

MODEL ENGINEER

Vol. 201

No. 4334

12 - 25 September 2008

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WHEEL
CLOCK**

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ON THE COVER...

The craftsmanship of J. Swindlehurst is apparent in this 5in. gauge model of Stevenson's 'Rocket' was awarded a first prize at Harrogate in May of this year. This 101st year of the Model Engineer Exhibition will feature many fine locomotives displayed and on the Sinshelm track. (Photograph by Michael Jones)

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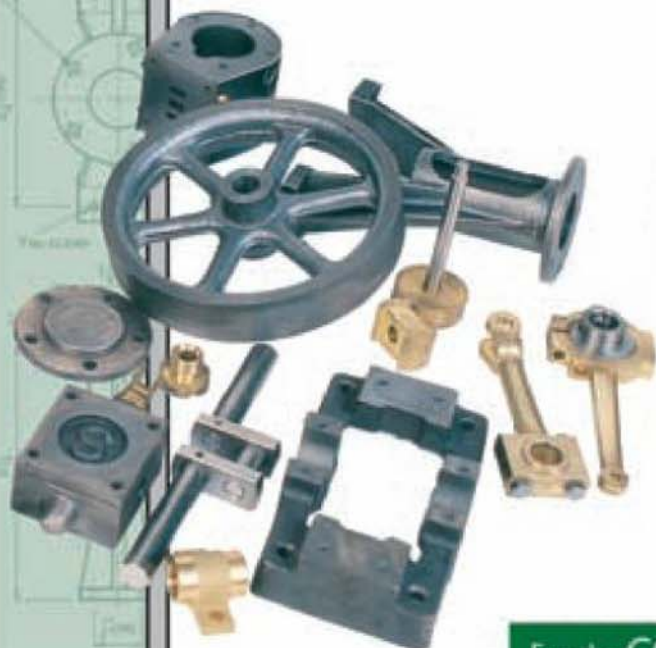
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Dear reader

A short note from the editor to let you know I have not been at all well. I have been in and out of hospital for a while. Fortunately all is gradually getting back to something like normal, and I expect to be back in the saddle late in September.

Meanwhile, Mike Jones has taken the reins, and he is receiving all my mail and emails for the time being. He has been doing a great job, with absolutely no notice at all.

However, it does mean that our editorial staff is rather stretched for a time, especially with our involvement in the Model Engineer Exhibition. Mike has given up his family holiday, and I know that the others have been burning the midnight oil.

So, sincere thanks to Mike, Roger and Kelvin. Meanwhile keep on sending stuff addressed to me, and that will ensure that things continue as seamlessly as possible. Look forward to seeing many of you at Ascot. It is going to be a great weekend.

David Carpenter
Editor

What's on at the MEX

The SMEE will be providing talks and lectures throughout the Model Engineer Exhibition.

At the central area workshop at their booth they will have 20 minute talks such as *Beginner's guide to choosing a lathe*, *Making and fitting piston rings*, *Sheet metal fabrication*, and *Techniques for accurate filing*. These will be repeated about eight times throughout the day, except Sunday.

Lectures will be *Successful silver soldering*, *Laser engraving on my desk*, *Designing model I/C engines using 3-D CAD*, *Modelling a 1:3 scale 1923 Bentley 3-litre engine*, *Building the larger Stirling engine*, *Modelling gas turbine locomotives*, *Abrasive water jet cutting*. On Friday only will be *Modern adhesives and paint systems* and on Saturday only *Milling for model engineers*. Check with the SMEE stand for the exact times and locations of the lectures.

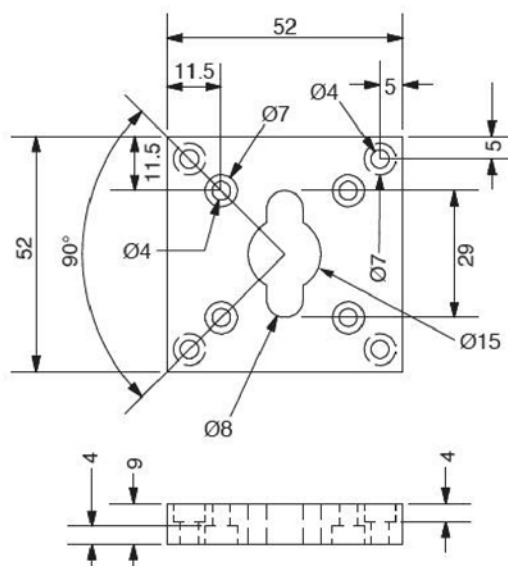
Car and coach parks

If you are driving to Ascot for the Model Engineer Exhibition, car parks 3 and 5 will be used for exhibition visitors. Car park 2, directly across from the main entrance, is reserved for exhibitors and disabled badge holders only. Coaches can drop off their passengers in front of the ticket hall and then will be directed to a nearby coach park.

Sinsheim track

Come have a go on the Sinsheim track from Germany. Bring your steam, electric, (or pedal-powered?) locomotive and your boiler certificate (if required). If you haven't decided yet, or are used to last minute decisions, there is still space and we can accept your booking via e-mail. Include your name, contact details including a phone number and tell us when you want to run Friday, Saturday, Sunday or any combination of those. Also let us know what kind of engine you're bringing! E. mex. steam@magicalia.com

CYLINDER MOUNTING PLATE ALUMINIUM



Set-up day for the exhibition

This is a reminder that the setup day is Thursday 18 September 2008. If you haven't heard from Lou Rex, our models organiser, you should contact him immediately by phone. T (home): 01977 661998 after 7pm up to 10:30pm; (works): 01977 699669; Mobile: 07876 452 816.

Thanks, Jez

Jez Walters supported the publication of *Model Engineer* and its companion titles for many years. His publishing career started as the 'tea boy' and progressed until he was the publisher of this magazine with Highbury House. As that organisation collapsed, through super effort he still managed to keep the Model Engineer Exhibition going. The Special Interests magazines were bought by Encanta Media who engaged him as their commercial director and later he became the events director for them and Magicalia Publishing. Jez is now moving on to start his own martial arts magazine and we wish him well.

New name for an old friend

As part of an expansion programme there is a new name for the company which publishes *Model Engineer* and nine other popular UK hobby and leisure titles. We are now known as MyHobbyStore Ltd.

Ridders' 2-cycle engine plan

There are some technical problems with the free plan for the Ridders 2-cycle engine included in *M.E.* 4333, 29 August 2008. Prospective builders should note the following:

The cylinder mounting plate drawing was omitted and we publish it here.

The four M4 holes in the corners of the 'cylinder bottom plate' should be 8mm from the edges, not 9mm as drawn.

The bore and stroke are both 18mm, not 24mm as quoted in the text on page 273. The crankpin offset should therefore be 9mm.

The outer bearing stand fixing holes (2 x M4) on the 'mounting plate' (base) should be 7mm from the edge of the plate. These are on the right-hand side of the drawing and are 42mm apart.

We apologise for these issues and hope that prospective builders enjoy building this interesting engine.

The change emphasises that the company is no longer just a magazine publisher and now has three significant parts to it - magazines, events and our rapidly expanding website myhobbystore.com. However, there has been no change of ownership and the same editors, publishers and commercial support are still here.



Gunpowder (1)

SIRS, - Unfortunately John Wilson has been lead astray by his reading matter. The distinction between 'organic' and 'inorganic' in chemistry is entirely independent of how the substance is derived: it is intrinsic in the nature of the substance and mainly reflects the way in which the atoms in the compound are bonded together. Nitro-glycerine is most assuredly 'organic'. Whilst it is made using inorganic acids, the glycerine is organic and the acid mix adds nitro groups on to the glycerine molecule. The nitro-glycerine is a single, highly unstable discrete chemical compound that is separated from the nitration acid mix during manufacture.

By contrast, gunpowder is a mixture of fuel (carbon and sulphur - both elements) and a source of oxygen (saltpetre - sodium or potassium nitrate). The saltpetre is quite positively 'inorganic' irrespective of what unspeakable source it has been derived from, by whatever dreadful process.

Science has its own specific meanings for many words, organic being a prime example: loosely it could be defined as the chemistry of carbon and covalent bonding - it now has nothing to do with being derived from living matter (or grown without pesticides). However, the historical origins of the term 'organic chemistry' do refer to the fact that early-identified organic compounds were naturally derived.

To add to the account of nitro-glycerine manufacture: the addition of glycerine to

the nitration mixture would of necessity have been a very slow, carefully monitored process. I understand that the process operators were given stools to sit on that were equipped with but a single leg - no falling asleep on the job!

On a more general note the recent 'which bit of kit' articles and free plans are a great idea. Hopefully there are more of both in the pipeline?

**Allan Hamilton,
Cambridgeshire.**

Gunpowder (2)

SIRS, - I had thought Terry Holland had put this one to bed, but John Wilson's venturing into territory he knows not cannot pass unchallenged. Unlike John, I trained as a chemist and have a doctorate in synthetic organic chemistry, so maybe this will resolve the matter.

The distinction between organic and inorganic compounds has an interesting history. It was originally thought that organic compounds could only be created by some 'life force', so organic = derived from living organisms, inorganic = everything else. This mystical belief was firmly knocked on the head by the German chemist Wohler, who made urea (an undisputed organic compound) from inorganic materials.

In modern times, organic chemistry is broadly taken as the chemistry of carbon compounds. There is a little fuzziness here, since certain compounds (such as carbon oxides and some others not containing hydrogen) are traditionally treated as inorganic. Included in this list of exceptions is elemental carbon itself, even though it is usually

(though not necessarily) made from wood, an organic material.

Whilst I am a great admirer of dictionaries, they are not always the best authorities on scientific terms. However, even the very simplistic dictionary definition John quotes does not help his point; 'compounds of carbon' does not include carbon (an element, not a compound) itself.

Glycerine, or glycerol, or 1, 2, 3 propanetriol on the other hand, is very definitely organic. It is made (not that this is the deciding factor) by the hydrolysis by alkali of animal fats, which are esters of glycerol with long-chain fatty acids such as stearic acid. This process, known as saponification, or soap-making (soap in soap bars is mostly sodium stearate, or similar compounds), was almost certainly the earliest application of organic chemistry in the service of mankind. 'Nitro-glycerine' is wrongly named; it is in fact glyceryl trinitrate, the nitrate ester of glycerol. The fact that strong mineral acids are used in the process of nitration of glycerol is irrelevant; most organic reactions involve use of some inorganic reagents.

So, in summary, we have on the one hand gunpowder, made from (approximately) 75% potassium nitrate (definitely inorganic), 10% elemental sulphur (definitely inorganic) and 25% carbon (only organic according to a mystic theory which died in the 19th century, now regarded as inorganic by chemists); on the other hand, glyceryl trinitrate, made from animal fats and quite definitely organic by any standards.

David Littlewood, Kent.

Write to us

Views and opinions expressed in letters published in *Post Bag* should not be assumed to be in accordance with those of the Editors, other contributors, or Magicalia Publishing Ltd. Correspondence for *Post Bag* should be sent to: -

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Responses to published letters are forwarded as appropriate.

An Ascot encounter

SIRS, - The forthcoming Model Engineer Exhibition at Ascot has reminded me of last year and the pleasure of a brief conversation with Cherry Hill. I was able to tell her of an incident that took place many years ago at one of the Wembley shows. A friend and I were studying her model of Batho's Steam Elephant. I wondered aloud to my companion "Do you think that the boiler water level test cocks work?" I had not seen that Ted Jolliffe was standing by us waiting to

photograph the very model that we were looking at. He proceeded to tell me in no uncertain terms "All the details on her models work." I felt that he was back in uniform and had caught me cycling the wrong way on a one way street! Suitably chastened we moved on, remembering to look around before making any further comments. This story is quite funny but was made even more so when she revealed during our conversation that the test cocks really were dummies after all.

David Richards, Swansea.

Gunpowder (3)

SIRS, - I hesitated to write this email because yours is an engineering magazine and not a chemistry journal. In my opinion, nitro-glycerine would definitely be classed as an organic compound, because it's based on an alcohol with three hydroxyl groups. Gunpowder is a mixture of carbon (an element), potassium nitrate (an inorganic compound) and sulphur (another element). Therefore I don't think it could ever be classed as an organic compound. I strongly recommend *The Big Bang: a history of explosives* by G. I. Brown for readers interested in the field. I'm no explosives expert but I did A-level chemistry back in 1988 and a useful subject it has been.

As a totally unrelated but possibly interesting aside, my great grandfather, William Hickman, was killed in the Holton Heath explosion. Allegedly his fate was decided by the flip of a coin: this was apparently the method he and a colleague used to agree who would do what jobs that day.

Phil Mason, by email.

Top-slide lock

SIRS, - I have enjoyed the *Letters to a Grandson* by M. J. H. Ellis, but I am not impressed with his advice on lathe top-slides (*M.E.* 4329, 4 July 2008). Moving the top-slide to its maximum forward travel, at least on my Myford S7, causes it to overhang by an uncomfortable amount, a position I would only use in extremis as it seriously reduces rigidity. (Other lathes may differ.)

A vastly superior solution, and one which has many other benefits, is to fit a top-slide lock. The design by George Thomas in Chapter 18 of his *Model Engineer's Handbook* combines the lock with the dowelling of the gib strip to improve evenness of travel, and is characteristically elegant and clearly described. I think it took me less than an hour (and I tend to be rather a slow worker) and is well within the capabilities of any lathe user. Once you have done it, you will wonder why you didn't do it years ago.

David Littlewood, Kent.

Machine quality

SIRS, - Over the years a lot of column inches have been devoted to the subject of Far Eastern vs. British machine tool manufacture. Recently I was contemplating a larger lathe and found myself asking origins aside, how should quality be rated? Or, for the more imaginative, if Dr Who whisked you away to a parallel universe to fix the Tardis, how would you select a machine if you didn't know the brands available?

Most industrial countries have their premier brand of precision toolroom lathe. In the US, Hardinge is well regarded; the Swiss hold up Schaublin; in Britain Dean, Smith and Grace is usually seen as top of the tree. However, these days there are lathes made in China or India that are being called precision toolroom lathes, sometimes direct copies of these makes. Specifications are fine on paper but what is it that tells you that you have bought a quality machine? Basic dimensions such as centre height, centre distance and spindle bore are usually dictated by the projects at hand; speed is a little more tricky, but is usually in proportion to the lathe. Accuracy? Most lathes in reasonable condition can be used to produce parts to a set dimension (although some may require more effort than others).

Therefore, it seems that physical capabilities are no guide to machine quality, although some of the machine features maybe - particular types of bearings, for example, or the lubrication method employed. However, for the most part things like this and features like the number of threads or feeds/rev are as much a function of the machine design as an indication of quality, and are usually related to the price being charged for the machine.

If specifications and features are not a reliable guide, all that is left are things like appearance, 'feel' and 'value for money' - a bit like buying a car. Reliability and longevity may be another issue, but as a US machine tool forum member stated when asked about lathe brands and reliability, "a hobby user won't wear out any lathe if only running it a couple of hours a week". This observation aside, I would suggest that most users would prefer a machine with a smooth sliding action and minimal backlash rather than something that feels gritty and sloppy. This suggests that to enhance your perception (or a buyer's) of a machine's quality, things like:

- Fitting handles/controls that feel comfortable and have a smooth action.
- Making sure any bearings/slides are lubricated and properly adjusted.
- Minimising backlash and other slop present in controls.
- Ensuring the paintwork and other detailing is in keeping with the machine.
- Having the machine on a sturdy (suitably rigid) stand. (Just like you would do when putting up a model for judging)

Various correspondents express a view that a (new) machine should not need to be rebuilt by the buyer yet between *Model Engineer* and *Model Engineers' Workshop* there seem to be at least one or two articles a year on how someone has taken a Myford in poor condition and rebuilt it. My lathe is 30 years-old, and in the years I've owned it I've scraped slides, made new feed nuts, had the motor overhauled, replaced seals and bearings and made other repairs - and it looks like the previous owner did so too. While ideally a new piece of equipment should be good to go from the box, industrially an expensive new machine tool (or one newly reconditioned) used to be subject to various acceptance tests, whether Schlesinger's or another version - taking a machine straight from the crate to use without these checks would have been seen as highly risky. Entry-level lathes for hobby purposes are built to a price, so is it realistic to expect them to be as well finished as an industrial machine, especially when built by an assembly worker rather than a skilled fitter/ machinist? It is also worth remembering that for every machine that is used to make a Gold Medal model there are many that are only occasionally used and for less exacting tasks - are all those occasional users prepared to pay a premium for a better finished machine?

However, all this does not explain why people buy used machines in place of new. Some part of the brain must make a trade-off between purchase cost and potential to meet expectations (of quality), especially when the cost of the used machine is more than an equivalently specified new machine. I would be interested in other people's thoughts on the quality of machines that they have used (both in terms of the machine's reputation and specifications but also intangibles like 'feel').

Michael Green, Adelaide, South Australia.

Film sprocket punching

SIRS, - John Cleve asked for information on the tools required for punching sprocket holes in celluloid film (*M.E.* 4330, 18 July 2008). I served my apprenticeship as a press toolmaker and such a tool would have been regarded as one of the more simple tools

to produce. That is, in a fully equipped tool room.

Making such a tool in the home workshop would not be difficult provided the engineer was able to work to 0.0001 inches. The best way would be to punch two rows of holes in 70mm film (to balance the work and keep it running

straight) and then to split to 35 millimetres. The usual way would be to make a tool that would punch possibly 6-10 holes down both sides at one go then index x 10 holes and punch 20 more and so on. The first 20 would be used as a register for the second 20. The design and construction



of die sets follows a standard pattern, with the usual die, stripper plate and punches. It was usual to make the punch set first, carry out a trial punch, and if acceptable harden, temper and grind, then use the punch set to 'broach' the first few thou in the soft die. Finishing off the die set by hand, then hardening and grinding. When punching steel a die clearance was normal, but in celluloid this would be size to size. Hence the need to work to within tenths of a thou. and to use a proper pillar die set, usually by Exacta.

To maintain the punches and dies in a dead sharp condition correct hardening and the use of a surface grinder would be vital. Modern tool rooms would no doubt use spark erosion etc, techniques not available in the 1960s. The second problem, probably greater than the first, is the press tool to do the work. Such a machine, with an automatic feed (to index the rolls of film) would cost £1,000s even if one could be found. There are many books on the manufacture of press tools and I suggest John reads these before he starts any work.

Colin Usher, Cheshire.

Water jet cutting

SIRS, - Grandpa is doing a great job in *Letters to a Grandson*, but I think we should gently steer Adrian in the right direction with regard to water cutting (*M.E.* 4329, 4 July 2008).

I've checked up with water-jet specialists Sciss Ltd. (usual disclaimer) and they have kindly supplied the following information:

- Water pressure is normally between 40,000 and 50,000psi, with a current industry maximum of 87,000psi - that's 18 tons to 22 tons and a whopping 39 tons, per square inch.
- The jet velocity is around 2,000 feet per second, roughly 1,350mph or Mach 2.
- The process is perhaps better termed abrasive jet cutting because the water is actually charged with garnet particles from 60 to 120 mesh size.
- The jet nozzle is made of boron nitride with a diameter of 0.50 to 1.0mm. It lasts 50 to 120 hours depending on various factors.
- Cutting velocity is variable throughout the job, slowing down for corners, but can be from 100 to 350mm per minute for 3mm steel, depending on the quality required.
- The work piece is fixed while the jet head is moved over it on X-Y drives, under computer control.
- The process can cut pretty much anything except toughened glass which tends to explode! Some materials, such as foam rubber are cut with water alone.

