MODEL ENGINEER

Vol. 197 No. 4283

29 September-12 October 2006

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On the cover ...

The Blackburn Agricultural Engine is latest in the line of models researched and constructed by Mrs Cherry Hill. The model won a Gold Medal at the last Model Engineer Exhibition, bringing the tally to no less than eight. In this issue we use the example of the Blackburn to find out how it is that these exquisite models become reality. The 'secret' is what happens before the first metal is cut.

(Photograph by Cherry Hill)

TURN TO PAGE 399 FOR YOUR MODEL ENGINEER EXHIBITION ENTRY DETAILS

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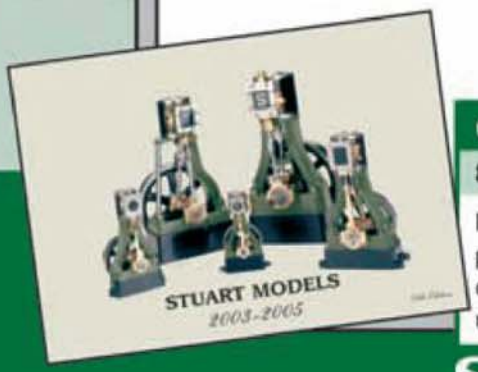

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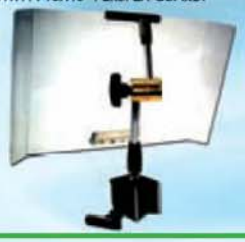

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XC59	INSERT	£4.00

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XC94	SET 7 INSERTS 6MM	~~£14.00~~ £12.00
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XC90	SPARE INSERT	~~£3.50~~ £2.50

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10 mm	12 mm
12 mm	16 mm
16 mm	20 mm

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SMOKE RINGS
With the Editors

B. Terry Aspin – 'Chuck'

It is with very deep sadness that I have to report the death of B. Terry Aspin, known to thousands in the model engineering world as 'Chuck', on 17th August at the age of 90. Terry was a very active member of the Wrexham and District Society of Model Engineers right up until the week before his death. He attended the club every Sunday and Wednesday without fail, and ran his locomotive at least twice a month. He was perhaps best known for his cartoons about the exploits of Chuck – The Muddle Engineer which have been published in the *Model Engineer* magazine since at least the 1950s, and, of course, some are being re-run at the moment. Chuck had many adventures, usually based on real events (most having happened to members of the Wrexham club!) but I have always had the sneaking suspicion that Chuck was Terry himself – we will never know.

Terry was an extremely inventive and creative individual whose attitude was not 'where can I get one of those?' but 'how can I make one of those?' Everything he built was truly from scratch. For example, I remember him showing me a glow plug engine in which the cylinder had been made from a hammer head "*I had to put it in the fire for a bit first*" and some beautiful 4mm scale locomotives which he had made from baked bean tins and other bits of scrap. He also taught himself to use a computer – very competently – when in his 80s.

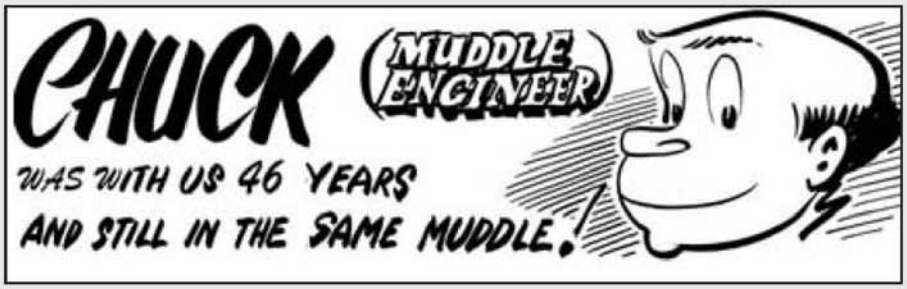
Apart from a steam engine which was made in a tool lorry in the desert during his service in the Second World War, Terry's early model engineering was centred on internal combustion engines, most if not all of which he designed himself. They ranged from single cylinder to a V8, all four-stroke. He even ran one on water – and has a witness to prove it! When Terry decided to venture into making steam locomotives he took the same approach. Two things he certainly did not do – buy anything and use someone else's ideas. He was most interested in narrow gauge locomotives, especially Hunslet, and scratch built several. He started with the maker's drawing. He redrew this to the correct scale for 3 1/4 or 5in. gauge (always working in metric – 'milligrubers' was Terry's name for millimetres) and then set about producing the patterns required for the necessary castings. The result was a truly superb locomotive each time, I know lots of people will agree with that.

