grinder, pedestal model                                                  | £145      |
| VICEROY Buffers, pedestal models                                                 | Each £250 |

### MISCELLANEOUS / FABRICATION MACHINERY

|                                                                                                                                                                      |                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| MYFORD VERTICAL SLIDES JUST IN                                                                                                                                       | £95 / £155            |
| MYFORD DIVIDING HEAD FOR ML7 AND SUPER 7 LATHES                                                                                                                      | AS NEW £395           |
| MYFORD VM-D MILLING ATTACHMENT FOR ML7 AND SUPER 7 LATHES                                                                                                            | AS NEW £675           |
| SCHOOL METAL AND WOOD WORKING BENCHES                                                                                                                                | JUST IN               |
| TAYLOR HOBSON ENGRAVER MODEL K + TOOLS AND EQUIPMENT                                                                                                                 | £1400                 |
| BCA 12" HORIZONTAL / VERTICAL ROTARY TABLE                                                                                                                           | VERY NICE £425        |
| QUANTITY OF SLIPS, HEIGHT GAUGES, SQUARES, STRAIGHT EDGES, MICROMETERS, CUBES, ANGLE PLATES, SCALES, WEIGHTS (KILOS) AND MISCELLANEOUS MEASURING TOOLS               | JUST IN               |
| FLAMEFAST DS 130 CERAMIC CHIP FORGE                                                                                                                                  | £345                  |
| FLAMEFAST DS 100 HEARTH                                                                                                                                              | £140                  |
| BRIDGEPORT SLOTTING HEAD                                                                                                                                             | £750                  |
| JONES AND SHIPMAN BROACHING PRESS ON MAKERS STAND                                                                                                                    | £375                  |
| MARCO BROACHING PRESS                                                                                                                                                | £425                  |
| JONES AND SHIPMAN 4" x 24" bench centres                                                                                                                             | £245                  |
| TOM SENIOR slotting head                                                                                                                                             | £450                  |
| STARTRITE 18-S-5 Woodworking / non ferrous bandsaw                                                                                                                   | £950                  |
| DIAMOND fret saw, variable speed                                                                                                                                     | £345                  |
| RJH BT 125 Fretsaw, variable speed                                                                                                                                   | £345                  |
| SMART AND BROWN / CLARKSON H3-H5 toggle presses                                                                                                                      | Each £195 / £275      |
| ARRAND 2MT long milling spindle                                                                                                                                      | As new £75            |
| VERDICT Clocks, Long/Short/Metric and Imperial models                                                                                                                | As new £40            |
| FLAMEFAST LD300 Soldering Iron Stove                                                                                                                                 | £75                   |
| GRANITE 18" x 12" Surface Plate                                                                                                                                      | £140                  |
| VIBROSHEAR Nibbler                                                                                                                                                   | Just in £425          |
| TRIUMPH BURNERD 4 Jaw Chuck                                                                                                                                          | £245                  |
| TRIUMPH FACE PLATE D14                                                                                                                                               | £70                   |
| VANCO Linisher                                                                                                                                                       | Very Nice £345        |
| JONES AND SHIPMAN Broaching Press + Stand                                                                                                                            | £375                  |
| CLARKSON Mk I Radius Grinder Attachment                                                                                                                              | £425                  |
| ABB Inverter & 1/2" hp motor, wired up                                                                                                                               | £250                  |
| SIP 7" bandsaw, horizontal & coolant                                                                                                                                 | New £750              |
| WIP SAW hacksaw                                                                                                                                                      | Choice £245 – £345    |
| BRIDGEPORT high speed drilling head                                                                                                                                  | £395                  |
| MYFORD dividing head                                                                                                                                                 | £750                  |
| STARTRITE SC315D cut-off saw                                                                                                                                         | £345                  |
| DUPLEX D29 toolpost grinder                                                                                                                                          | £65                   |
| BOXFORD (imperial only) thread dial indicator                                                                                                                        | £85                   |
| ABWOOD 6" swivel tilt machine vice                                                                                                                                   | Each £345             |
| BURNERD, D13 6 jaw Gripru chuck                                                                                                                                      | £345                  |
| VANCO, 1" linisher / vertical + extractor                                                                                                                            | £495                  |
| BURNERD, D14 lever collet chuck + collets                                                                                                                            | £400                  |
| BURNERD, LO lever collet chuck + collets                                                                                                                             | £400                  |
| VERTEX Dividing head                                                                                                                                                 | New £245              |
| VERTEX 6" – 8" – 10" rotary tables                                                                                                                                   | New From £825         |
| BOXFORD Turret attachment 4 1/2" + quantity of drill chucks                                                                                                          | £825                  |
| MYFORD ML7 / Super 7 rear tool post                                                                                                                                  | £40                   |
| MYFORD 254S rear tool post                                                                                                                                           | New £40               |
| MYFORD Vertical slide / fixed type (copy)                                                                                                                            | £99                   |
| LOCKWOOD QUAD HEADED 2mt Die Holder                                                                                                                                  | New £40               |
| LOCKWOOD QUAD HEADED 3mt Die Holder                                                                                                                                  | New £40               |