I have used quite a lot of water jet cutting on my 5in. gauge locomotive; it's a great way to speed up model building with high accuracy. I



Water jet cutting machine in action.

simply draw the component on my computer and email a dxf file to the specialist water-jet company and a week or so later a heavy parcel arrives at the door. Main frames, tender and bogie frames, coupling rods, brake gear parts, cab components, window frames and oval buffer heads are all water-jet produced.

There is a slight draft angle but this can be ignored for many components. The cut edge is smooth, but has very sharp edges which need to be relieved at an early stage in handling the component. There is no problem cutting holes down to the diameter of the jet nozzle and partial-thickness cutting can be used to form fold lines in sheet components.

I have included a photo of a water-jet machine. The process takes place in a tank of water and so is pretty boring to watch!

Tim Coles, Cambridgeshire.

ISSUE NEXT ISSUE NEXT ISSUE NEXT ISSUE NEXT IS
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- **Bristol show report**
- **Micro-hydro electricity**
- **Derek Brown's Anna locomotive**
- **Beginner's locomotive boiler**
- **No frills cylinder drain valves**

Plus all your regular favourites

Contents subject to alteration

ON SALE 26 SEPTEMBER 2008

Bristol Show: Chris Rayward (Hotspur Designs) showing a stainless steel connecting rod made using the lost wax process.



An original mill overshot waterwheel abandoned and rusting away. Our Pico-Hydroelectricity feature describes how a more modern generating method can be employed.

Square Wheel Clock

Donald Unwin describes the seemingly impossible - a clock with square wheels!

About a year ago I had a dream in which I imagined a clock with square gearwheels! This occurred at a time when I was between projects, so I thought the idea might be worth investigating.

Eight or nine years ago, when giving a talk to a model engineering society, I met a member with horological interests. He invited me to stay overnight at his house and showed me many fine clocks he had made - mostly longcase. He had a well-equipped workshop and, amongst other interesting things, there was a clock with square gearwheels in the early stages of construction. It 'tickled me' so I took a photograph of it. A short while after, his wife rang me to with the sad news that he had died. I asked about the square clock and she said

that it had disappeared. I forgot all about it until recently when, looking through some old folders, I came across the photograph which, presumably, sparked off the dream!

I decided to make such a clock, but there were a number of problems to be solved: Firstly, I decided to try and make an experimental square gearwheel meshed with a circular pinion. This was to have a 12:1 reduction ratio and, if successful, could be used to drive the hour hand from the minute arbor in the final clock.

Experimental gear

For my experimental gear I wanted to use my homemade involute module cutters and I chose 0.5 module. To avoid bad tooth form, the minimum number of teeth on a pinion without addendum correction should not be less than 10, that gives each corner three teeth, but I decided four teeth would be better - equivalent to 16 on a full circle. The mating pinion would have 12 teeth giving 144 teeth on the gear. Subtracting the four teeth on each corner from the total of 144 gives 128 teeth, or 32 teeth on each of the four straight sides.

The method I adopted was to calculate the length of 32 teeth of 0.5 M (1.517mm circular pitch), that is $32 \times$ circular pitch or $32 \times 0.5 \times \pi = 50.27$ millimetres. However, as my milling machine indexes are calibrated in metric units, I chose 1.6mm circular pitch for easy indexing, giving the length of the straight sides as 51.2 and the module as 0.51; the 0.5 M cutter would still be satisfactory. To find the size of the square gear blank: to 51.2 must be added twice the pitch circle radius of the equivalent corner gear, plus the height of the tooth above the pitch line. The outside diameter of a gear is given by $(n+2) \times M$ which, in this case, is $(16+2) \times M = 9.18$ millimetres. Hence, the size of

square brass blank needed was $51.2 + 9.18 = 60.38$, plus a small machining allowance.

Next the gear blank was clamped, with a piece of hardboard underneath, onto an angle plate gripped in the machine vice. One edge was accurately aligned with the machine traverses then the sides milled to the correct size with an end mill. Next the central hole and four holes, marking the centre point of each corner radius, were centre drilled by using the traverse and cross slide indexes (**photo 1**). The plate was removed and the holes opened out and reamed $\frac{1}{16}$ in. diameter.

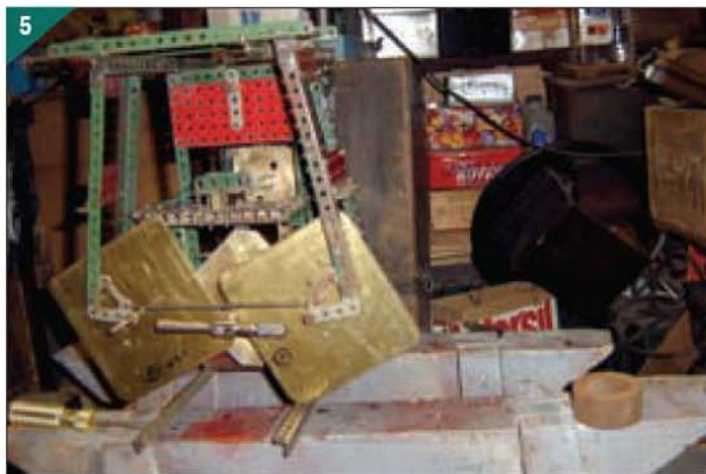
The plate was transferred to the rotary table with a $\frac{1}{16}$ in. dia. pin fitted in the central bore. The corner radii were made by locating each corner hole in turn on the $\frac{1}{16}$ in. dia. pin and machined using an endmill - taking care to rotate the table exactly 90 degrees.

To cut the teeth, a fixture was made to hold the gear blank on the rotary table. This was made from a short length of channel steel with the three outer faces machined accurately flat and at 90deg. to each other. Two $\frac{1}{16}$ in. dia. reamed holes were drilled in one flange 5mm from the web face, one hole being 5mm from one end. Exactly opposite this hole another hole was drilled in the other flange, taking great care to get the two holes exactly opposite. A larger additional hole was drilled to accept a bolt to secure the fixture onto the rotary table. The rotary table, with the $\frac{1}{16}$ in. dia. pin in the centre, was mounted vertically with the surface at right angles to the machine table traverse. Before proceeding further, the rotary table indexing plate and sector were fitted and set for dividing a full circle of 16 teeth, ready for machining the four corner teeth (**photo 2**). The channel fixture was located on the central pin in table, then clamped. The top edge of the fixture was carefully

1. Setting out holes in gear blank.
2. Index and sector on rotary table.



SQUARE WHEEL CLOCK



3. Set-up for cutting the teeth on the straight side.

4. Cutting corner teeth.

5. Test in driving barrel gears using Meccano.

6. Set-up for indexing longitudinal traverse.

7. Set-up for cutting large square spur gears.

set parallel to the machine cross traverse and the table index set on zero. Two pieces of $\frac{1}{8}$ in. dia. rod, put in the two holes in the fixture web, located the gear blank, which was secured by two small G clamps.

For the first tooth, the cutter was located precisely over the centre of the corner pin. The cross slide index was set on zero and the backlash eliminated. The total tooth depth was $2.2 \times 0.51M = 1.12mm$, 0.2 being clearance. With the

machine running, the table was raised until the cutter just touched the job. It is always worth testing the indexing before applying the cut (photo 3). After the first tooth was cut, the cross traverse was moved 1.6mm for cutting the next tooth; this was repeated until all 32 teeth had been cut. The cross traverse was then locked. Using the rotary table, the square gear was turned one tooth and the tooth cut. This was repeated until all four corner teeth were cut, and the next side of the gear blank was horizontal (photo 4). With the cutter well out of the way, the machine settings were returned to the start position. The blank was repositioned on the location pins ready for cutting the next side. A check was made to ensure that the cutter entered the last corner tooth correctly! The gear blank was indexed one tooth using the cross slide. The tooth was cut and then the remaining teeth cut along that side. The procedure was repeated for the remaining sides and corners.

The 12 tooth pinion was cut in the normal way. The gear and pinion were tested using a Meccano test rig. The gear arbor ran in a frame that slid up and down on two guides. Much to my surprise, the square gear and conventional pinion ran remarkably well together! Having proved that a square gear would work, I began to consider the design of the clock.

Design and construction

My original intention was to make a table or shelf clock so I chose a 15.3in. (388.6mm) pendulum giving 1.25 second beat (complete cycle). I later changed my mind and made it a floor standing clock. However, the shorter pendulum has the advantage that the faster movement of the square escape wheel, verge and train enables the rather quaint action to be seen more easily.

As the effective radius of the square gear varies between corners and sides, the torque transmitted by the minute arbor pinion would vary. To reduce this



Fig 1

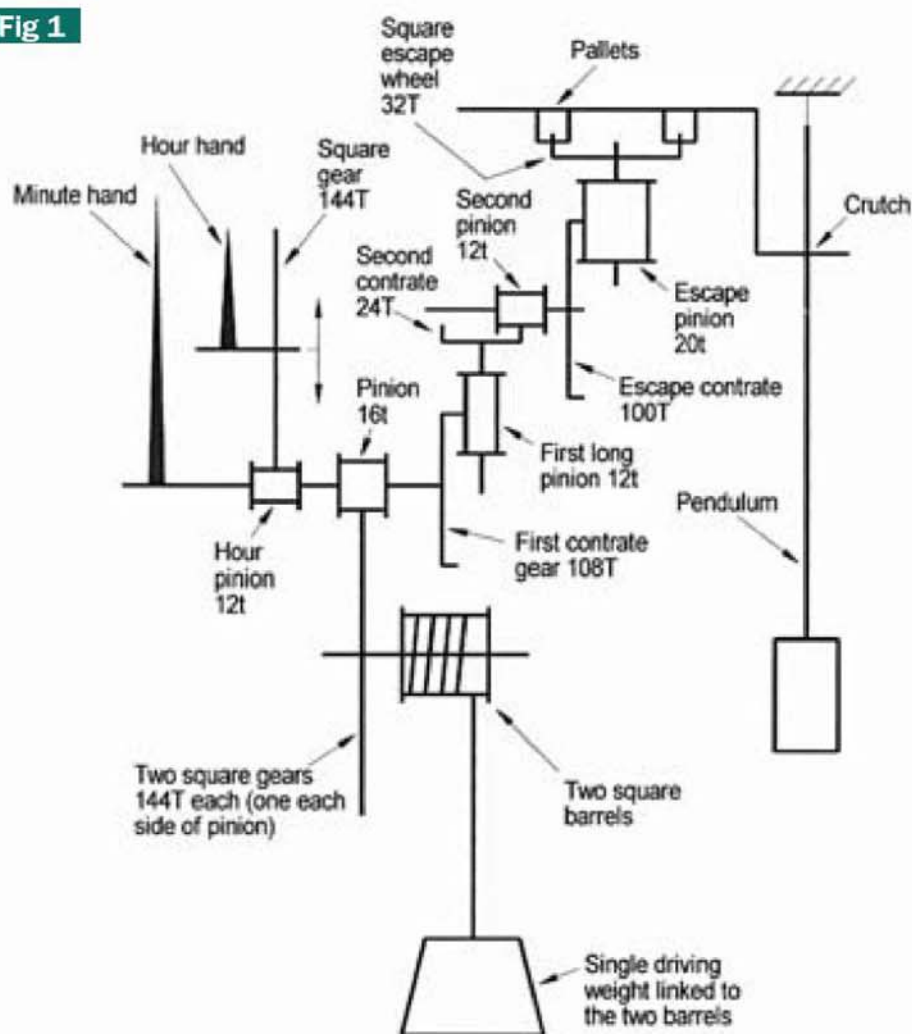


Diagram Of Train

Fig 1. Diagram of train.

8. Cutting square ratchet gear.

9. Testing experimental contrate gear and long pinion.

Throughout the clock, wherever possible, parts were made square or comprised of right angles. For example, the barrels, ratchet wheels and arbors were all square.

Photograph 8 shows a square ratchet wheel being cut.

A 32 tooth escape wheel and 1.25 sec pendulum needs a 90:1 step up gear ratio from minute arbor to escape wheel arbor. To avoid the problems of varying centre distances of square spur gears, square contrate gears driving long pinions were proposed for this part of the train. An experimental pair was made (**photo 9**). Much to my surprise, like the square spur gear, the square contrate gear, meshed with a long conventional pinion, worked surprisingly well! The corners of the contrate gear were short 45deg. sections and the teeth were 1M. The teeth were cut radially and equally spaced using the rotary table.

Having demonstrated that gearing of this type would work, the train was sketched out (**fig 1**). The 90 to 1 ratio was achieved by 9:1, 2:1 and 5:1 ratios. These three ratios were necessary to obtain a vertical escape arbor for the escape wheel. A verge escapement seemed the simplest way of incorporating a square escape wheel.



I used two barrels, one on each side of the minute arbor pinion. The gears were meshed with the pinion so that as one gear was at maximum radius - on the corner of the square, the opposite gear was at the point of minimum radius - on the side

of the square. To accommodate the varying centre distances, the barrel arbors were pivoted in two swinging frames. This arrangement was proved to work using Meccano (**photo 5**). These gears were much larger than the experimental gear so

a slightly different machining set-up was required, although the procedures were similar. The large size made it necessary to use the longitudinal traverse for indexing the teeth and an auxiliary spindle to hold the cutter (**photos 6 and 7**).



SQUARE WHEEL CLOCK

10. Cutting large contrate gear.
11. Escape wheel, first cut.
12. Escape wheel, second cut.
13. Side view of Meccano framework.
14. Pendulum suspension and crutch.
15. Escape wheel, pallets and suspension.
16. Barrel gear with guide plate.

Photograph 10 shows the large contrate wheel being cut on the rotary table. All the gears were fitted with bosses, having two setscrews positioned at 90deg., to enable adjustment on their arbors. The long pinions had square bores and fitted onto square sections of their arbors. To reduce friction, the ends of the arbors were domed and rested on the ends of screws to provide adjustable meshing.

Photographs 11 and 12 show the two stages necessary to cut the teeth of the square escape

wheel. The pallets are flat plates secured on the crutch arbor by square blocks with setscrews for adjustment. There is screw adjustment between the pallet arbor and the crutch fork to enable the beat to be set.

Testing

After all the gears and pinions were made, the whole assembly was tested using a Meccano framework (**photo 13**).

Photographs 14 and 15 show the pendulum, suspension, escape wheel and pallets. Needless to say, there was quite a lot of re-arranging necessary before the clock ran sufficiently well for me to proceed with a permanent framework! Eventually it did, albeit with two pretty hefty weights; then a frame was made and the movement fitted.

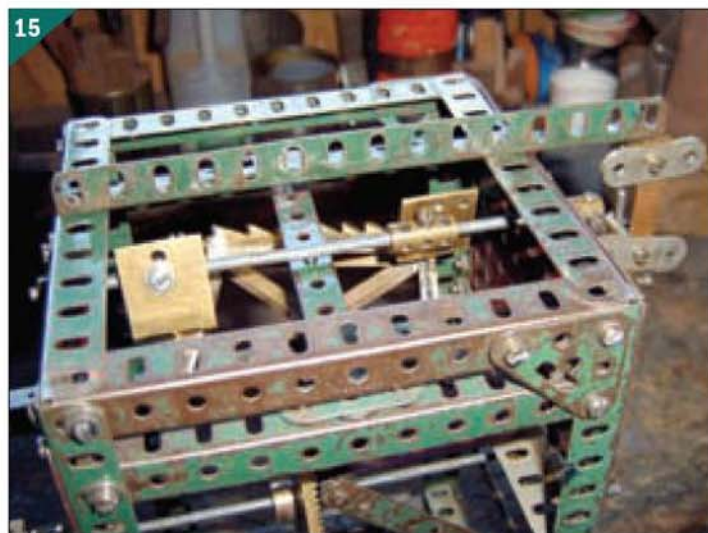
There was a tendency for the barrel gears to come out of engagement as they passed the corners so, while on the

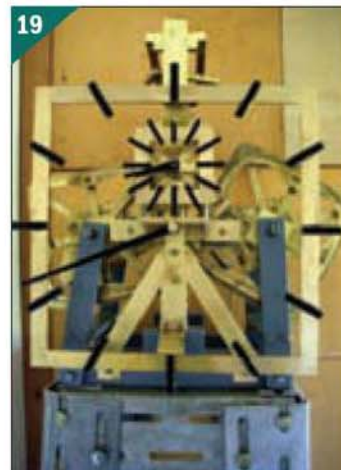


Meccano frame, the gears were held in engagement by springs. To overcome this problem, guide plates were fixed to the face of each gear with the inner edges running against ball races fixed to the framework. This prevents the gears from moving away from the pinions (**photo 16** shows the left-hand gear and ball race). To mark the shape of the inner

edges of the guide plates, a special face cutter was made - the same diameter as the ball races (**photos 17 and 18**).

The chapter rings were then fitted comprising a large minute dial and, within it, a smaller hour dial (**photo 19**). The original experimental square gear was used for the motion work. Since the hour hand is driven by a





square gearwheel, the hour dial rises and falls but, due to the slow movement, it is not obvious. The hour dial moves up and down on two guide rods just behind the hour dial. This is very convenient for setting the hour hand: the dial frame is raised - disengaging the teeth, the hour hand reset and lowered back into engagement.

Floor standing

It was my original intention to pass the weight cords upwards over pulleys above the clock but, as I hadn't been able to find a suitable table to stand it on, I decided to make it floor standing. The advantage of floor standing over the table mounting is that it gives a longer run between windings. A considerable weight was necessary to keep it going, so double lines were out of the question. At first two separate lines were used, then it was realised that, as they descended at the same rate, they could be linked with an equalising bar and pulleys (photo 20). Note the

pulleys are square! However, the double weight was too heavy to hook on with one hand so it had to be made in two sections. The top half was hung first and the bottom half hung below it. Each half was a piece of square steel tubing with a block of lead inside. Fortunately, the reason for the excessively heavy weight was discovered soon afterwards and the amount of lead in the lower half was considerably reduced.

Finished

Photographs 21, 22, 23 and 24 show the complete clock. Since this was essentially an experimental design, I have

just 'tidied it up' and not attempted to 'posh it up'. The clock keeps very good time, a minute or so per week - far better than I expected.

A square wheel dream, a fascinating clock, and smiles all round

ME

- 17. Guide plate marker.
- 18. Marking the guide plate.
- 19. Unfinished minute and hour dials.
- 20. The equalising bar and weight.
- 21. Complete clock.
- 22. Movement - right side.
- 23. Movement - left side.
- 24. Hood and dials.

Foolin' around with pulse jets

Dave Fenner plays around with a pulse jet engine and avoids burnt fingers.

Most readers will probably be aware of the pulse jet engine, most famously employed to propel the German V1 flying bomb. For the benefit of any not familiar with the workings, a valved pulse jet is basically a length of tube having a means of introducing fuel, either in a venturi intake or by pressure system, and a set of non return valves to ensure that combustion products leave by the tail pipe. The fuel-air mix burns/explodes in the tube, aft of the valve assembly, and rushes out rearwards, the high velocity creating thrust. Inertia then has the effect of drawing in more fuel - air from the front via the valves, the new charge being ignited by the residual exhaust. The process continues while fuel is supplied, creating a noise like an unsilenced engine, at a frequency determined by the length of the pipe. An alternative design is the valveless pulse jet, where the tube is formed into a U shape with unequal length arms, but the theory of that type is another subject.

My own pulse jet has been one of those disjointed projects which started in 1962. As a



control line aeromodeller, and having read the *Model Aero Engine Encyclopaedia*, compiled by R. G. Moulton, it was my ambition to build a pulse jet to the Brauner design. The project was begun during the first year of my apprenticeship with Rolls-Royce. The experts in the pipe-work section soon produced a stainless steel combustion chamber and tailpipe, and it really was a superb work of art. Having moved on from the comprehensive range of machining equipment in the apprentice training centre, and also having developed an interest in fast motorcycles and cars, the project, along with aeromodelling, was put to one side.