Terry was very interested in casting, writing two well known books on the subject. He had a furnace of his own at home, but he also helped build a furnace at the Wrexham club – both to his own design of course. He would help anyone who was genuinely interested to produce their own patterns and castings, and more often than not he would lend his own patterns to other club members.

The photos are of Terry driving his last locomotive, a 5in. gauge model of 'Charles' which Terry called 'Charlie'. To quote, "*Charles is theirs, Charlie is mine!*" The other photo was taken at his 90th Birthday party, which was held jointly for Terry and another member in late May this year. Terry rarely took the regulator in latter years but he was seriously talking about building another locomotive at the time of his death.

I could write lots more about this remarkable man, but Terry, I am truly privileged for you to have regarded me as a friend for so many years and, yes, I will finish that Alice Class Hunslet! We will miss you.

Brian Millington,
Hon. Sec. W&DSME



Myford collets return

Myford Ltd tell us that after a long delay, their famous 11445 patent 2 Morse Taper collets are available again. These collets are quite different from other 2 MT collets which generally have a blind bore and have to be closed by using a draw bar. The patent Myford collet permits longer lengths of material to pass through the collet, where it is then supported in the spindle against whirling. Myford collets also allow machining close to the spindle nose, which results in greater accuracy.

Myford Collets used to be made at the old Crawford Collets factory in Witney, Oxon. When the factory closed production was moved to a new part of the same group. However, prices also increased greatly. Each collet cost Myford £10 more than its retail price.

After four years of searching a new supplier has been found and the collets are available again, priced £21.62 each plus postage and VAT.

POST BAG

Combustion in small cylinders

SIRS, - With reference to Mr. Benjamin's letter, *M.E.* 4276, 23 June 2006. The problem to which Mr. Benjamin refers, that of unsustainable combustion in small cylinders may well be due to his suggestion of quenching, which would most probably be a function of the combustion chamber surface area/volume ratio.

It is a primary design requirement of all combustion chambers (the space above the piston at TDC) that the surface area should be as small as possible to minimise heat conduction from the gas to the cooling system, the intention being to keep the heat in the gas thereby to provide the maximum possible pressure to act upon the piston crown during the power stroke.

It may well be that in a single cylinder engine of only 5 cu. cm. swept volume the combustion chamber volume could be very small for its surface area, i.e. a high ratio. This would be particularly so if the piston crown had a deflector.

The enclosed notes mention *"high combustion temperatures"* (higher than petrol) for butane and propane which would result in a steep temperature gradient between the gas and the cooling fins leading to a rapid heat loss from the charge, maybe to reduce its temperature below the ignition figure; the flame goes out and the engine stops!

The notes also refer to pre-heating of the fuel and the use of a gas carburettor which might be worth looking into.

Wishing Mr. Benjamin every success in his endeavour.

R. L. Wright, Surrey.

Coil winding machines

SIRS, - Anton Vella writes (*M.E.* 4278, 21 July 2006) seeking information on the Macadie automatic coil winder. I well recall the machine from my apprentice days, there was a rod acting as a guide for a block which could be traversed along it. The block was driven by two half nuts which could be toggled by an over centre spring one way or the other onto a lead screw arrangement consisting of two rods, left and right-hand threaded. The lead screw was driven from the variable 'gearing' consisting of a rubber wheel between two parallel plates (clearly seen in the photograph). The toggled block was coupled to the wire guiding pulley feeding the copper winding wire onto the former, thus laying alternate layers. The limit pins were set to reverse the feed by tripping the toggle as required. I hope these rough notes will enable Mr. Vella to sort out the missing items.

Ken Willson, Hampshire.

Astronomical quadrant calculation

SIRS, - I think that I have found a simple answer to the question which I left unanswered in *Letters to a Grandson* No. 88, (*M.E.* 4273, 12 May 2006) in which Fig 3 refers.

John Bird's problem was how best to inscribe on an astronomical quadrant a graduation midway between two existing graduations; points A and B in the enclosed diagram.

The arc AB of the quadrant has a radius of 8ft. or more, and is therefore comparatively flat. My suggested procedure is:

(1) Strike arcs with a pair of dividers with A and B as centres to intersect at C, which should be as close as is conveniently possible to the arc AB. At the same setting, strike the arc BF, with C as centre.