| LOCKWOOD Test Bar / 2mt Boxed                                                                                                                                        | New £39               |
| LOCKWOOD Test Bar / 3mt Boxed                                                                                                                                        | New £42               |
| MAGNETIC chuck – 18" x 6" fine pole                                                                                                                                  | Never used £325       |
| TOM SENIOR Model E pedestal stand                                                                                                                                    | £150                  |
| UNION tool and cutter grinder stand                                                                                                                                  | £135                  |
| HARDINGE Capstan type toolpost                                                                                                                                       | £175                  |
| 50 INT Tooling: Selection                                                                                                                                            | Just in               |
| STARTRITE 352 woodworking band saw                                                                                                                                   | £975                  |
| STARTRITE 14-S-5 woodworking band saw                                                                                                                                | £775                  |
| ALCOBA GF 080/1 Rapid Melting Furnace                                                                                                                                | £300                  |
| ALCOBA BF 620-2, 24" Box and Pan general use folder                                                                                                                  | £325                  |
| MYFORD Burnerd Gripru 3 Jaw Chucks                                                                                                                                   | Boxed £225            |
| COLCHESTER / HARRISON D13 Burnerd 4 Jaw 8" light body independent chucks                                                                                             | Boxed £175            |
| RJH 4" Linisher / Vertical (Build in Extraction)                                                                                                                     | £625                  |
| MICROMETERS and associated measuring tools                                                                                                                           | Still packaged as new |
| POTTERY WHEELS, kilns and associated equipment                                                                                                                       | Just In Cheap         |
| SPECAC Powder type press                                                                                                                                             | £225                  |
| HARRISON L6 Metric Gearbox                                                                                                                                           | As is £250            |
| HARRISON L6 Tailstock                                                                                                                                                | £245                  |
| NEW FROM NEW ZEALAND:- Machine vice, 55mm. Jaws precision miniature type ideal for vertical slides and smaller milling machines such as BCA now with the swivel base | £134                  |
| Vice on own                                                                                                                                                          | £95                   |
| Swivel base on own                                                                                                                                                   | £49                   |
| SIP 1 TON MOBILE CRANE Manufactured 2000                                                                                                                             | As new £375           |
| MITUTOYO grade A set of slips                                                                                                                                        | £245                  |
| F.J. EDWARDS 24" hole cutter                                                                                                                                         | £225                  |
| Lange bench vice                                                                                                                                                     | £70                   |
| LINK 1.5 ton vehicle crane + top hat                                                                                                                                 | £625                  |
| MITUTOYO 103-913 metric set micrometers                                                                                                                              | £275                  |
| NORTON / EDWARDS arbor presses                                                                                                                                       | £75 / £145            |
| ALJAX 6" hacksaw                                                                                                                                                     | £425                  |
| SURFACE plates from 12" x 12" to 36" x 36"                                                                                                                           | Very nice from £325   |
| WEBER 1 1/2 ton mobile garage crane, late blue colour                                                                                                                | £495                  |
| ELLIOTT 1250 STURDYMILL vertical head                                                                                                                                | One off (rare) £525   |
| RJH linisher 4" wide belt, pedestal                                                                                                                                  | £345                  |
| STEEL STOCK Just arrived                                                                                                                                             | to callers only       |
| ELLIOT U1 / U2 Slotting Head                                                                                                                                         | £475                  |
| SWAGE BLOCKS                                                                                                                                                         | £125 / £145           |
| J & S Universal grinding vice                                                                                                                                        | Choice £275 / £325    |
| BOX TABLES: Grade A and B, many sizes                                                                                                                                | £40 – £150            |
| SLIPS / GAUGES: Metric / Imperial, New Sets; 87 / 81 piece                                                                                                           | £215 / £145           |
| HORIZONTAL METAL BANDSAW 6" x 4 1/2" capacity                                                                                                                        | New £170              |
| COLCHESTER STUDENT / MASTER Round head, face-plates, small / large                                                                                                   | £50 / £90             |
| QUALTERS AND SMITH 6" Hacksaw                                                                                                                                        | £345                  |
| BORING HEADS 2 / 3 Morse, R8 Taper, Max. Capacity 4 1/2" round bar                                                                                                   | New, each £90         |
| ODONI Machine Bed Clamps (pair)                                                                                                                                      | Special £24.50        |
| HEIGHT GAUGES by Chesterman, Shardlow, Moore and Wright                                                                                                              | From £95              |
| ELLIOTT 10M Shaper, 10" stroke                                                                                                                                       | £325                  |
| DIE BOXES                                                                                                                                                            | From £45              |
| TRANSWAVE 3HP Converter                                                                                                                                              | New £295              |
| TRANSWAVE 5.5HP Converter                                                                                                                                            | New £385              |
| TRANSWAVE 22K-RT rotary converters                                                                                                                                   | From £485             |
| CROMPTON PARKINSON 1/2 HP, resilient mount, Boxford / Myford Super 7 Type motor                                                                                      | New £140              |