The beautiful piece of pipe did, however, stay with me throughout several decades and house moves, but mysteriously disappeared just a few years ago. So, when the project was revived, it was back to the drawing board. Fortunately a copy of the plans had been gathering dust for all of 35 years so a fresh start was possible.

The intention now was just to make a working pulse jet, not a flying model, so minimising weight would not be a serious consideration. Accordingly, as I had various bits lying around, the tailpipe was fabricated from 18g exhaust pipe tube and sheet steel.

The tapered section was drawn, cutout with tinsnips, then bent into a conical shape by repeatedly making small folds on a flypress. Fabrication was completed using a combination of MIG and TIG

welding. Back in the days when I undertook a fair amount of welding work, a tidy job might have resulted. Unfortunately these days, being somewhat out of practice, the mouse droppings need a fair amount of fettling. The threaded attachment ring was turned and brazed in place. The assembled engine is shown in **photo 1**.

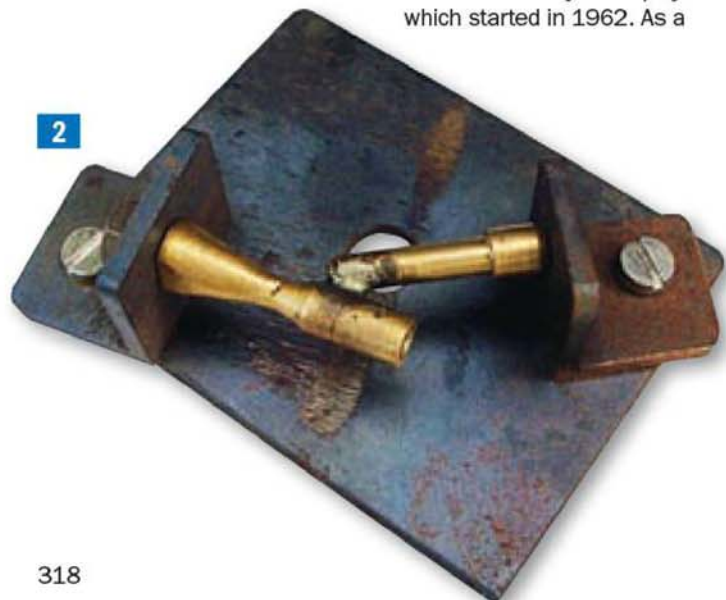
The nose piece, which forms the venturi intake, is turned from aluminium. The drawing shows that the wall section is reduced to 2mm to save weight. For the present, mine has been left at billet size (easier to hold if re-machining is needed). The internal throat venturi shape was cut by making a couple of metal templates, which were then used in conjunction with a contour turning arrangement.

I altered the design slightly to enable the valve plate to be made from steel plate rather than as a turned or fabricated item. The apertures were formed by a combination of drilling and milling. This design change makes it slightly less convenient to change the valve or valve restrictor, as a single bolt also retains the jet assembly. On the original, the valve plate was retained by peening over the aluminium, I have used a couple of 8BA bolts for the job, thus allowing repeated dismantling or the substitution of an alternative plate.

The fuel jet assembly components were turned and drilled, then the two parts were assembled by silver-soldering using a purpose made jig (**photo 2**). An internal thread was

1. Pulse jet based on the Brauner design.

2. Jig for silver-soldering jet assembly.



added to the air jet for holding/positioning while soldering.

Manufacture of the petal valve was solved when I had a chat with a friendly glazier. He happened to have a CNC water jet cutting machine which, although normally for glass, would also cut shim steel. Due to the flexible and springy nature of the material, the shim was actually cut by sandwiching between two sheets of glass. The shape was drawn in CAD, saved as a DXF file, and passed to the glaziers. Other methods of manufacture might include presswork or etching.

The overall simplicity of the engine is seen in **photo 3**, which shows the components, including an alternative valve restrictor.

Ignition system

Chatting to Bryan Passey at the Machrihanish model flying get-together, I learned that nowadays, the preferred method of firing up a pulse jet on the flying field, is to use a sort of extended spark plug which is poked up the tail pipe into the combustion chamber. Mulling over the long spark plug idea, I first thought about passing a length of welding wire down a PTFE liner and running both inside a length of $\frac{3}{16}$ in. bore steel tube. A day or two later I had one of those 'Eureka' moments, when I wondered if a

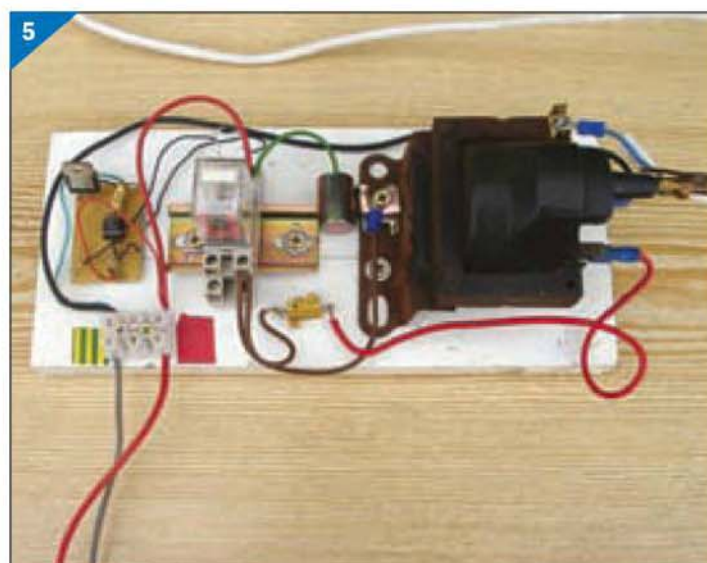
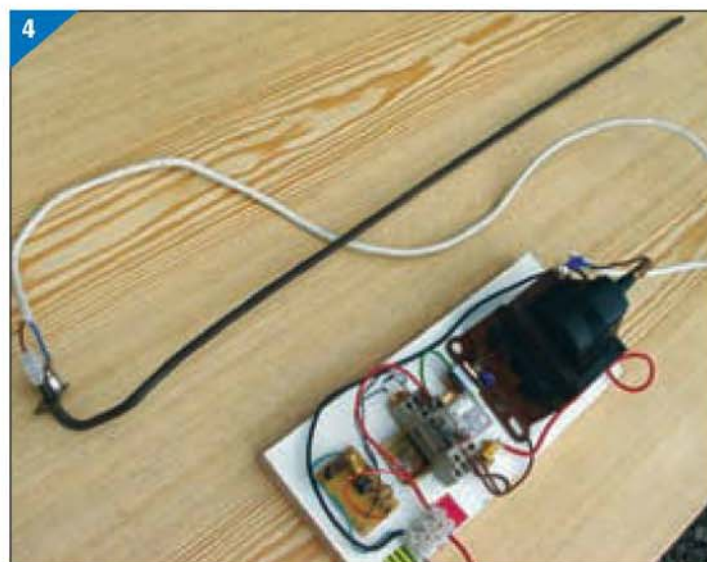
circular oven element could be straightened. If it could, and if it would deliver a spark, it would certainly be a better proposition in terms of high temperature capability. It did in fact work.

It was then a case of providing a spark, and here I knocked up a 'Heath Robinson' arrangement which gives sparks at a frequency of just a few Hz. A 555 timer generates pulses, which are amplified and fed to a 12 Volt relay that controls a car ignition coil. Given the popularity of electronic ignition, it should be possible to dispense with the relay arrangement and increase the frequency - but I'm no electronic expert.

Photograph 4 shows the 'long plug' attached to the spark generator, and **photo 5** gives a closer view of the ignition components. Presumably, because the sparks are created at atmospheric pressure (unlike the high compression of an I/C engine), it was possible to connect the 'plug' using normal domestic 240 Volt two core flex.

Firing-up

I recently managed to acquire a 1958 copy of the Ron Moulton book which started me off, all those years ago. Several interesting points are mentioned in the chapter on the pulse jet. Petrol or white spirit is suggested as a fuel, although it is interesting to note that recent comments on the web mention a mix of petrol and kerosene. An



additive is included when bag tanks are used, to keep the bag material pliable. To cope with varying ambient temperatures, three main jets are suggested having 0.9, 0.95, and 1.0mm orifices. The drawing quotes just 1 millimetre. The shape of the valve restrictor is another factor mentioned for experiment. In connection with starting procedure, the book says "use the Continental method of ignition by playing a blowlamp across the end of the tail pipe".

Since I could not get the electrical method to work, I resorted to the blowlamp system. The book suggests using a car tyre pump connected to the air tube, and deliver long and short bursts. I used an airline set to about 35psi. Modern day

3. Component parts of pulse jet.

4. Long spark plug made by straightening oven element.

5. 'Heath Robinson' spark generator.

aeromodellers seem to use pre-charged air bottles. Subsequent experiments indicate that the air should be applied first to the air jet, then after fuel is drawn up, the air supply moved back a couple of millimetres so that air is also fed past the air tube into the air intake proper.

Success was eventually achieved, resulting in a deafening noise. After about 15 seconds of mayhem, I decided discretion might be the better part of neighbourly valour and pulled off the petrol feed.

An immediate attempt to restart was unsuccessful.



6



Post run examination

Because a piece of 1½in. aluminium bar had been available at the time of construction, my valve restrictor was 38mm diameter rather than the 40mm specified on the drawing. It was noticeable that the valve petals had taken on a slight fold, in line with the restrictor periphery and therefore were no longer closing. This will be area for experiment: Firstly, to increase the restrictor diameter to drawing. Secondly, to alter its shape to try and encourage more of the bending to take place nearer the centre where it may be cooler. A second restrictor was made and the revised form can be seen in photo 3. It was also evident that the pressure of the repeated combustion had caused the petals to deform slightly into the apertures in the valve plate. This slight, two dimensional bend would no doubt have some effect on the flexing characteristic of the petals, but whether this would in turn influence performance, is not known.

The original valves were cut from shim steel (low carbon) and a change to either spring steel or stainless steel may be beneficial. Type 302 stainless steel shim stock is readily available in a variety of thicknesses, and this may be tried in the future.

Some of the other designs, found via the internet, feature needle valve control of the fuel feed as opposed to the fixed jet arrangement used here. A soft-soldered needle valve assembly was made (photo 6). The valve includes a nylon cap, the purpose of which is to seal against air ingress, as a bubble of air would most likely cause the combustion cycle to stop. The version shown can be

simply inserted in the fuel line. A second version was made and assembled with silver solder. This one was designed to screw into the nose, in place of the fixed jet.

Concluding comments

If this is a topic in which other readers have an interest or experience, then perhaps they may care to write in to the editor. Apart from tweaking the mechanical details, and considering other methods of valve manufacture, an ignition circuit to give a high frequency spark would be a significant step forward. With regard to making the petal valve, it could probably be made using nothing more scientific than a pair of scissors or small tinsnips but, as the component needs to be replaced regularly, some means of batch production would be preferable. My local laser cutting firm tells me that working in thin shim for them is not possible. Do others know more? Other methods considered, but not tried, include press tooling and etching.

At the time of writing, successfully starting the jet, seems to be very much a matter of chance. It is probable that with practice, a procedure may evolve which will give more predictable and reliable operation. Certainly, after a bit of initial fiddling to find the settings, the needle valve has given encouraging results.

A fair amount of information can be found on the internet - clearly others have experimented with varying degrees of success. One site visited some time ago carried a drawing giving details of a design used by a Dutch group (Team Helmond) around 1989. This appears to have a 12 petal valve, and a fuel feed

(presumably pressurised) directly into the combustion chamber. One internet source indicated that this design could also deliver controllable thrust, but I have not found information to corroborate this. Close examination of the Dutch drawing suggests that they may have used a multilayer valve, a little like a leaf spring.

The website www.pulse-jets.com is a mine of information, leading to downloads of a number of drawings and pictures, including some relating to the original V1 Argus engine. The American Bailey unit appears to be similar in size to the Brauner, but has a slightly larger petal valve, and a venturi intake design similar to that employed on the Dynajet (popular in the 1950s and 60s and available commercially at that time in the USA).

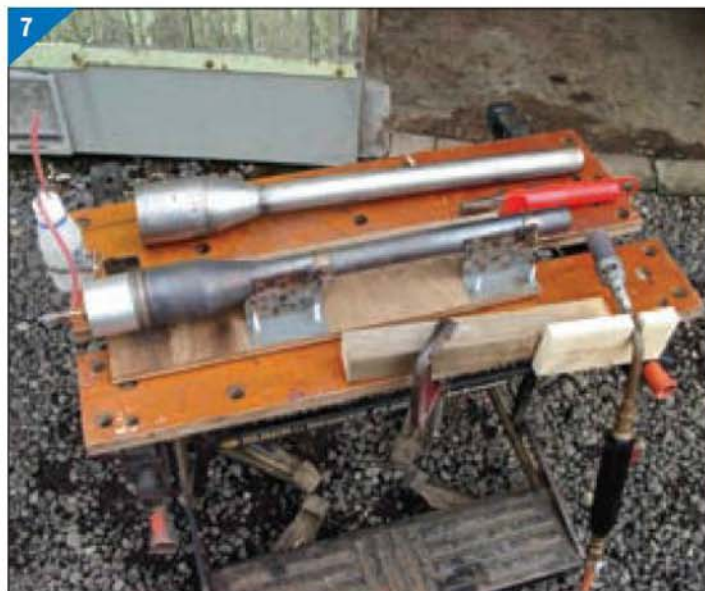
Any one interested in seeing pulse jets in action, will find some fascinating clips on YouTube - typing in 'Pulse jet' will bring up a number of devices both valved and valveless, static and attached

to vehicles such as sleds, go karts, and bikes. 'Twin Pulse Jet' should take you to a short video taken at the 2006 Machrihanish event, showing a model plane fitted with two commercially made Italian 'ZZ Model' pulse jets, flown by Steve Rickett achieving something in the region of 230mph. Apparently the plane has since been modified to take three jets.

The improving affordability and reliability of miniature gas turbines (which are highly controllable - unlike the 'all or nothing' characteristic of a pulse jet) has meant that serious jet aeromodellers are looking more to this option. Nevertheless, construction of a small pulse jet is an ideal 'quickie' project on which to wind down after a major opus. For myself, the Mk. 2 pipework has already been roughed out (photo 7). This is the Brauner design scaled up by 20%. The picture also shows the test bed with blow lamp, and the revised version of the needle valve. Comparison with photo 1 shows that the original 'warmed up a touch' during testing. **ME**

6. Components of needle valve.

7. Brauner pulse jet with fuel tank and blow lamp, together with Mk. 2 pipe.



Peter Spenlove-
Spenlove suggests
a technique to make
your drill chucks
easy to remove
without damaging
arbors or spindles.

1. This 1/2in. capacity 'Cardinal' Industrial chuck is fitted onto a No. 2 Morse taper shank with a Jacobs No. 33 taper. A standard pair of wedges cannot release this chuck.

2. Jaws opened for drilling and tapping from the other end. Grip this end in the lathe chuck.

3. Pop a good quality, long screw such as an Allen hex cap screw in the lathe chuck and face the end to a slightly hollow shape to press the end of the arbor, shank or spindle without damaging the 60deg. centre hold on the end.

4. The chuck's taper was blind and so it was drilled and tapped from this end.

Except for the cheapest and some portable/DIY tool chucks, most engineers' drill chucks are fixed to their machine or arbor/shank by a self-gripping taper much like a very short Morse taper. For nearly a century this has been known as a Jacobs taper and has been the industry standard for chucks from all makers.

The metric people have introduced some tapers, similar in looks to Jacobs, but tool factors only list a small range of chucks, as these are not popular and fitting them properly causes confusion until the machine tapers are carefully measured and identified.

I wanted to replace a cheap DIY chuck with a good Jacobs or Albrecht chuck. The spindle on the far-Eastern made machine had a metric taper. A national tool factor could only supply a chuck of medium quality. It was used until the stockists got good ones with metric tapers.

Once fitted, however, it can be hard to remove a chuck (photo 1). The usual way is to use a pair of forked wedges forced between the back of the chuck and the machine tool spindle and bearing assembly. This is the standard method, but my far-Eastern chuck quill assembly was not strong enough to withstand the wedges method.

I use a jacking screw, a method which I have used



since the 1950s, with standard Jacobs and Cardinal chucks from 1/4 to 3/4in. capacity (photo 2). At the bottom of the Jacobs taper is solid metal - a blind hole (photo 3). With the jaws fully open one can pass a drill in and though the taper hole side and then tap it. When tapped through, a screw can be run in from the open jaw end to push

against the taper spindle or arbor and so force the chuck off. If you have a really good, but costly chuck and use a jacking screw, it is possible to fit it to a lathe tailstock arbor or shank, to an R8 milling arbor, etc, thereby utilising the one chuck for several places.

Use the largest thread that will fit and drill such that a full, non-truncated thread can be tapped to be a snug - not sloppy - fit on the jacking screw. I use an Allen head cap screw whose tip is slightly hollowed to avoid jacking against the centre hole left by the arbor makers (photo 4).

Although I used 3/8in. BSF in the photos 2 and 3, the jaws opened to just over 1/2in. (its drill capacity), so I could have used a larger fine thread up to 1/2in. BSF.

Almost all arbors, shanks and machine spindles have centre holes. It is sensible not to damage these as, in future, they may be needed. **ME**



Roger Backhouse reports on a well organised event held at the Langford Museum of Power, near Maldon, Essex.

SEQLEC 2008

Langford Museum of Power was an appropriate venue for this year's 7½" Gauge Society Locomotive Efficiency Competition (SEQLEC). Visitors were rewarded by some energetic running in the new setting of the Langford and Beeleigh Railway within the museum's attractive grounds.

This was my first visit to a locomotive efficiency competition and in my innocence wondered if it might be like a race meeting. Thankfully there were no ghastly hats, no bookies and no front-runners mysteriously doped. Instead there was interesting running, excellent catering and good

organisation. Everyone was given a very warm welcome.

The purpose of a locomotive efficiency competition is to assess thermal efficiency - how much effective work is done for the coal consumed. Runs are timed, load is known and a dynamometer car measures drawbar pull. Coal is weighed before and after the run to



determine the amount used.

Sutton Coldfield MES kindly loaned their dynamometer car for the event.

Neal Harrison of Sutton Coldfield MES was chief judge and John Dines of the Langford and Beeleigh Railway was organiser. He faced problems finding coal because the local yards had closed. Eventually he found a coal supplier in Brightlingsea.

Visitors had not previously driven at Langford's track - a pleasant undulating quarter mile route through trees around the museum, and along the banks of the River Blackwater. Although only begun four years ago, the line includes some of the oldest miniature railway track in the country with a short length of ex-Surrey Border and Camberley rails dating from 1936. The line is constructed to a good standard. All running stock is vacuum braked. There is a station building and a well laid out motive power depot with unloading facilities and steaming bays. Plans are in hand to erect an overall roof on the station. This will look good and, as John Dines said, "it will protect us from the rain of conkers in autumn." Several footpaths cross the track and, for SEQLEC, all were supervised by flagmen from the line's volunteers. Trains are protected by electric block signalling. For SEQLEC these were activated by magnets hung from the front buffer beam of each locomotive.

The total of five entries was down on previous years. This year entries offered a variety of tank engines and different driving styles. The number against the competitors name is the running order:

Paul Collins (1)

Paul was driving a GWR type 0-6-0 saddle tank number 1361. He managed a remarkably fast trial run despite a speed limit of 6mph. As he said afterwards, "Speed helps draughting by reducing the need for the blower."