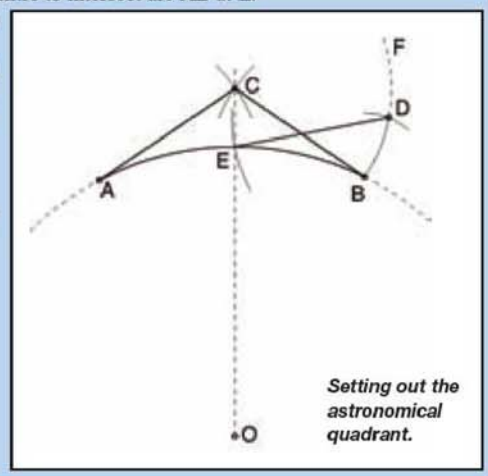
(2) Lay the dividers on one side, and with a second pair, take off by eye the shortest distance between C and the arc AB.

(3) With B as centre, use these dividers to strike an arc to intersect BF at D.

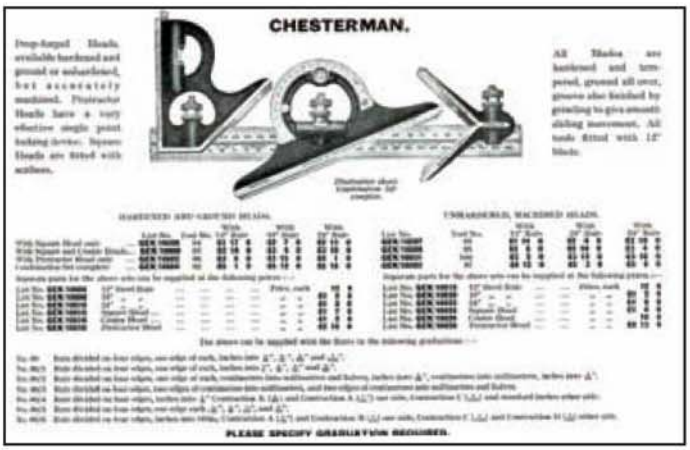
(4) Without altering the setting of the first dividers, use them to strike an arc with D as centre to intersect arc AB at E.

This is then the required graduation. It will be seen that even if there is a slight inaccuracy at stage (2), it will have little effect on the location of the graduation E. For practical purposes, the triangles EBC and EBD are congruent.

M. J. H. Ellis, Bristol.



Setting out the astronomical quadrant.



The Chesterman No. 96 box from Geoff Shackleton.

One toolbox identified

The Moore and Wright 930 toolbox sent by Tony Finn.

SIRS, - In response to Brian Cutler's letter (*M.E.* 4278, 21 July 2006), I can identify the Moore and Wright tool box which is, as can just be seen on the photograph, No. 930.

This is listed and illustrated as one of three sets in their catalogue No. 65 dated 1965 under the heading:

SETS OF TOOLS
Ideal for presentations

930 Contents
1 outside caliper firm joint, No. 331, 4 inch
1 pair spring dividers, No. 50, 3 inch
1 precision feeler gauge, No. 124 with 10 blades from .0015"—.025"
1 precision try square, No. 400, 3 inch
1 rule—3 fold—9 inch
Supplied in wooden box with hinged lid

Plainly this is the same box, so perhaps Mr. Cutler will be able to find these items among his late father's tools and restore them to their rightful storage!

Tony Finn, Yorkshire.

Another box identified

SIRS, - In answer to Brian Cutlers' query (*M.E.* 4278, 21 July 2006), Chesterman Tool No. 96 was an engineers protractor with a hardened and ground drop forged head.

The tool was also available with a square head (No. 94) or centre head (No. 93) or as a combination set with all three heads (No. 92). The associated rule was available in different lengths with a choice of the scale of graduations. In 1935 the protractor and rule cost 24 shillings but by 1953 the price had risen to 65 shillings!

Geoff Shackleton, by-mail.

Drilling digital scales in stainless steel

SIRS, - There are dozens of stainless steel grades and it can be regarded as tough rather than hard. With proper equipment all grades can be machined fairly easily. The ferritic grades (Chromium above 14%) are the easiest to machine, while the martensitic grades (Chromium below 14%) produce a stringy chip. The austenitic grades are somewhat more difficult to machine as they 'work harden'.

It is not advisable to use a normal centre punch as the indent is very hard. I recently drilled over 400 holes through quite tough stainless steel and the shank wore out before the drill required sharpening. Use a metric cobalt

stub drill with a 135deg. point. Typical Part No. DSE-20197C from J+L Industrial Supply, tel: 0800-663355.