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24th - 26th  
JANUARY

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

### Conquest Lathe

NOW INCLUDES TEST CERTIFICATE



**£395**

VARIABLE SPEED  
STANDARD ACCESSORIES

Price includes VAT & Delivery\*

- 80MM 3-JAW CHUCK
- 1-10MM DRILL CHUCK & ARBOR

### 920 Lathe Deluxe

- SWING OVER BED: 229MM
- SWING OVER CROSS SLIDE: 133MM
- DISTANCE BETWEEN CENTERS: 500MM
- SPINDLE BORE: 19MM
- TAPER IN SPINDLE NOSE: MT3
- MOTOR: 1/4HP
- 6 SPEED: 100-1800RPM
- NET WEIGHT: 100KG

STANDARD EQUIPMENT:

- 4" 3-JAW CHUCK WITH 2 SETS OF JAWS
- 7" 4-JAW CHUCK WITH REVERSIBLE JAWS
- STEADY REST • FOLLOW REST
- MT2 DEAD CENTRE
- MT3 DEAD CENTRE
- 4-WAY TOOL POST
- FACE PLATE
- TOOL BOX & TOOL KIT
- TRAY & SPLASH GUARD



**£699**

Price includes VAT & Delivery\*

### Model B-Super

- SWING OVER BED: 420MM
- DISTANCE BETWEEN CENTERS: 500MM
- MILL DRILL SPINDLE TAPER: 19MM
- TAILSTOCK BARREL TRAVEL: 80MM
- 7 SPEEDS 60-1300RPM
- SWING OVER CROSS SLIDE: 160MM
- SPINDLE TAPER: MT3
- DRAW BAR: M12
- CROSS SLIDE TRAVEL: 180MM
- MOTOR: 1/4HP
- NET WEIGHT: 155KG

STANDARD EQUIPMENT

- 4" 3-JAW CHUCK
- 2 DEAD CENTERS
- 1/2 DRILL CHUCK
- CHANGE GEARS
- MT3 CHUCK ARBOR



**£725**

Price includes VAT & Delivery\*

### Centurion

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

STANDARD EQUIPMENT

- 4" 3-JAW CHUCK
- 2 DEAD CENTERS
- 1/2 DRILL CHUCK
- CHANGE GEARS
- MT3 CHUCK ARBOR



**£1100**

Price includes VAT & Delivery\*

### Champion Mill

- DRILLING CAPACITY: 20MM
- FACE MILL CAPACITY: 63MM
- NUMBER OF SPEEDS: 4
- SPEED RANGE: 400-1640RPM
- SPINDLE TAPER: MT3
- MOTOR: 1/4HP
- END MILL CAPACITY: 25MM
- TABLE SIZE: 150x630MM
- SPEED RANGE: 400-1640RPM
- TILTING HEAD: 90° Left & Right

From

**£585**

Price includes VAT & Delivery\*



### Eagle 25 Mill/Drill

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

Price

**£699**

Price includes VAT & Delivery\*

STANDARD ACCESSORIES

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



### Eagle 30 Mill/Drill

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

Price

**£899**

Price includes VAT & Delivery\*

STANDARD ACCESSORIES

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



### 626 Turret Mill

- MILLING CAPACITY: 25MM
- DRILLING CAPACITY: 32MM
- TABLE SIZE 152 x 740MM
- FINE FEED
- NUMBER OF SPEEDS: 9
- SPEED RANGE: 190-2100RPM
- SPINDLE TAPER: MT3 OR R8
- TILTING HEAD
- MOTOR: 1 1/2HP

Price

**£1340**

Price includes VAT & Delivery\*

STANDARD ACCESSORIES

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



### Craftsman Gap Bed Lathe

- SWING OVER BED: 300MM
- SWING OVER GAP: 450MM
- SWING OVER SADDLE: 170MM
- DISTANCE BETWEEN CENTERS: 570MM
- SPINDLE BORE: 36MM
- SPINDLE NOSE TAPER: MT5
- CROSS SLIDE TRAVEL: 150MM
- COMPOUND TRAVEL: 89MM
- TAILSTOCK BARREL TAPER: MT3
- TAILSTOCK BARREL TRAVEL: 92MM
- RANGE OF SPEEDS: 50-1250RPM
- MOTOR: 1 1/2 HP
- NETWEIGHT 398KG

STANDARD EQUIPMENT:

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



**£1550**

Price includes VAT & Delivery\*

### Super LUX Mill

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

Price

**£1500**

Price includes VAT & Delivery\*

STANDARD FEATURES

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