On test runs, his engine suffered water feed problems forcing him to stop. Nevertheless, he still managed 10 laps. On examination he found an insect had blocked the feed pipe, giving rise to witticisms about the need for 'debugging'. There was also the only heavy shower of the day when passengers unfurled umbrellas. I wonder if the extra wind resistance was taken into account! However, he came fourth overall despite this bad luck. (Thermal efficiency 0.72%)

John Hampshire (2)

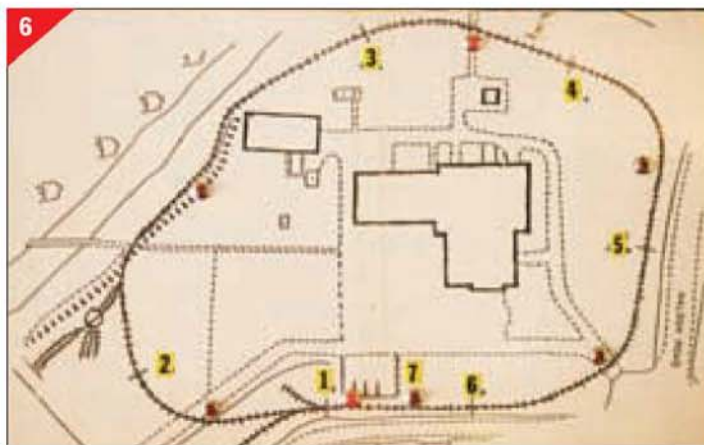
John's impressively detailed 2-6-4 standard class tank 80076 was next. Despite a lubricator problem he managed a good run to come in third place. (Thermal efficiency 0.76%)

Ron Manning (3)

Following a short break, Ron was next with the only narrow gauge prototype - his Single Fairlie *Merlin Ambrosius*. Ron put in a 'wizard' performance, despite the derailment of a passenger car, and finished in second place. (Thermal efficiency 1.01%)

John Painter (4)

John is the 2007 SEQLEC winner and again drove a GWR 14XX tank. I was pleased to see the number 1420 - the same number as the full-size engine which pulled the last goods train on the Kington



branch when I was a 14 year-old passenger. Talking to John afterwards, I found he fires the real 1420 on the Dart Valley Railway as well as driving stock cars and owning several preserved wagons.

John's approach was rather different to the other competitors. He took all available passenger stock plus goods wagons. His advice, freely shared with others, is that maximising the load increases drawbar pull. The only problem en route was some slipping at the station approach, but his methods worked and he finished in first place. (Thermal efficiency 1.34%)

6. Railway map: The quarter mile route partly follows the River Blackwater.

7. Steaming bays after a heavy shower of rain with 80076 and Merlin Ambrosius.

Stuart McKay (5)

Stuart was last to run driving a Romulus he'd bought two weeks previously. Despite being new to the engine, Stuart put up a decent performance and finished in fifth place. (Thermal efficiency 0.61%)

Ideas please

Talking to Bill Dadswell, assistant secretary of the 7¼" Gauge Society, I was interested



Run #	Driver	Society	Locomotive	Time (Min-Sec)	Distance (feet)	Work done (ft-lbs)	Coal used (lbs)	Average DB HP	Specific coal consumption (lb/DB HP hr)	Overall Thermal Efficiency (%)
4	John Painter	Swindon	14XX	29-12	12974	455746	3.1250	0.473	13.597	1.34
3	Ron Manning	Chingford	Single Fairlie	31-4	15164	516205	4.6875	0.504	17.980	1.01
2	John Hampshire	Malden	Std. Class Tank	31-34	15179	272451	3.3125	0.262	24.073	0.76
1	Paul Collins	Ascot	GWR 1301	30-5	12461	146990	1.8750	0.148	25.257	0.72
5	Stuart McKay	L&B	Romulus	29-38	15168	465901	7.0000	0.476	29.749	0.61



8. John Painter's 1420 and Stuart MacKay's Romulus.

9. Preparing locomotives.

10. John Hampshire prepares to start 80076, followed by Ron Manning with Merlin Ambrosius. Neal Harrison (judge), checks the dynamometer car while John Dines (organiser), oversees operations.

11. John Painter's GWR 14XX 1420 - the winning locomotive.

12. Roger Backhouse (at right) presents John Painter with his winner's certificate.

13. Winners - left to right: Ron Manning, Paul Collins, Stuart McKay and John Painter.

14. Maxine Haley, Sheri Grigg and Sylvia Carpenter - the catering team.

to learn that the society has over 1,600 members. They would like to increase the number of entries in future SEQLECs and welcome suggestions on how this might be achieved. Bill felt that, although members liked public running, they were reluctant to enter competitions. These engines are not the easiest to transport to events but when run look most impressive.

Museum

During a lull in proceedings I looked round the adjacent Museum of Power. This is well worth a visit. The centrepiece is a fine Lilleshall triple expansion engine, augmented by many other engines (mostly I/C), plus displays of domestic equipment,

and a recreated belt-driven workshop. Hopefully the museum will be featured in a future article.

The winner

On behalf of *Model Engineer*, it was a pleasure to present the Bristol Trophy to the winner, John Painter, and certificates to the runners-up.

Model Engineer would like to thank all SEQLEC 2008

competitors. The effort of preparing, transporting and running the locomotives is much appreciated. Particular thanks go to the catering team: Maxine, Sylvia and Sheri, who did a splendid job throughout the day. Finally, our thanks go to the Langford and Beeleigh Railway for hosting SEQLEC 2008 - a well organised, enjoyable event, in an attractive location. **ME**

The Museum of Power is open:

April to October Wednesday to Sunday 10-5

November and December at weekends only from 10-4

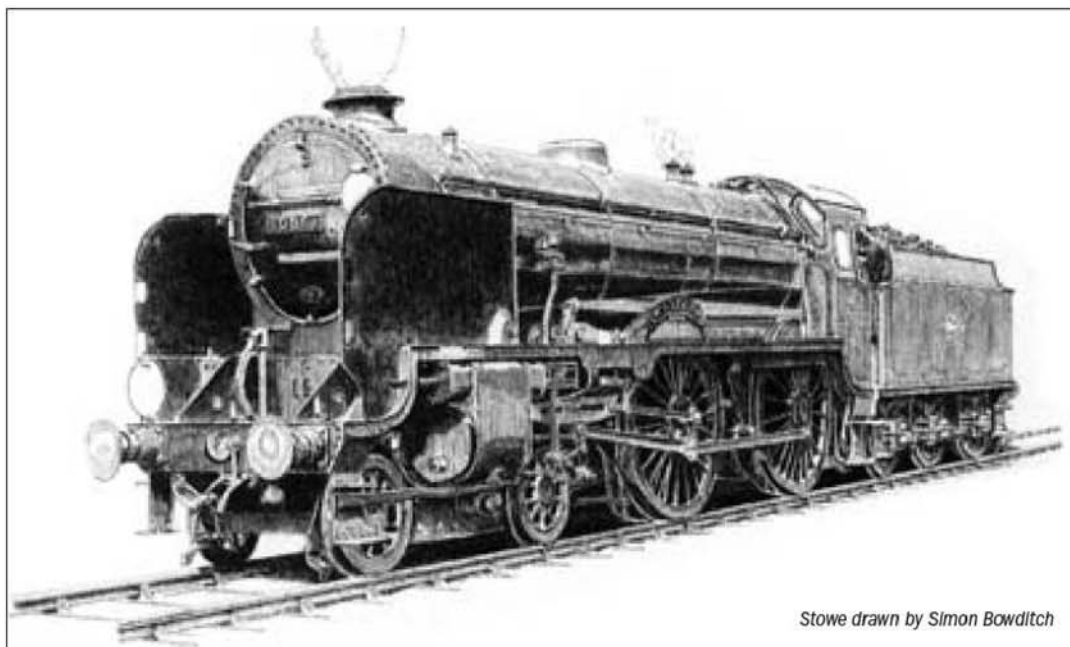
February to March Friday to Sunday 10-4

W. www.museumofpower.org.uk

E. enquiries@museumofpower.org.uk T. 01621 843183

The Langford and Beeleigh Railway usually runs on the first Sunday in the month and summer Bank Holidays.

STOWE - Southern Railway Schools class locomotive



Stowe drawn by Simon Bowditch

Neville Evans considers the development of chimneys and describes the Stowe smoke deflectors.

*Continued from page 208
(M.E. 4332, 15 August 2008)*

In the early days of the steam locomotive, that is before about 1880, boilers and therefore grate areas were quite small, and so chimneys were tall in proportion to the boiler. This meant that there was a natural draught through the grate, along the fire tubes, and up through the chimney. It was possible to use a simple front end layout which comprised a parallel chimney or a chimney which tapered slightly from bottom to top and a blast nozzle placed underneath it, with no petticoat or cowl. Engines laid out like this certainly did steam. They may not have steamed as well as they could, and they may very well have had a smallish blast nozzle which would result in some backpressure on the cylinders. The effect was that some of the power, which should have been developed in the cylinders, was instead used in accelerating steam velocity from the top of the blast nozzle in order to induce enough draught. However, one of the beauties of the

conventional 4-4-0 locomotive was that it could accommodate a deep narrow firebox between the coupled axles. Designers were therefore able to provide a simple round-topped boiler that was extremely easy to fire. One just dumped in large quantities of superb British coal, giving a thick, hot fire. Steaming troubles were practically unheard of. Boiler pressures remained at around 180psi except on the North Eastern R class which used 200psi together with a rather weird and wonderful piston valve layout, the work of Walter M. Smith, who was the locomotive superintendent Wilson Worsdell's chief draughtsman. The cylinder and piston valves were inclined in opposite planes, and weird though it might be, wonderfully effective it certainly was, as these locomotives remained in passenger service in North Eastern England until 1952. The single chimney was developed by using a combined cowl and petticoat, with a curved sweep into the petticoat

and a progressive taper out to a larger diameter at the top of the chimney. The vast majority of steam locomotives had a front end of this type until the end of steam.

Double chimney

The next development was the advent of the double chimney. The main reason for this device was that because of the lack of height, with the huge boilers of the more powerful modern engines, you could not obtain the correct proportions for a simple single exhaust system. You simply couldn't pass enough steam and still have reasonable characteristics over a large range of working conditions. The answer was to use two chimneys in line astern, so that each one had a reduced diameter compared to its height. In this way correct proportions could be retained. Further improvements were made in the smooth mixing of the flow of steam from the blast pipe and the hot gases which arrived from the grate via the fire tubes. A Finnish gentleman called Kylala invented the mixing basket, which facilitated said merging, reducing turbulence in the smokebox by mixing the two gases in several stages. He later collaborated with Andre Chapelon (to whom we doff our caps) in the design of what became known as the Kylchap chimney, first used, with huge success, by the French railways in their double and triple blastpipe engines.

The story of how Ernie Nutty developed the double chimney that was fitted to the ex GWR 'King' class deserves to be retold. He believed that "there are no bad boilers, only bad front ends" and set out to prove it. Mr. Nutty incidentally was the author of the splendid little book (they used to be called 'Slim



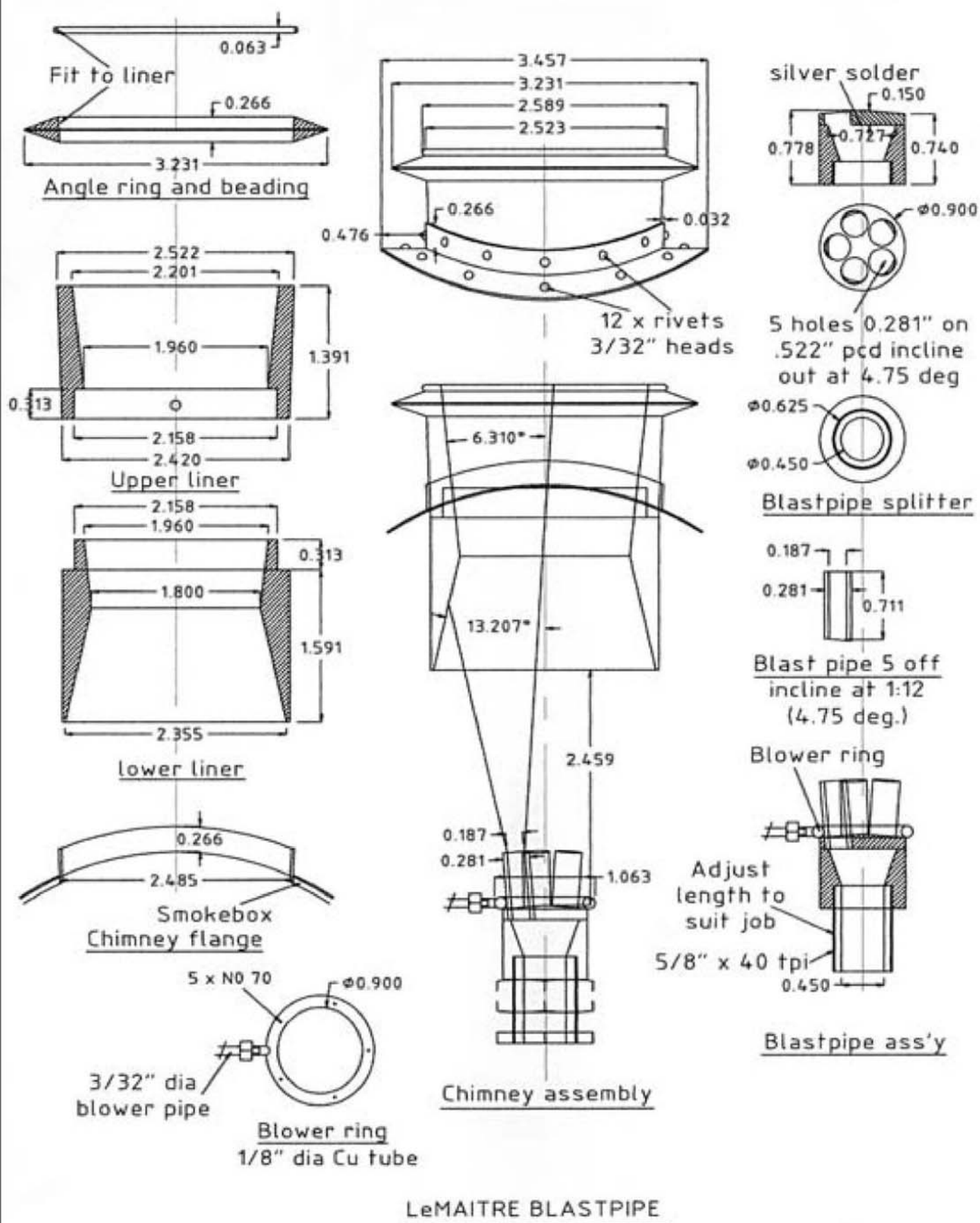
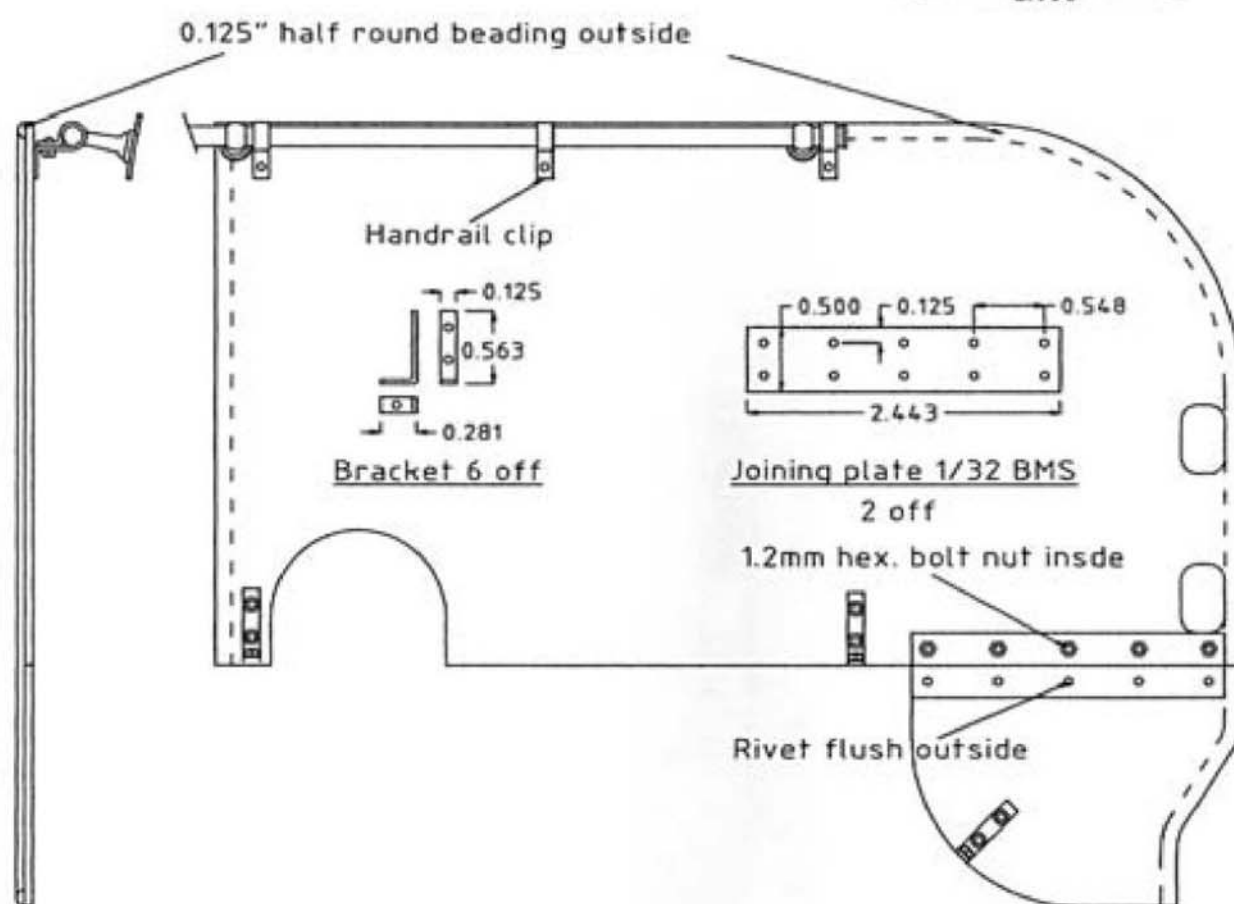
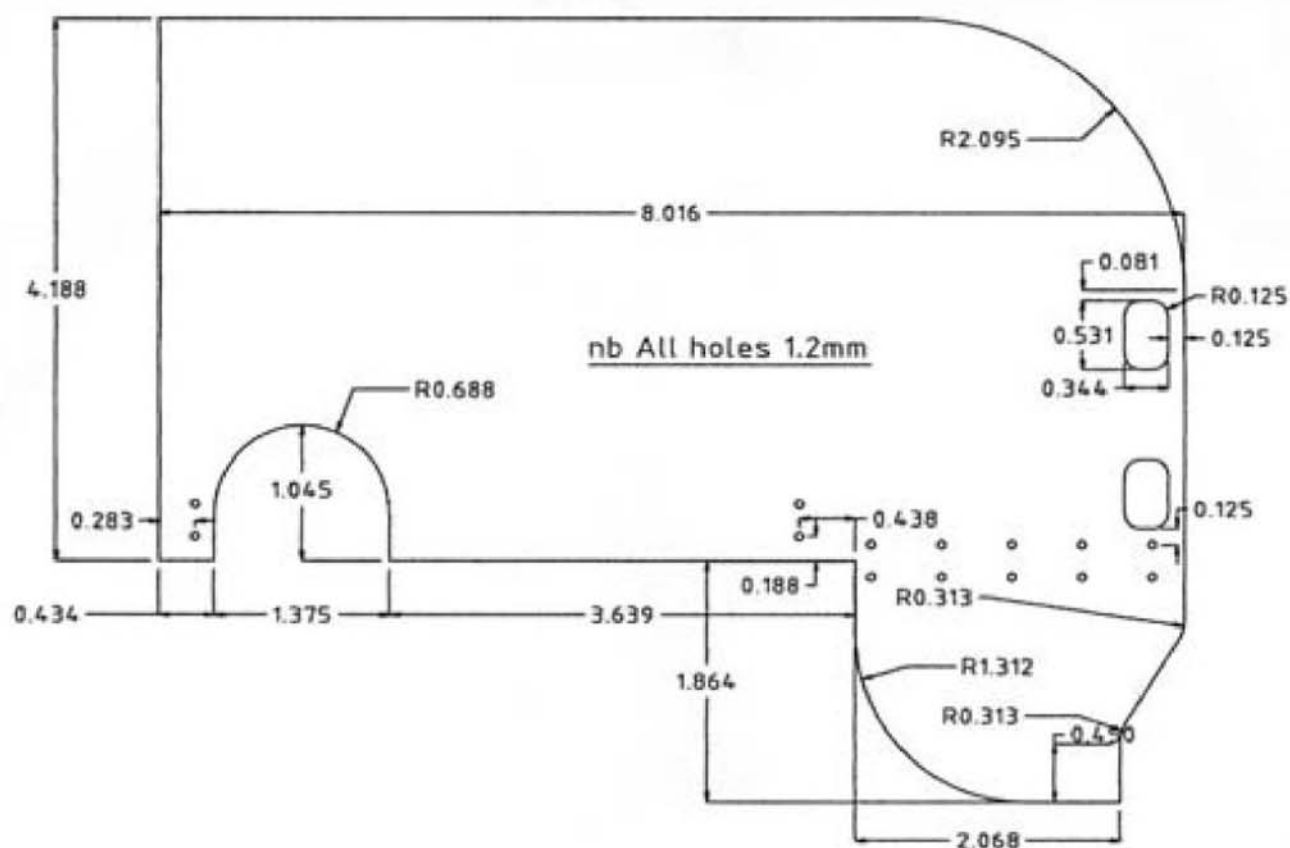
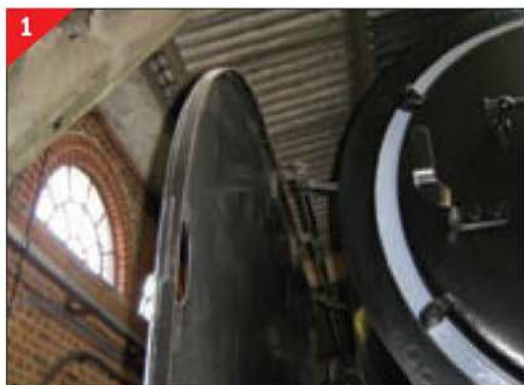


Fig 1



SCHOOLS SMOKE DEFLECTOR 2 off handed
1/16" B.M.S. plate

Fig 2



1. Top view of deflector showing top clips.



2. View showing fishplate and bottom clip.

Volumes) *GWR Two-Cylinder Piston Valve Steam Locomotives* which should be required reading for all serious students of the steam locomotive, and held a high position on the Western Region of British Rail. It appears that Ernie was sitting in his office recalling how Chapelon had considered that the King boiler was so large and well proportioned that it should be capable of developing over 3,000hp. The obvious problem lay in the blast pipe and chimney. The blast nozzle was so constricted that steam left it at somewhat more than the speed of sound, leading of course to considerable difficulties over the mixing of the exhaust steam and the hot gases emerging from the fire tubes. The backpressure must have been enormous and restricted the locomotive to a maximum of under 2,000hp. Taking a pragmatic view, he looked for a locomotive that with a single chimney produced a maximum of 1,400hp. The 2251 class 0-6-0 filled the bill. The next step was to obtain two 2251 liners, blast pipes and nozzles from stores, and install them in a King that was just being reassembled after overhaul. A splitter was contrived on which to stand the two blast nozzles, and a lash-up arrangement to secure the two chimney liners in a rolled up sheet steel chimney, as a temporary measure. After a little bit of tuning, the locomotive performed very well on test. It

was then handed over to the test engineer, Mr. S. O. Eli, and the double chimney was properly developed. The results were quite amazing. It was said that on test the locomotive hauled 29 dining cars 80 miles in one hour. It needed two firemen to do this, one firing left-handed and one firing right-handed, and a man on the tender bringing forward the coal.

If the object of the exercise was to show the ultimate power to which a King could be forced, then it succeeded only too well. There are two points however which should be considered. The first question was how long the rather fragile crank axle of the King would hold up under this sort of treatment, and secondly, the amount of coal consumed could only be practically fed by means of a mechanical stoker. Oil firing is the obvious solution, but if oil is to be used, then equally obviously it has to be burned in a diesel engine at about 18% efficiency, and not in an externally fired boiler at 4% efficiency.

LeMaitre exhaust

The LeMaitre exhaust used a slightly different approach. The original idea was that you have five blast nozzles, four of which are arranged in a circle, but leaning outward from the vertical, while the fifth is placed vertically in the centre. For some reason which I am unable to fathom, Bullied arranged all five nozzles concentrically, as can be seen from the drawing. This arrangement appears to have made no difference to the steaming ability of the front end, as the LeMaitre

equipped engines on the Southern all steamed very well indeed, including the hitherto troublesome Lord Nelsons, which admittedly were re-cylindered at the same time. These five nozzles fed into a perfectly normal petticoat and chimney, albeit of a far larger than normal diameter. In other words the problem of providing a large enough diameter chimney had been solved by using a large number of blast pipes. Because the area of the nozzles is so large, the speed of the gases is comparatively low, which means that losses due to back pressure are minimised and all the energy remaining in the exhaust steam and gases is transferred into creating a smokebox vacuum with the result that the locomotive steams furiously. The only snag is that it is more difficult to get the exhaust to clear the boiler casing.

I must admit that I approached the problem of designing a small LeMaitre exhaust with a certain amount of trepidation. My fears were allayed however by my friend Neil Simkins who has a vast breadth of knowledge of steam engines. I knew that Neil had built a Bullied Pacific in 3½in. gauge many years ago. He told me that he had merely scaled down the Bullied exhaust from the original drawings. The locomotive steamed like the proverbial witch. Nuff said. I have followed Neil's lead and simply worked straight from the original Eastleigh drawing of the Schools class exhaust. I notice that on the original are printed the words 'Steel BRS 115 ordinary quality, electrically welded by the Boiler Shop'. Would that things were as easy in model sizes.

Schools blastpipe

The problem with the Schools blastpipe arrangement is that of assembly. As can be seen from the drawing the bottom part of the tube is larger in diameter than the top (fig 1). The only answer is to make the top and bottom of the tube as two separate pieces. The half round trim at the top, the angle ring and the base can be pushed on from underneath, and the whole lot assembled to the smokebox by means of the wide angled flange. This flange may be made by first cutting a hole of the appropriate size in the smokebox. The large horizontal flange is measured out from this hole plus 0.476 inch. The vertical flange is then inserted and silver-soldered to the inside of said horizontal flange. The vertical flange may now be trimmed to size and they can both be drilled for rivets and screws. The bottom taper is fitted on a spigot from underneath and held in by a single 6BA grub screw. This arrangement allows access to the snifter valve and to the wet header for withdrawal of the superheater tubes. The centre line of the LeMaitre chimney was moved forward about 4½in. from the previous arrangement for clearance reasons, and to allow a better entry for gases from the firetubes. We therefore have to use a modified manifold which allows the exhaust pipe to sit 0.348in. further forward. This will be available for them as needs it as required.

Smoke deflectors

Straightforward fabrications in 16 gauge steel (fig 2). The thickness will pass unnoticed due to the half round beading on the edge. The fiddly bits are the tiny brackets that hold them onto the smokebox sides. The first 10 engines were built without deflectors and they were retrofitted when the next batch of locomotives was built. In my opinion, for what it's worth, their appearance was improved, as the Schools class seemed front heavy as built, and the deflector plates softened an otherwise rather ungainly appearance.

●To be continued.

A miniature steam turbine turbo generator

Raymond McMahon
continues his
description for a
unique steam turbo
generator construction.

Continued from page 213
(M.E. 4332, 15 August)

Before the turbine can be assembled and tested, the front cover and steam jet must be made. Machine up the front cover end plate taking care that it fits into the turbine casing with no shake whatsoever (**fig 3**). At the same setting, machine the bore for the ball bearing. Don't forget the clearance at the rear for the ball bearing centre. Reverse in the chuck and machine the recess for the motif plate (**photo 5**). The motif (**fig 3**) is quite simple, the only tricky bit is to keep the stamped letters in line.

The drawings for the next three parts appeared in fig 2, M.E. 4332, 15 August 2008.

Assembly

I have used a bit of license here, but it all adds to the final



5. Front cover of turbine with motif plate attached.

6. Turbine housing with rotor and mounting studs installed ready for assembly to generator section. Coupling for generator drive is not installed.

7. Generator housing showing the drive gear which is engaged by coupling pins

appearance. For the housing use small-headed hex bolts, they are much neater than standard size.

Steam jet

The steam jet (fig 2) is nothing fancy. It's just a straight hole with a number 70 drill. If you want, you could experiment with tapers. In my experiments with larger jets, by the time I got to number 70, I thought enough was enough! It works well. The external threading on the jet and in the turbine main housing are the same, but both threads are not marked on the drawing (fig 2).

You can now hook it up to an airline and see for yourself. **Photograph 6** shows the complete turbine housing.

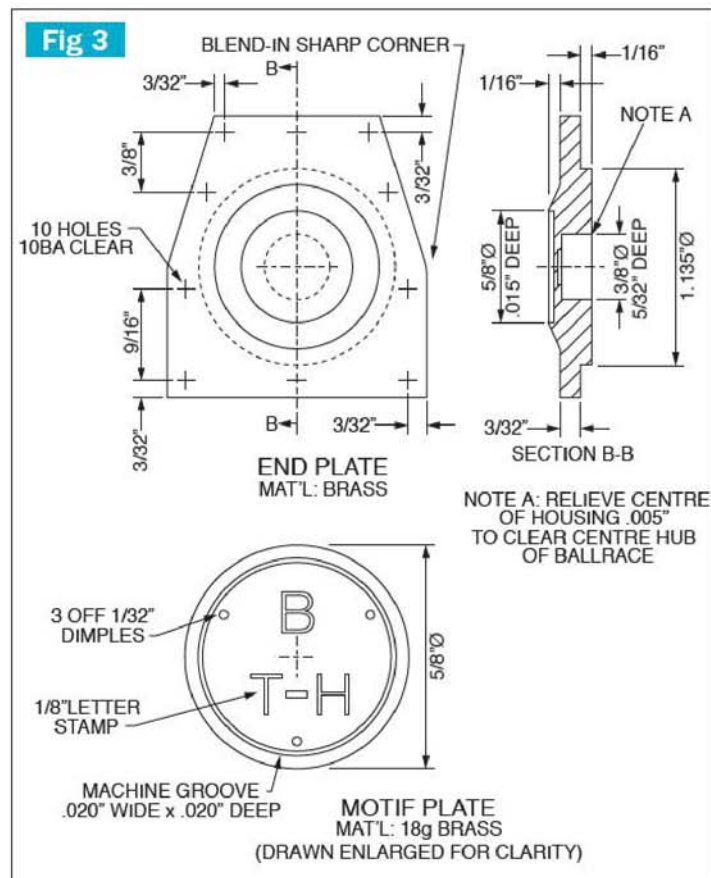
Coupling

I must confess, I spent a lot of time thinking about this. There were so many methods one could use. The main difficulty was the gear wheel on the generator (**photo 7**). There was not enough room to use an extractor to remove it. Using other methods might have damaged the innards of the generator.

The coupling itself had to be light and strong on account of the very high operational

speeds. It also had to be small with a little bit of flexibility built in and easy to fit and to mate up to its partner automatically.

The final solution was to leave the gear wheel on the shaft and use it as part of the coupling (fig 1, M.E. 4332, 15 August 2008). The three pins are radially spaced to intersect the gaps between the gear teeth. A few thousandths of an inch gives it running clearance until the drive takes up. While the pins are only 0.028in. dia., they are more than adequate for the purpose. The holes are a No.70 drill, not as shown in fig 1. Exhaustive



TURBO GENERATOR

Fig 4

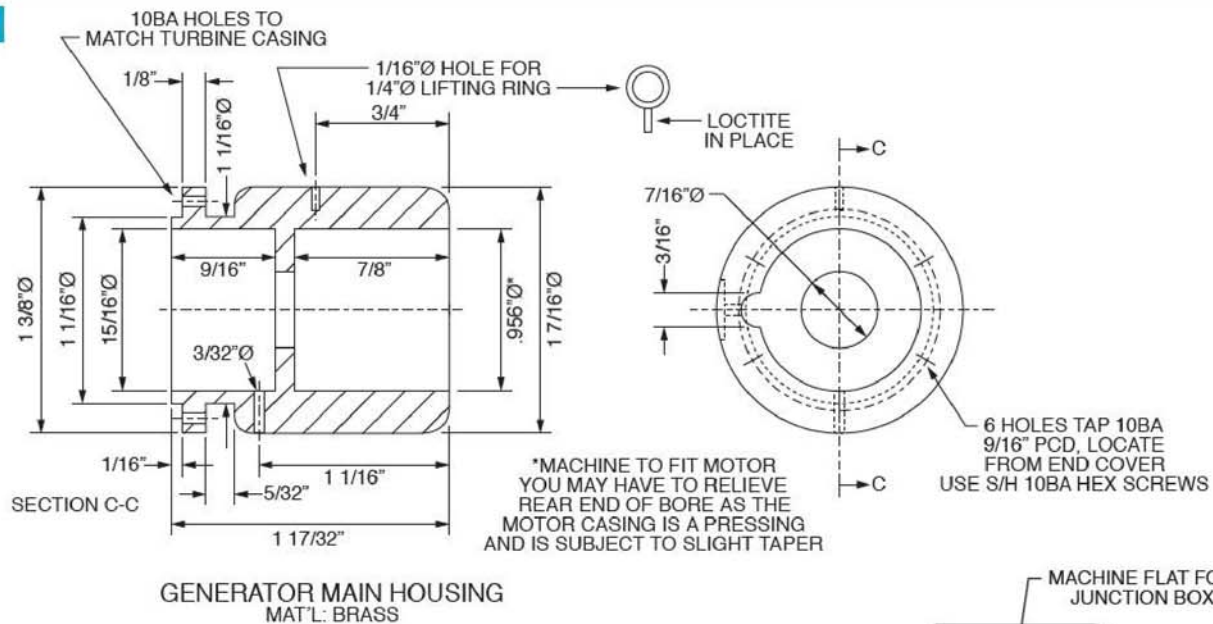


Fig 5

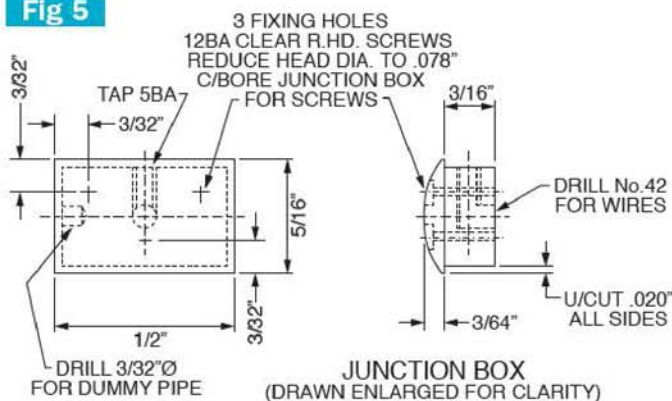
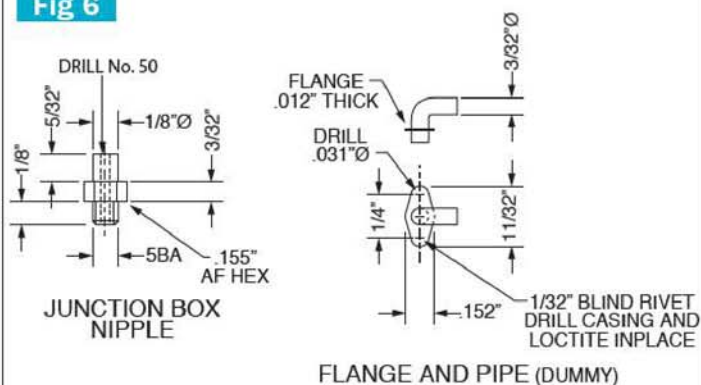


Fig 6



testing under air has presented no problems whatsoever. You will need to space the holes accurately on the desired PCD: a rotary table or dividing head will be of assistance here. You can carry out all the machining before parting off. Be careful not to bend the pins on insertion. That also applies when fitting and removing the coupling; they are

easily bent which can prevent the turbine from starting up.

Note that the grub screw in the coupling should be 10BA, this was inadvertently omitted from the drawing (see fig 2).

Generator main housing

This item is some straightforward turning of a piece of 1½in. dia. brass (fig 4). Start by turning the

flange end first and make sure the 1½in. dia. dimension is a neat fit into the turbine housing.

Finish the ¾in. dia. with a boring tool. A drill used here might decide to runoff centre on you.

Bore the coupling recess at this time. It should be 15/16in. dia. by ¾in. deep.

Finish machining the outside diameter and part-off allowing a little for end finishing. Please note that if you are using the other make of torch, B-Square, you may have to make the housing a little bit longer to accommodate it.

Reverse the part in the 4-jaw chuck and with a dial indicator set the ¾in. dia. bore to run true. Now bore out for the generator. This is approximately 0.956in. dia., but should be checked. Also note, that you may need to ease the bore a bit at the back end as the generator can be a pressing and may be tapered. In my case it was parallel for most of its length except for its rear. Aim for a light push fit.

Finish the housing to length and you can now drill all the

small holes. There is a small one to be drilled in the coupling compartment, which is to drain off any steam condensation that may leak through the plain bearing in the turbine housing.

There is also a small flat to be machined for the junction box (fig 5) along with three 12BA threaded holes which should be located from the junction box when it is completed.

The half round cavity accommodates the internal wiring. A ½in. dia. cutter, if carefully used, will soon scoop it out.

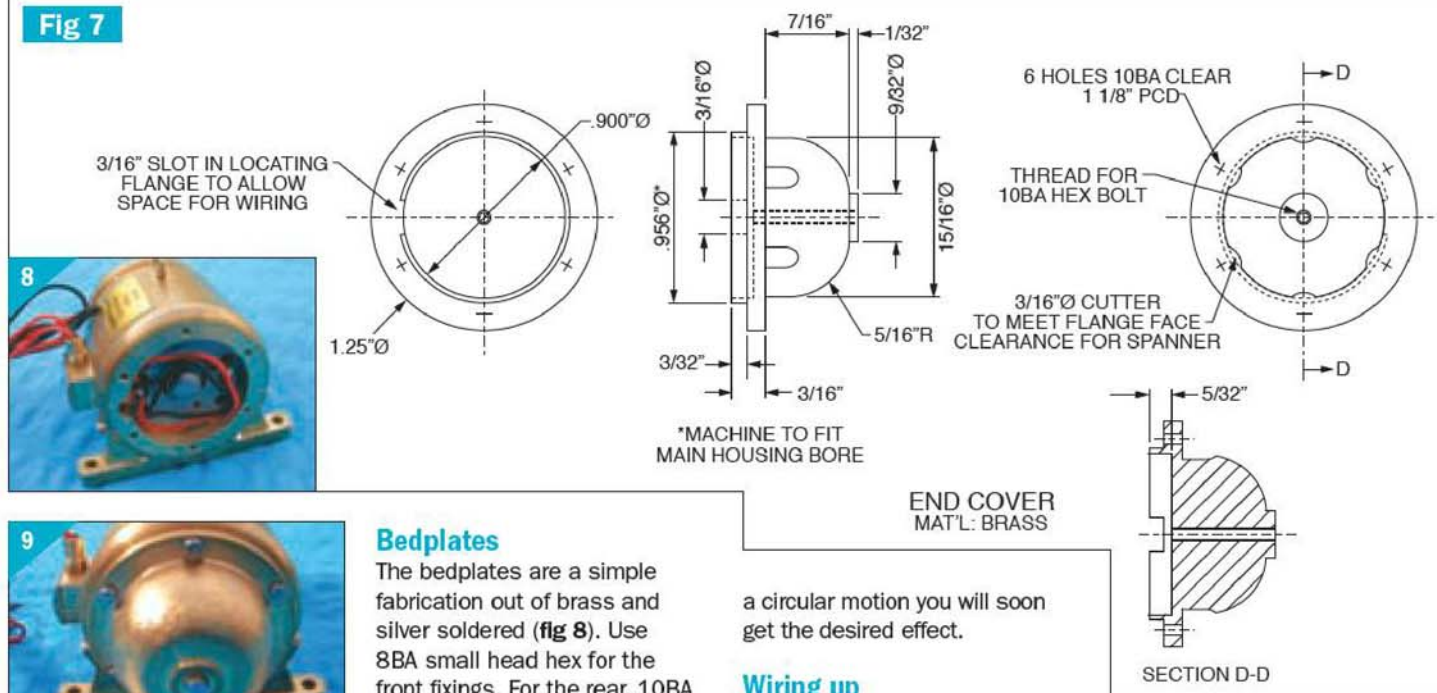
The little dummy pipe with flange, although small, is worth making and fitting (fig 6). The tiny rivets are simply Loctited into the blind holes.

For assembling the generator housing to the turbine section, use 10BA standard nuts. For attaching the rear cover to the housing, use small head 10BA hex bolts.

End cover

The end cover is next. It is quite straight forward, but it is worth pointing out the very

Fig 7



Bedplates

The bedplates are a simple fabrication out of brass and silver soldered (fig 8). Use 8BA small head hex for the front fixings. For the rear, 10BA standard hex fitted to the edge of the radius.

It is best to fit the front one first and clamp the rear so that both are parallel to one another, the two radial holes can then be carefully drilled into the casing, there is no need to drill through into the cavity.

The casting texture

The rough casting effect was achieved with the aid of a tiny dental burr mounted in my high speed Proxon hand-held drilling machine. The procedure is to lightly go over the surface making small indents in the metal. If you move the burr in two planes, vertical and horizontal along with

a circular motion you will soon get the desired effect.

Wiring up

The circuit board from the wind-up torch can be reduced in size by cutting it just beyond the positive and negative generator wires, the LEDs can be carefully unsoldered at the same time taking note of their connections. You have the choice of cutting up the existing holder into three parts or tuning up little flanges out of plastic which can be mounted appropriately in the cab roof.

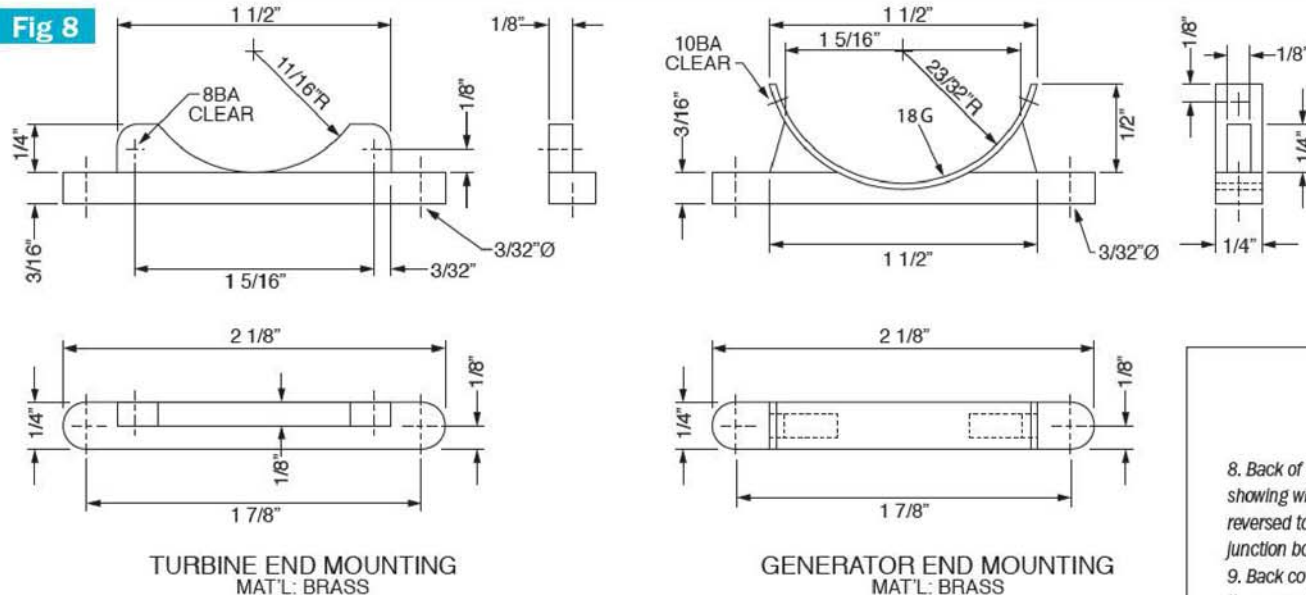
The circuit board can be mounted somewhere convenient underneath the footplate or running board. A slot will be required for access to the switch. I would recommend a little plastic case to hold it in order to give it protection.

The little wind-up torch battery will power the lights for approximately 30 minutes and the turbo generator should charge the battery after about one minute of running.

Postscript

There is no reason why the forward turbine section could not be used in a boat. With the high speed the turbine can achieve, you would naturally have to build up a small reduction gearbox. I have no doubt it would make for a small, but very powerful combination. Perhaps I will take up this idea again where I left off all those years ago. **ME**

Fig 8



8. Back of the housing showing wiring being reversed to emerge at the junction box.
9. Back cover installed on the generator housing.

McONIE'S OSCILLATING ENGINE

Anthony Mount completes the cylinder and commences work on the steamchest.

*Continued from page 217
(M.E. 4332, 15 August 2008)*

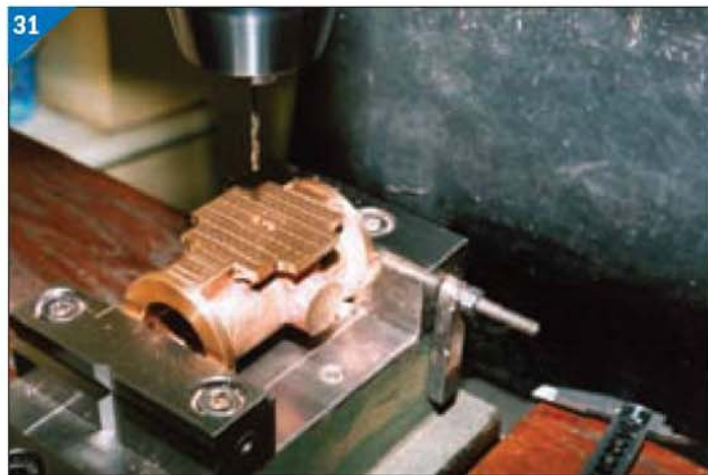
Now that the cylinder has two machined end faces, these can be used to mount the casting in the machine vice on the milling machine. Use two pieces of packing of equal thickness under the steamchest flanges to level the casting.

Using an end mill, machine the valve face flat. Note that the face is 1mm below the end flange diameters; these can be used to set the dial on the down feed. Pick up the edge of the cylinder flange with an edge finder and zero the dial. Co-ordinates can be used to bring the edges of the steamchest flange to size, which is the same width as the end flange diameter. A 6mm end mill can be used to form the rebates at each corner of the flange.

31. Drilling the steam ports.

32. Machining the face of a pivot boss.

33. Drilling the steam passages.



Steam ports

With all the edges cleaned up, an edge finder can be used to find the co-ordinates of the steam and exhaust ports. Use a centre drill to spot the hole positions, then drill a 4mm hole at each end of the exhaust slot, and four 2mm holes along the line of the steam port slots (**photo 31**).

Change to 4 and 2mm slot drills to remove the material between the holes to form slots, which are all 6mm deep. At the same setup, use the centre drill to spot the positions of the holes that join inlet and outlet passages to the exhaust port. Also at the same setup, a long series end mill is used to face off the ends of the pivot bosses (**photo 32**). The edge of the steamchest flange is used as a datum to find the lengths of the bosses.

Steam passages

The casting can now be upended in the machine vice to drill the steam passages. I used three of 2.7mm diameter. As the holes are quite long, frequent reversals are needed to clear the chips and stop the drill jamming in the hole. Take special care when breaking into the slot that the drill does not snatch.

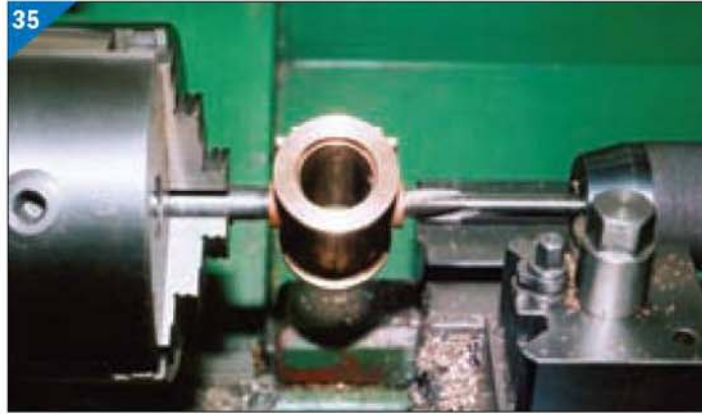
The ends of the steam passage holes can then be

tapped 5BA and 1/8in. brass rod, threaded for about 3mm, screwed tight into the holes and sawn off. File the sawn off stubs flat to the flanges. Clamp the cylinder to the milling machine table as shown in (**photo 33**), and use a Woodruff cutter to form a slot to join the cylinder bore with the steam passages. Remount the cylinder on the expanding arbor and reface the ends, removing the 0.5mm to bring them to finished length. The plugs will now be almost invisible.

Pivot bosses

We can now turn our attention to the cylinder pivots. As you can see from the drawing they are quite long, but the bosses on the cylinder casting are a lot shorter, and the pivots are screwed on as additions. They could have been cast on, but it is much easier to machine the casting with short pivots and to machine the pivots themselves as separate items.

Clamp the casting in the milling machine vice by the ends and set the valve face vertical using a square off the bottom of the vice. Use an edge finder to find the centre of the casting and zero the dials, then move over to the theoretical centre of the boss. Because we are dealing with a casting, my centre was about 0.5mm away from the centre of the boss, but it does not matter in this situation. Centre and drill 9mm diameter. Square out the bottom of the hole with a D bit or slot drill. If a slot drill is used, take care as they can snatch in bronze. Open out the hole in stages to 11mm dia. and again square out the bottom of the hole. Hold a M12 x 1 tap in the drill chuck and turn it by hand to



start off the thread; the thread needs to be concentric with the hole (**photo 34**).

Turn up a 12mm dia. mild steel arbor and thread the end M12 x 1 for about 12 millimetres. Turn away the first few threads to clear the partly formed threads at the bottom of the hole. Also, centre or counterbore the arbor to clear any pip in the centre of the hole. The cylinder needs to screw onto the arbor so that the end of the arbor sits square on the bottom of the hole. Hold the arbor in the self-centring lathe chuck and drill and tap the other boss on the cylinder casting (**photo 35**). The tapped holes in the bosses should be in line and run true.

Angled holes

The next job is to drill holes between the hole positions spotted on the valve face and the ends of the tapped holes in the cylinder bosses. As you can see from the drawing, there is not much space around these holes, so exercise a little care in their positioning. I have shown 'two angles' on the drawing; these can be used to make templates for positioning the casting for drilling these holes (**photos 36**).

With the first two holes drilled, the exhaust port needs to be connected to one of them by drilling a third hole. Use the other template to position the casting in the vice (**photo 37**). The hole needs to be started from the corner of the exhaust port using a centre drill (an ordinary drill will merely slip away). Some centre drills are quite short. You may need to use a 3mm long series slot drill to start the hole. Drill down until it breaks into the other hole. Clear away the debris and tap the top of the exhaust passage for a plug but do not fit it yet.

That completes the major machining on the casting but there is still more to do to complete the cylinder.

Cylinder pivots

As mentioned before, the pivots are not integral with the cylinder but are screwed in as separate items. The pivots are turned from free cutting stainless steel. Face off the end, turn the various steps and thread M12 x 1. Turn away the first few threads so that the bottom of the pivot will clear any radii and partial threads at the bottom of the hole, as with the arbor.

Drill and ream 9.5mm ($\frac{3}{8}$ in.), part off and clean up the flange face to finish at 2mm (0.080in.) thick. Screw the pivot into the cylinder casting and check that it bottoms okay. Hold the cylinder in the machine vice on the mill, pick up the relevant hole in the valve face and drill 4mm dia. to complete the steam or exhaust passageway. Remove the pivot to clear away any chips. You will see the drill has cut a notch in the end of the pivot stem. Do the same with the other pivot. For final assembly the pivots can be held in place using Loctite or Araldite - but do not do that yet. Next, screw a plug in the exhaust passage in the valve face, file flush using a fine file, so as not to damage the valve face, and finish with abrasive paper. **Photograph 38** shows the fully machined parts of the cylinder and **photo 39** the parts assembled.

Jobs for later

There are several more jobs to be done to complete the cylinder but these must wait until other parts have been made. One job to drill and tap for the cylinder studs. This can be done when the cylinder covers, steamchest and glands

34. Tapping a pivot boss in the milling machine.

35. Tapping the opposite pivot boss in the lathe.

36. Using the first template to set the cylinder at an angle for drilling.

37. Using the second template for drilling through the exhaust port.

38. Cylinder and pivots.

39. Cylinder and pivot assembly.

have been machined. These can then be used as drilling jigs to position the stud holes. Note that four of the end stud holes are blind tapped holes. Do not go too deep or you will break into the steam passage slot and allow steam to escape!

Another job is to fit the steamchest top cover to the cylinder. The bottom edge fits into a groove in the cylinder valve face. If you are only going to run the engine on compressed air the cover can be a close fit in the groove and held in by Loctite. However, if you intend to steam the engine, the steamchest cover should ideally be silver-soldered to the cylinder.

Steamchest (Part 10)

The steamchest is a gunmetal casting (**photo 40**). There is some interesting machining involved but, with a generous machining allowance, it is not difficult to make.

Begin by cleaning up the casting, i.e. remove any flash and rough spots. Hold the casting vertically in the machine vice and machine all the edges to the finished overall dimensions. Reposition the casting horizontally and machine the clamping face to leave a 2mm thick flange on three



OSCILLATING ENGINE

sides. Turn over the casting and machine the top flange edge to finish at 19mm wide.

Slide valve cavity

The cavity for the slide valve needs to be done at two settings as the end of the cavity is angled. Start with the casting horizontal (**photo 41**). Use a slot drill, or a three-flute end mill with an over centre cutting edge, to allow the cutter to be plunged in without having to drill a pilot hole. Set the stops on both slides and machine in a series of steps - the depth is too great to allow a single pass.

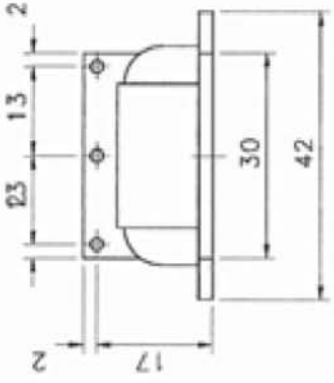
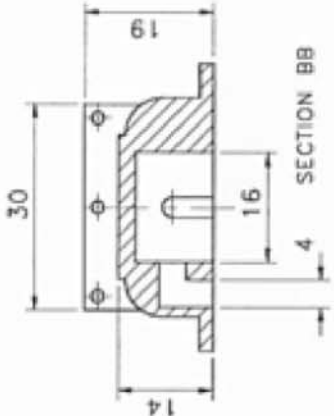
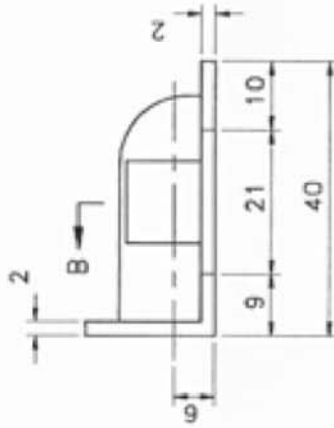
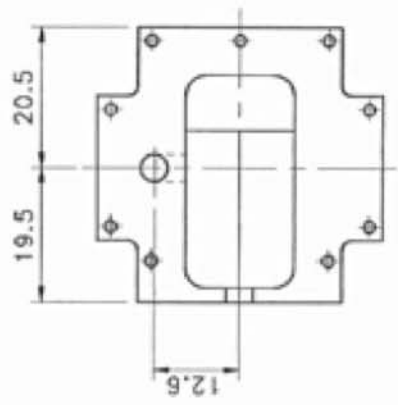
● To be continued.



40



41

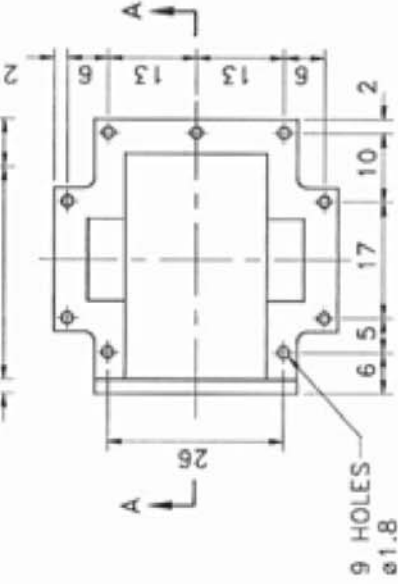


STEAMCHEST COVER
1 OFF BRONZE CASTING
PART NO 10

1st ANGLE PROJECTION

SECTION AA

SECTION BB



40. Steamchest casting.
41. First stage in machining the steamchest cavity.

A practical approach to injector making

Terence Holland's review of injector articles in *Model Engineer* led to his simplified way of making these useful devices.

During my interest in model engineering spanning four decades (and two centuries!), injector making has, until recently, been a mystery to me. Following LBSC's user-friendly methodology, I made three of them in the past and not one worked - after which I gave up and purchased commercially made units for my various engines. Life, I thought, was too short and so I got on with the myriad of other jobs associated with making live steam vehicles and locomotives.

Recently, following retirement with plenty of time on my hands, the desire 'not to be beaten by the injector gremlin' raised its ugly head and I embarked on a review of all the literature I could lay my oil-stained, metal-splintered hands upon regarding the construction of miniature live steam injectors. The references to injector making at my disposal were in general associated in some way with *Model Engineer* articles, but

were not specific enough for my purposes. They consisted of:

- early instructions from Curly published in *Maisie - Words and Music and LBSC's Shop, Shed and Road*;
- articles by Basil Palmer, W. J. Hughes, Martin Evans etc. published in the 1970s and 80s and;
- significant recent contributions from D. A. G. Brown and Keith Wilson.

This article reviews miniature injector making in general and, from the information gleaned, a working design of injector is presented which is capable of useful, reliable performance and which, importantly, is also relatively easy to construct.

A list of references is provided in the bibliography at the end of this article.

History

The injector, a simple and effective device for feeding water into a boiler, was invented

around 1850 by one Henry Giffard, a French engineer. However, due to misgivings as to its likely reception, he was very cautious when introducing his invention to the public. As expected, the device was received with some scepticism as to its ability to force water into a boiler against the same pressure as the motive steam. Once the suspicions of it being just another crackpot perpetual motion machine were disproved, it was finally patented in 1858. Eventually, the invention became a great success and by the end of the 19th century, injectors were in common use, particularly on railway locomotives where they virtually replaced the earlier use of steam and axle-driven pumps, which were more complex, bulkier and of lower efficiency.

For a detailed explanation of how injectors work, I can't do better than refer you to the comprehensive technical article by D. A. G. Brown published in this magazine in early 2000. A schematic cross section of a typical injector is shown in **fig 1**.

Design and construction

During his career, LBSC presented a method of injector manufacture, which, with regard for the small size of the device, was over simplified and, for me, further simplification resulted in well-deserved failure; I had little experience then! Instructions such as "if you own a mike make it as near as possible to 0.055in., if no mike make it halfway between $\frac{3}{64}$ and $\frac{1}{16}$ of an inch," didn't help!

I believe many other model engineers have suffered similar problems when attempting to make injectors. Laurie Lawrence in his comprehensive series published in 1975

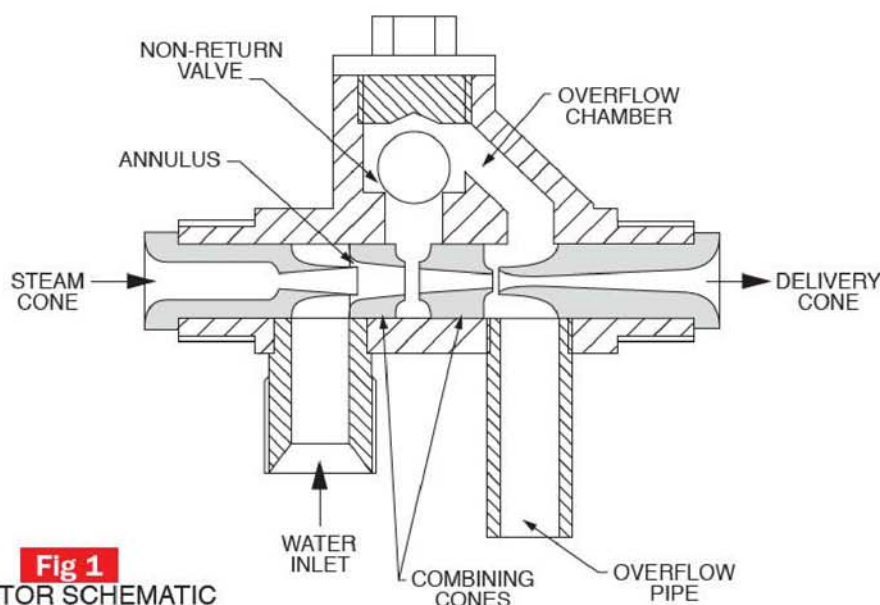


Fig 1
INJECTOR SCHEMATIC

INJECTORS



1. A selection of injectors made by the author. Tested and passed ones have been painted; those unfinished await testing and adjustment.

and repeated in 1986 did the complete opposite and applied strict controls to all aspects of construction thereby ensuring reproducibility. Unfortunately, this approach makes construction tedious as it applies control to areas where high degrees of precision are unnecessary, such as in the positioning of the various connections on the body.

The method of construction presented herein is part Keith Wilson and part Eric Rowbottom. It works and I have so far made several working units for installation on various engines. These are illustrated in **photo 1** (the unpainted injectors have not been fine tuned - after which they are rewarded with a coat of paint!). The performance characteristics of these units are excellent and are summarised in **Table 1**.

A word of warning is necessary regarding size. I have deliberately gone for the largest, as bigger must be easier (even if not always best!), especially

with regard to drilling small holes etc. In addition, I am one of those operators who have always used high capacity units on my engines. I justify this practice by pointing out that my locomotives have crosshead or axle-driven feed pumps with by-pass valves which can be set to maintain a background water level. Consequently, the injector is only used when the engine is stationary or for water level adjustment at the end of a run - when quick action is desirable and hence the larger feed rates. Incidentally, if maintaining pressure is a problem when feeding water at a high flow rate, it helps to have an efficient steam blower installed on the engine.

Laurie Lawrence produced an article in the *Model Engineer* in 1978 detailing a multi-jet blower which is very effective and functions from very low boiler pressure. Details of the article can be found in the bibliography.

In the bigger scales, of course, a hand pump is not an effective option and a reliable injector, particularly one which will operate at the higher pressures (when the safety valves are lifting), is essential. For the other school of model engineers, who prefer a lower capacity unit which can be left running for long periods, I'm afraid it's 'back to the drawing board'. However, I have included a modified procedure for applying the same techniques to Laurie Lawrence's 'Laurie No 1' injector which feeds at the lesser rate of 25 ounces per minute (just over a pint a minute) and the same

procedures could be applied to any one of D.A.G. Brown's designs. It is also possible to make smaller units using the standard Martin Evans/Keiller/Rowbottom proportions which I have used and these are included for those who wish to have a go: DIY-style.

Note that the Keiller dimensions result in a fairly long injector; it is possible to reduce this length to make a more compact unit. Laurie's No.1 injector, for example, would be 1½in. long using the Keiller data, compared with 1¼in. on the Lawrence drawings.

The injector presented herein owes most to Keith Wilson and his recent injector article for *Lillian*, which I used as a starting point. I have chosen for construction the unit providing a feed rate of 55 ounces per minute, which at 20 fluid ounces to the pint is equivalent to 2¾ pints per minute. Thus the injector is suitable for large 5in. standard gauge locomotives, 3 to 4in. scale traction engines and 5 to 7½in. narrow gauge locomotives. Further details regarding construction have been taken and incorporated from the Basil Palmer article about Eric Rowbottom's work published in *M.E.* in 1975.

Design features

My design departs from current convention in that it reverts to the original LBSC concept for the steam cone, which has a plain drilled hole for the steam inlet, thereby eliminating the need for a 13deg. reamer. This, along with the recommended 9deg. reamed

holes for all the other cones (including the steam cone outlet), means that only one reamer is required, somewhat simplifying preparatory work. At the same time that the reamer (or rather reamers; it is worth making more than one) is machined, a couple of brass or mild steel tapers are turned at the same lathe setting. One of these will be used with a collar to insert and position the combining cones.

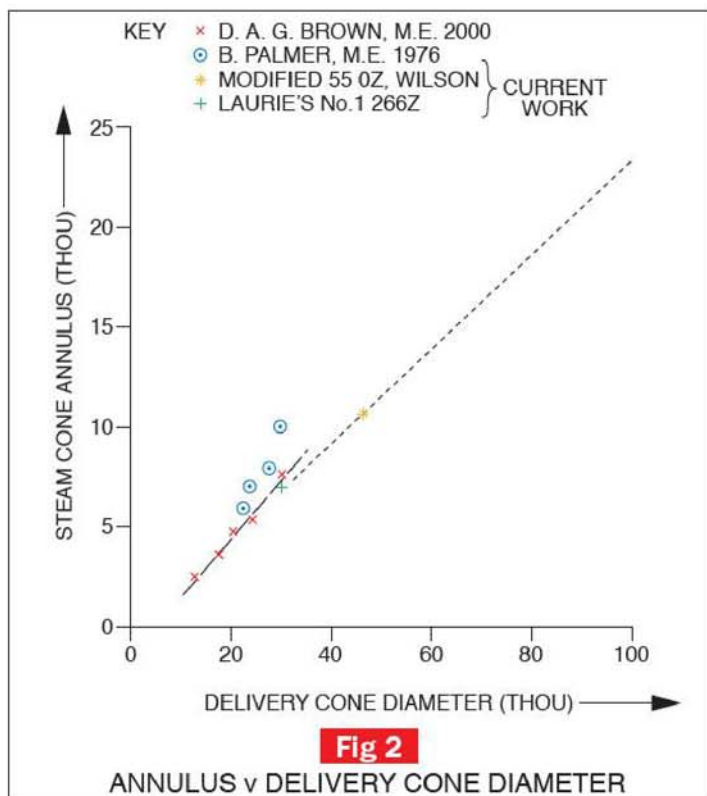
Both steam and delivery cones are constructed 'on the job' to fit the in-situ combining cones using the method devised by Rowbottom. This ensures that all cones (in conjunction with the stop collar/tapered former emplacement of the combining cones) are in the correct place with reference to each other, rather than being set in their individual positions with reference to body dimensions. Note that it is still important to accurately machine the body to length, to ensure correct positioning of the combining cones. The positions of the water inlet and overflow connections are not so critical.

The annular space between steam cone outlet and combining cone inlet is the most critical area and data for these relative to delivery cone jet size (and, indirectly, feed rate) are shown in **fig 2**. Note that the delivery cone diameter in thousandths of an inch is roughly equivalent to the delivery rate in ounces per minute. For this particular injector design, I started with an annulus of 0.012in. (latterly 'fine-tuned' to 0.010in.) which was extrapolated from the Brown data (top dotted line). Note that the Palmer figures relate to operation at high altitude. In **fig 2**, the lower dotted line provides a starting point for the construction of larger injectors.

Insertion depth according to the Keiller data is equal to the delivery cone jet size (in this case 0.047in.). However, Rowbottom used a fixed depth of insertion of 0.010in., but I found this insufficient for an injector capable of lifting and self-starting and used the Keiller figure.

Table 1: Injector Characteristics

Injector No.	Auto Start Range (psig)	Minimum Pickup (psig)	Feeds to: psig	Comments
4	120 - 50	40	30	
5	110 - 60	20	20	
6	120 - 70	50	30	
7	115 - 30	28	20	Flow rate 60oz/min. Lifting range 110 - 30 psig
8	100 - 30	30	25	Laurie's No. 1



I initially made two units and after much experimentation achieved useful operation over a wide pressure range (from a blowing-off pressure of 110psi down to 30psi). Both units are self-starting between 110 and 60psi. I followed this up by making two more to prove the methodology. Both of these functioned well 'as built', but fine-tuning resulted in two more useful units operating over a wide pressure range.

Ambient conditions were approximately 1,000 foot above sea level and feed water temperatures in the mid 20s deg. C - it's difficult to get cold tap water where I live in southern Spain in the summer and half-way decent coal is not easy either! I note that Basil Palmer, in his article, comments that less water is required for lower steam pressures or at lower altitudes.

Photograph 2 shows an injector fitted to my 5in. gauge Andrew Barclay well tank locomotive.

Sensitivity to steam cone dimensions

Figure 3, compiled from tests carried out during this work and using subjective criteria to define performance,

demonstrates how sensitive injector performance is to the annulus between the steam jet and the entrance to the lifting cone. In practice, this annulus can be adjusted by removing material from the front of the steam cone flange (to decrease the gap) or by fitting spacers (to increase the gap). However, if large changes in insertion depth are necessary, e.g. plus or minus 0.028in. equivalent to an annulus of plus or minus 0.004in., this will significantly affect the insertion of the steam jet into the combining cone entrance and pick-up performance may be compromised. In such cases, it may be necessary to make a new steam cone with the corrected jet diameter and standard insertion depth.

Note that a large change in insertion results in a relatively small change in the annulus. From tangent tables, 0.001in. of insertion is equivalent to approximately 0.0001in. of annulus, i.e. one tenth of a thou. Note that it is important, using the Rowbottom method for making the steam cone, to proceed with extremely light cuts when fitting the steam cone jet to the combining cone inlet.



Sensitivity to other parameters: injector body dimensions

Because the steam and delivery cones are fitted to the in situ combining cones there is no need for absolute accuracy when laying out the various body connections. The steam, water and feed connections can therefore be laid out with a ruler or can be scribed using the points of a digital calliper.

Cone press fits

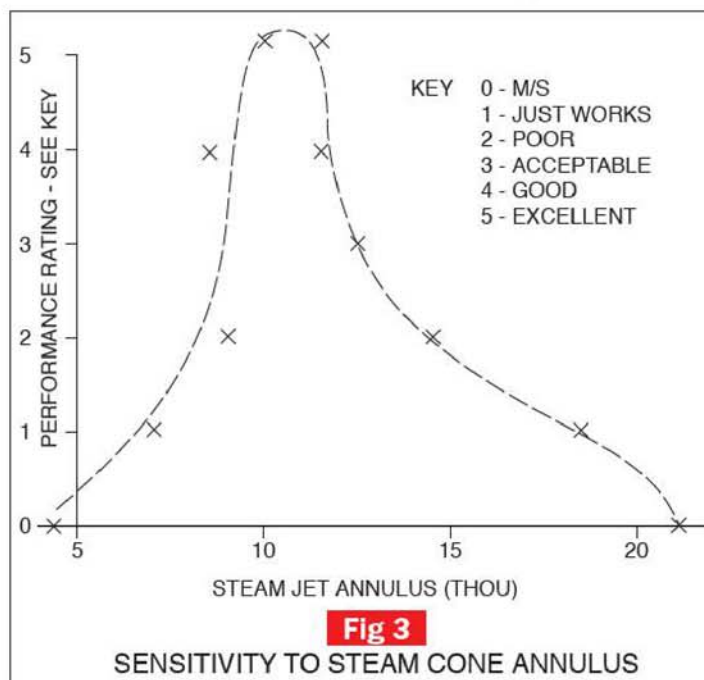
Once a tight fit was obtained by turning, the desired finished fit for the cones was achieved using 600 grade emery cloth - it's surprising how many times this has to be applied, making it a fairly sensitive procedure. My old Myford has taken some wear over the years, so those of you with sparking

2. An Injector of the author's design fitted to his 5in. gauge Barclay well tank locomotive.

new machines may not have a problem in this area. If a good press fit is not achieved when inserting the combining cones it is possible to use Loctite to retain them in place.

For fitting the steam and delivery cones, a tightish fit is desirable but a loose fit also works and does not influence injector performance. As I see it, the only reason for a tightish fit is to prevent losing the cones when dismantling. I've lost cones about three times so far and had to enlist the wife's help to find them on the gravel drive, which is not always 'conductive', especially when dinner's about to be served!!

● To be continued.



AN ENGINEER'S DAY OUT

The National Cycle Museum at Llandrindod Wells

Roger Backhouse

packs his raincoat (just in case!) to visit this gem of a museum in the heart of Wales.



1. Automobile Palace, home of the National Cycle Museum.

2. Replica of Kirkpatrick Macmillan's 1840 treadle bicycle.

3. A 1869 velocipede by C. Taylor of Bristol.

The Shell Guide to Mid Wales is cruel about Llandrindod Wells. In the 1966 edition the author, the late David Verrey, wrote "Round every corner you expect to see the sea, but there is no sea, only rain." Don't be put off by that bleak description.

Llandod, as it's known locally, is a Victorian spa quite different from most mid-Wales towns and home of a museum with the best collection of bicycles in the UK.

The bicycle is one of the world's great engineering achievements. Fast, versatile

and almost unpolluting, it has evolved remarkably since the 19th century. New developments continue to make it lighter and faster. The museum presents almost the whole history under one roof. The nucleus of this collection was developed by





- 4. A Singer Ordinary, or Penny Farthing, of 1880s vintage.
- 5. Otto Patent Safety of 1882, an unusual design.
- 6. Rover type Antelope of 1884 with front wheel steering.
- 7. Classic diamond design frame, though this time made of bamboo!
- 8. Solid-tyred Safety of 1880s unknown make.
- 9. Dursley-Pederson of 1905 a revolution in cycle design.
- 10. An Austin 7 bought from the Automobile Palace in 1928.

the late Tom Norton. He was a local entrepreneur, originally a cycle racer and dealer in Newtown who branched out into car sales, even promoting aircraft. He built Llandrindod's Automobile Palace as a car showroom in 1919. It is an impressive period piece.

Although most of the business was cars, he kept up a lifetime interest in bicycles using a Kendrick tricycle to go to work at the age of 83. Other

items came from the former National Cycle Museum at Lincoln and the collection of the present curator, David Higman.

Scottish inventor

Scotsman, Kirkpatrick Macmillan, is often claimed as the inventor of the bicycle. A replica of his 1840 lever driven machine is in the museum. Unfortunately this was a technological dead end and we have to move to the 1868

invention of the French Michaux Brothers who put pedals on the front wheel to create their velocipede. This was much copied. Llandrindod has an example dating from 1869 made in Bristol.

The velocipede was the first really popular bicycle. It was developed for racing but the only gearing possible was by increasing the size of the front wheel. Racing models of the 'ordinary' or Penny Farthing had

front wheels up to 8ft. diameter. They were the preserve of athletic and daring young men. Many Penny Farthings still exist with several specimens in the collection.

Several technical advances led to improvements. The wire tension wheel was light and strong. It was applied to the bicycle by the American Virgil Price as early as 1870. However, the greatest contribution came from a Swiss ➤





11. Hub gear disassembled.

12. Sturmey Archer gear advertisement.

13. Postman's Elswick bicycle had two speeds only.

14. The Norman of 1950, equipped with a 32cc Cyclemaster engine, had a claimed 230mpg!

15. Moulton bicycles a second revolution in cycle design.



the Dursley-Pedersen Cycle Co. to make a luxury model weighing less than 20lbs. With a seat slung like a hammock, it was very comfortable. In 1902 Pedersen added to his invention with the first three-speed hub gear - a year ahead of the better-known Sturmey Archer gear.

Pedersen's use of scientific principles to redesign the

bicycle was rivalled only by Dr. Alex Moulton who developed his open frame model in the late 1950s. Though dismissed by many, including Raleigh's engineers, it proved as fast as a safety bike. The small wheels and innovative rubber suspension gave it a distinctive look and there were several less successful spin-offs by other manufacturers.

engineer living in Manchester, Hans Renold, who invented the first roller chain.

This chain was a key part of the safety bicycle invented by James Starley of Coventry. Originally he concentrated on elaborate tricycles aimed at the well to do market, but in 1886 he brought out the 'Rover' safety bicycle. Main features were direct steering, sloping forks, rear drive and the diamond frame. It was easy to ride and far safer, sweeping the 'ordinary' out of manufacture within a few years.

Now women could ride easily. The bicycle gave women a new freedom, helped by the

adoption of 'rational dress' better known in America as 'Bloomers' after the Mrs A. Bloomer who first wore them.

The diamond frame remains the classic shape. There are dozens of examples in the museum from different materials including one made of bamboo. In more modern times carbon fibre has been successfully used for racing bikes.

Gradual improvements

The bicycle has seen surprisingly few truly radical innovations since the safety bike. More gradual improvements were made such as the derailleur gear invented by Tulio Campagnolo in 1933. This and other innovations, like the safety bicycle, were often resisted by the racing fraternity. Sport did not drive progress in bicycle design.

One of the most revolutionary inventors was Mikael Pedersen, a Dane who produced a light frame of radical form. He worked from first principles of scientific design and with the help of R. A. Lister set up





16. Glories of Victorian cast iron in Llandrindod Wells.

17. Llandrindod Wells Signal Box Museum.

18. Lever frame in the Llandrindod Wells Signal Box.

19. Street Organ Festival Llandrindod Wells.

Other bikes were made for appearance rather than hard work. The Raleigh 'Chopper' was almost unspeakably clumsy but was once very popular among teenage boys. Despite new designs, such as recumbents, the basic diamond frame has proved adaptable. The British Post Office used thousands of bikes with a distinctive bent top tube. Folding bikes were also made for paratroopers.

Many early motorbikes showed their bicycle origins. Some firms made motor attachments designed to drive a bicycle front wheel. An example in the museum is the 32cc Cyclomaster which was claimed to do 200 miles per gallon.

The museum has many different tricycles. 'Barrow boys' or tricyclists have a long history and some weird and wonderful machines were made from 1869 in Coventry. One was the rotary tricycle with one large wheel alongside two in line steering wheels.

Tom Norton's own Kendrick tricycle of 1937 reversed usual practice with two driven

front wheels. Whatever the engineering merits of this arrangement, Tom Norton claimed it kept gout at bay when he rode it to work in his later years. Many readers will remember the 'Stop me and buy one' ice cream sellers and the collection has one of those classic tricycles.

The collection is rich in cycling memorabilia ranging from trophies to a cyclist's tombstone, and from lights to advertisements. It adds up to a fascinating collection in this Victorian town.

Opening

The museum is located at The Automobile Palace, Temple Street, Llandrindod Wells, Powys LD1 5DL and is open daily from 10 to 4pm from March to October. Winter opening is from 1 November to end of February on Tuesday, Thursday and Sunday, though please ring to check opening hours prior to visit; T. 01597 825531. E. cycle.museum@care4free.net W. www.cyclemuseum.org.uk

Other attractions

Llandrindod is pleasantly situated with attractive walks in the neighbourhood. It has become a centre for mountain biking too. As a spa Llandrindod has several hotels, though these can be taken up with conference bookings. It is on the Heart of Wales railway line, one of the great scenic routes of Britain and worth a journey in its own right. The viaducts at Cyngordy and Knucklas are impressive civil engineering. (The Heart of Wales 48 hour rover ticket offers good value on the whole line).

The re-erected Llandrindod No. 1 signal box is open as a museum on selected days from Easter to October. Although not operational, levers work in the same sequence as they did when controlling trains. When I visited, a former BR signaller was showing how the systems worked.

The town has a fortnight's Victorian Festival in late August each year. The signal box is then open daily and

the town has many other attractions including street performers, displays in local shops and the annual barrel organ festival.

Massive civil engineering is on show at the Elan Valley dams about 10 miles away near the small town of Rhayader. A series of reservoirs were created in the late 19th century by Birmingham Corporation to supply water. The stone dams are spectacular but almost equally impressive, though largely invisible, is the carefully engineered aqueduct which takes water by gravity through tunnels and over siphons to the Midlands. Further information is available in the Elan Valley Visitor Centre.

Most other engineering attractions are over an hour's drive away but mid Wales has good roads even if public transport is limited. The Welshpool and Llanfair and Vale of Rheidol Railways offer narrow gauge steam. The Museum of Internal Fire is a fascinating collection of internal combustion engines located near Llandovery.

Mid Wales is a lovely area and Llandrindod Wells a good centre, even if, as the Shell Guide warned, it sometimes rains! **ME**

Dremel announce some new tools useful to model engineers.

1. The Dremel VersaFlame gas torch and accessories.
2. The Dremel 300-55 kit comes in a neat case with 55 accessories.
3. Those upgrading can buy the tool only kit for the Dremel 300 without the accessories.

Would you like to be featured here?

If you are a trader/supplier to the model engineering fraternity, why not let us know of any products or developments that may be of interest to our readers. Words and pictures (high resolution please) can be sent to the Editor at the usual addresses. We are particularly interested in new or specialist products and intend to run this column regularly if there is enough interest.

Dremel VersaFlame

Autumn sees the launch of the new Dremel VersaFlame (photo 1). Designed for hobbyists and DIY-ers alike, it caters for all small soldering needs in one tool.

This extension to the Dremel range will be of interest to model engineers and others who carry out small soldering (hard and soft) jobs and need a handy portable torch for such things.



It is the only hand-held or stationary burner that safely combines open flame use with a catalyst and soldering head, making it the most versatile stationary burner on the market today.

The Dremel VersaFlame is powered by liquid butane gas for quick heat-up and fast re-charges.

Sold as a kit comprising the VersaFlame tool plus four accessories - a catalyst, soldering tip, flame extension piece and deflector - it comes packaged in a metal tin which also contains solder, a sponge box and 7mm spanner.

The VersaFlame is priced at £33.99 (SSP) from all good DIY shops from September 2008.

Dremel 300 Series Kit

With a new and unique design to improve ergonomics and increase comfort, the Dremel 300 Kit (photo 2) will prove useful in many model engineering projects for such

operations as de-burring and polishing or even drilling small rivet holes.

The powerful 125W motor optimises performance and its soft grip has been designed to reduce vibration and better handling of the tool.

The variable speed, 10,000-33,000rpm, matches the speed to the project at hand and the comfort switches allow better control.

With 55 accessories to choose from, the Dremel 300 Series is a tool able to carry out a number of functions including drilling, sanding and polishing. Its on-board wrench storage means the wrench is always readily available but neatly tucked away.

The handy integrated hang hook allows you to hang the Dremel 300 Series on your workstation or near your project. Once you have finished using it, the convenient storage case allows you to easily put the tool away until it is needed again, helping to keep any work area tidy.

The Dremel 300-25 with 25 accessories costs £39.99; The Dremel 300-55 with 55 accessories costs £59.99.

Dremel 300 Series - Tool Only Kit

A high quality precision multi-tool, Dremel's new 300 Series tool-only kit (photo 3) is packaged without accessories for those who are looking to upgrade an existing tool set.



3



Model engineers wanting to replace their current multi-tool and who already own all of the Dremel accessories need look no further than the new 300 Series tool-only kit.

The Dremel 300 Series Tool Only Kit is now available priced at £29.99.

About Dremel

Dremel is the brand of choice for people passionately engaged in hands-on projects such as DIY, automotive restoration, woodworking, model building, and other creative hobbies.

Since inventing the Dremel multi-tool over 70 years ago, Dremel has become the trusted brand name in the category, providing quality products for a wide variety of user types.

Dremel's leadership in design and manufacturing has made it the top-selling multi-tool in the world, a reflection of the company's commitment to innovation and quality.

The Dremel core product line is defined by the Dremel multi-tool, a versatile high speed motor unit which can be used to drive a system of over 150 available Dremel accessories and attachments.

Dremel products make it easier to perform detailed and intricate tasks, within any kind of hands-on project, creatively or functionally oriented, and for professional or hobby users.

Visit the Dremel website: <http://www.dremeleurope.com>
Dremel is Official Supplier and Sponsor of the Force India F1 Racing Team.

ME



Malcolm Stride reports

Notices

Model Engineering Courses

Gorseinon College (Belgrave Road, Swansea SA4 6RD) is running two courses of interest to model engineers starting in September this year.

The Welding for

Beginners course meets on Wednesday evenings (7.00 - 9.00pm) and teaches the beginner how to weld safely using both gas and arc welding equipment.

The **Model Engineers Club** meets on Thursday evenings and provides the opportunity for full use of the extensive engineering workshop facilities in a friendly environment. Full assistance is given to those unfamiliar with operation of any equipment.

For further information or to reserve a place on either course contact the college on T. 01792 893054 or 890754.

Kew Bridge Festival of Models

This year's autumn models event will be held on Saturday/Sunday 4/5 October at Kew Bridge Steam Museum and has been completely revamped by combining the long-running steam models event with the model boat show, previously held earlier in the year. The new show will see the exhibits on the twin themes of model engineering and model boats.

For the steam enthusiast there is the chance to see model engineering at its best and to be able to draw direct comparisons between the miniatures and their full-sized counterparts. Static exhibits, compressed air running and real miniature steam will all be present, including stationary engines, traction engines and fairground models. The museum's narrow gauge railway

will be operating together with the steam hall rotative engines and the Maudslay beam engine of 1838 will be demonstrated twice on each day.

For the model boaters the exhibits range from an extensive Review of the Fleet collection in 1:1200 scale through to scale models of *Medway Queen* and HMS *Vanguard* measuring around 6ft. long. There will also be another large model of *Medway Queen* made entirely from Meccano and with working 'feathering' gear on the paddles! A supporting cast of models of all types will provide plenty more to see. The demonstration pool will have modeller's demonstrations mixed with 'have a go' sessions for everyone to enjoy.

The show will include trade support, society stands and refreshments in the museum's tearoom.

Train rides and a quiet area with simple activities will be available throughout both days for the younger visitors. The Kew Bridge Steam Museum is at Green Dragon Lane, Brentford TW8 OEN (T. 020-8568-4757, E. www.kbsm.org). The event will be open from 11am to 5pm (last admissions 4pm) and is jointly in support of the Kew Bridge Engines Trust and the Medway Queen Preservation Society W. www.medwayqueen.co.uk and is sponsored by Edgcam W. www.edgcam.com

Locomotive driving weekend for beginners

The **Lindsey Model Society** and **Ryedale SME** are running a driver training weekend for absolute beginners at the Gilling East track in North Yorkshire.

The railway at Gilling East is worked on mainline practice and consists of an extensive double track mainline which is fully signalled with the additional facilities of a locomotive shed, marshalling yards and carriage sidings.

Following a classroom introduction, there will be a walk round the line to explain the functions of all the signals, followed by a practical lesson

on preparing engines and raising steam.

Once the engine is in steam, the new drivers will be able to run up and down one of the long sidings in the Up Yard until they are completely at home with their new situation. Some shunting will then be required to marshal a pick up goods train to work on the mainline. The drivers will then be shown how to prepare the engine for working on the mainline and will be accompanied by a Pilot man to learn the road and working to the semaphore signals.

The dates for the event are 18/19 October 2008 and the fee for the day will include a buffet lunch and tea and coffee all day.

Up to 10 candidates can be accommodated per day so applications will be treated on a first come, first served basis.

Application forms are available from Doug Hewson, 73 Victoria Road, Barnetby-le-Wold, North Lincolnshire DN38 6HY. E. doug@the-hewsons.co.uk

UK club news

The station building at **Bournemouth DSME** suffered a break-in recently. The culprits used a paving slab to break the door panelling and gain entry before going through all the lockers inside. In spite of rain dampening the 16mm narrow gauge Sunday runs, the group has made up for this by having several additional Wednesday running days.

Running days at **Crawley Model Engineers** have been very successful recently. Several days have had high numbers of passengers carried. On one Sunday a total of 416 tickets were sold with the passengers riding behind a GT3 (electric-powered), a Lion, an O8 diesel, a Hunslet and a Warship, a good variety of motive power by anyone's standards. The society was asked by the local council to keep the railway running on one Wednesday afternoon because there was to be an inspection of the park taking place with a view to obtaining a 'Green Flag' award. Such was the weather that the track seemed to be the only activity

In Memoriam

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

Geoffrey Buckley
Harold Flavell
Ron Livesey
Art Pickles

Wigan DMES
Manx Steam and MEC
Wigan DMES
New Jersey Live Steamers



1. Having stood down as Chairman after 22 years, Mike Casey now has time to drive his *Lion* at Manx Steam and MEC.
2. Jack Dibnah driving the first passenger train of the season at the Manx track.
3. The new guard's carriage attached to two 8ft. carriages and diesel locomotive Doris at Saffron Walden DSME.

in the park with no children in the play area and no golfers on the pitch and putt course. The visitors stayed at the track for around 30 minutes and "were obviously impressed."

Fylde SME attended the Thornton Gala Day with the portable track and although some rain fell during setting up, the weather soon improved and running started with two electric locomotives. The club Class 20 did not last long because "the overlong cable connecting the hand controller got caught under the passenger truck wheels." I am sure many readers will have seen this happen and wondered why the manufacturers fit such long cables. In spite of this the day turned out to be a profitable one for the society.

Harrow & Wembley SME has a very helpful council, so helpful that its weed killing team sprayed weed killer on the ivy sprigs planted by members to conceal the new fence alongside the track. Eric Basire is updating his history of the society and is looking for interesting photographs of the club taken between 1961 and the present day. We will be pleased to pass on any from readers who have visited the society.

Mike Casey has stood down as Chairman of the **Manx Steam and MEC** after 22 years



in the position. In recognition of his service to the club, Mike was presented with a book from the members and elected an honorary life member. At least he now has time to drive his superb *Lion* locomotive (photo 1). Maurice Shaw was elected to the position following Mike's departure. We wonder if 22 years served in one position is a record? The winter work programme was completed on schedule and the track realignment near the tearoom has resulted in a very smooth ride. The new design operating modules for the signals are now installed. Jack Dibnah drove the first passenger train (photo 2) of the season in March.

Northampton SME is organising a series of lectures for the coming winter months. Using expertise from within the society, subjects will initially cover workshop practice and railway locomotion, the first to be given on 7 October.

Reading SME members have had a busy time lately with several events taking place at the prospect Park site. The M&J Engineering day was held in fine weather with a good number of locomotives turning out on the track and a traction engine

running in the car park. Visitors were treated to a Ploughman's lunch. The later children's festival, run as part of a wider series of events in Reading, was by contrast, very wet and members got somewhat damp giving rides to those attending the events in the park. The June club running Saturday was very well supported with around nine locomotives running on the tracks.

The pneumatic actuation of the points at the exit from the station loop at **Saffron Walden DSME** is now operational and is proving to be very effective when the society is giving two laps of the track for public running. An operational instruction sheet is being prepared to give to drivers so that they are aware of the new driving disciplines needed. The new guard's carriage (photo 3) is almost finished, just needing a padded seat.

Among the topics discussed at the May meeting of **Wigan DMES** was the thorny subject of tool and drill sharpening. Several members brought along sharpening jigs and I am sure many good tips (excuse the pun!) were exchanged among the members. Brian Barrow suggests a way of making D-bits to match drill sizes. He simply fashions the D-bit profile on the shank end of the drill use to create the hole before hardening and tempering it. As he says, "If you have just drilled a hole, you now have the corresponding D-bit on the other end of the drill." He also points out that this is only for those whose drill chucks are long enough to still grip the shank when reversed. Alan Atherton has tested his latest locomotive, a 5in. gauge 'King' on the track. The locomotive is still quite stiff and needs some adjustment to the springing but should be a fine performer.

World club news

South Africa

Alex Groothuizen, Editor of the **Centurion SME** newsletter asked himself "How old is the lathe". After some research he came up with the surprising fact that lathes were in use in 1000 BC. "Uncovered artefacts show that lathes were in use during these times. Egyptian tomb paintings dating from the 3rd century BC illustrate lathes, or very rudimentary examples of same, being operated. Early lathes were also found in, amongst others, Assyria, Greece, the Roman and Byzantine Empires and soon reached from Scotland to the Crimea and from Denmark to Spain due to the expansion of the Celtic culture all over Europe." So next time you are in your workshop, remember that the lathe is not quite the modern tool that you thought.

United States

Following the annual general meeting, **New Jersey Live Steamers** has a new Secretary and President. Cathy Madlinger has taken on the role of Secretary and Gary Madlinger is installed as President. We wish both success in their new roles in what is obviously a family affair! At the Spring Meet, a trial was made of a full breakfast for the early risers. A total of 31 customers took advantage of the new service and discussions are underway for a repeat in the fall (autumn). The Memorial Day Run attracted a good selection of locomotives in the good weather.

Humour time

This pair of politically incorrect items came from **Model Engineers and Live Steamers Association Maryborough** in Australia.



Wedding dresses

A boy asks his mother, "Mum, why are wedding dresses white?" The mother looks at her son and replies, "Son, this shows your friends and relatives that your bride is pure."

The son thanks his mother and goes off to double-check with his father. "Dad, why are wedding dresses white?" The father looks at his son in surprise and says, "Son, all household appliances come in white."

The school play

A young boy comes home from school and says to his father, "Dad, I'm so excited. I got a part in the school play."

Father says, "That's wonderful son. What part do you play?"

"The part of a married man, Dad."

"Well, don't worry son. I'm sure that one day you'll get a speaking part."

DIARY

SEPTEMBER

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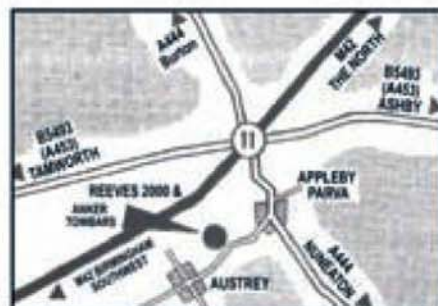


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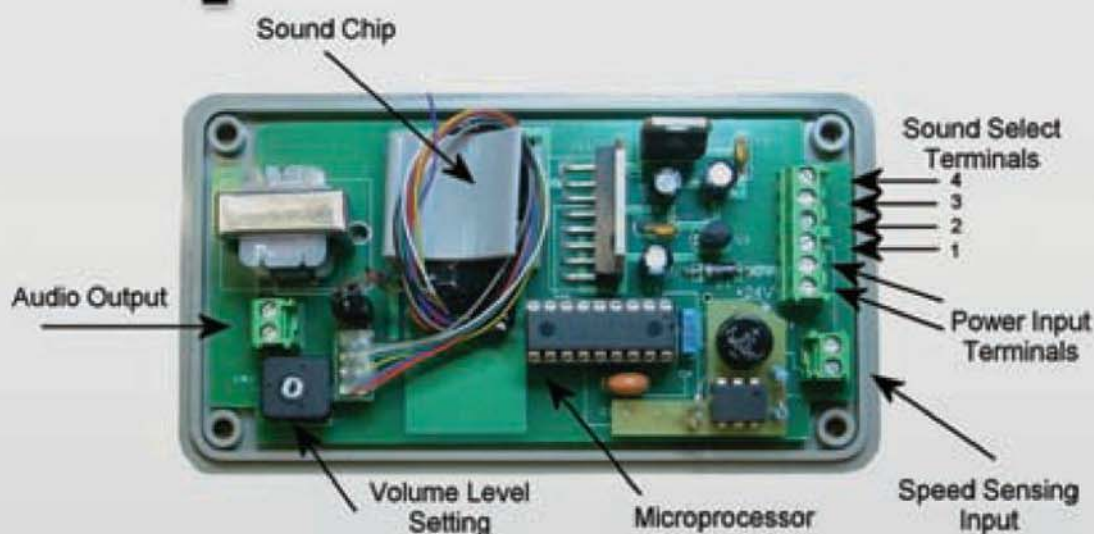
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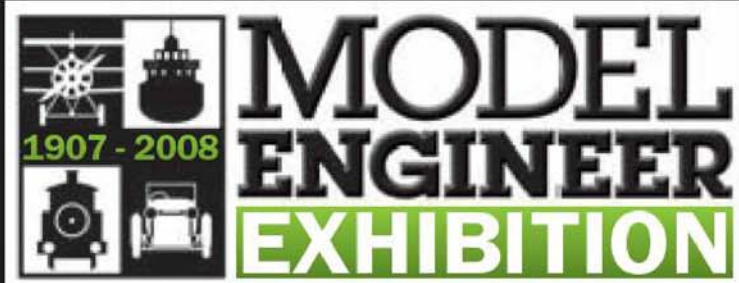
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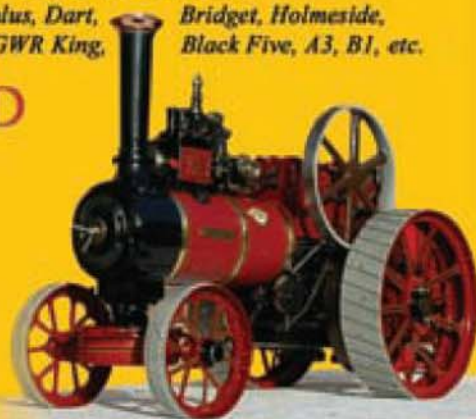
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