Using a standard Dormer drill is a waste of time. Do not attempt to regrind drills or taps, use very short stub drills, use a triangular punch if the material may work harden, do not stop once drilling has started, apply continuous pressure, back up the work with a solid plate. Always use cutting fluids, the one supplied by Greenwood Tools seems to work well, also WD-40 and paraffin.

When threading use a TiN or TiCN coated tap and reduce the percentage full thread as low as possible. Most tapping drill charts do not state percentage full thread but this is usually 75-80%. You can go as low as 50% in non-critical applications.

When hand tapping, use a guide or the tap will break. A programmable tapping drill chart can be found at **www.colinusher.info** in the Model Engineers' Utilities section.

Colin Usher, by e-mail.

Mystery steam engine

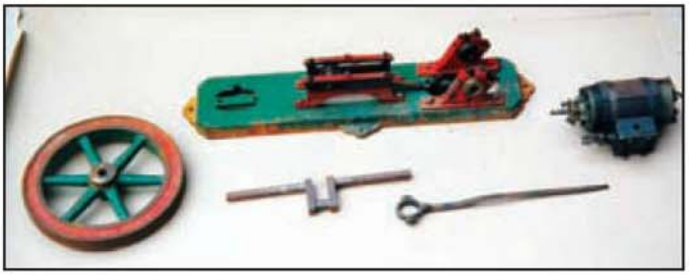
SIRS, - I am trying to identify a steam engine. One photograph shows the engine in the condition it was in when I was given it and one showing the stage restoration has so far reached. The person who gave it to me had inherited the engine from his father. His father evidently bought it as 'basket job lot' a considerable time ago.

I have no idea who originally built the engine and whether it was made to a set of drawings or is a freelance build. It is thought that it possibly dates from before the First World War.

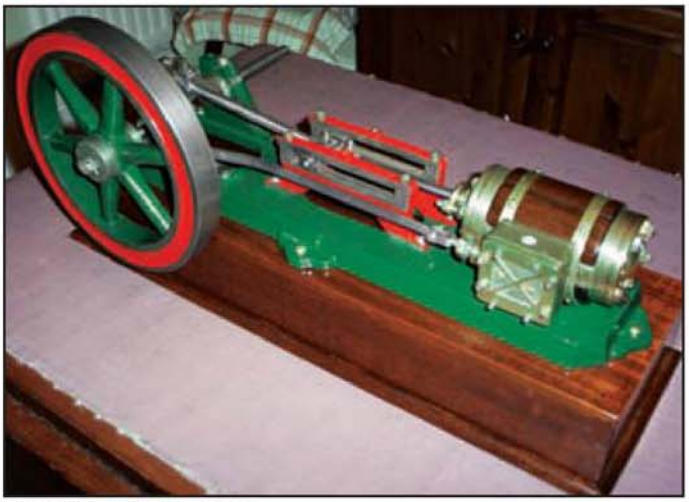
The threads used in its construction are all Whitworth and parts such as the parallel guide bars, cylinder, crankshaft, cross head and drain cocks are similar to those shown in the Bassett-Lowke catalogue for 1904 (and 1940). The engine although similar to some Stuart Turner designs, is somewhat longer than any I have seen and has a 9in. diameter flywheel.

Any help your readers can give towards identifying the engine would be greatly appreciated.

Edward. W. Lawrence, Devon.



Mr. Lawrence's mystery engine as received.



The engine after restoration.

AVO meters

SIRS, - In response to Mr. Johan Beserik's request (*M.E.* 4277, 7 July 2006) for information regarding his faulty AVO meter Model 7, he and readers will be interested to know that Bill Barton of Bolton (Tel: 01204-61106) is the acknowledged authority, and may well be able to help to source spare parts.

Harry Cawthorne, by e-mail.

Sifbronze in boilers

SIRS, -I have the highest regard for the opinions of my old friend Dennis Monk, but on this occasion I have to say that, like Peter Rich, I have used sifbronze on boiler sub assemblies for around 40 or 50 years and have yet to experience a failure.

I have always brazed the fire hole door ring into the firebox door plate, and bushes into the back head from the inside using sifbronze. I fear that both Dennis and your contributor Mr. N. F. Counsell have fallen into the trap of thinking that de-zincification is a national problem, which clearly it is not.

Certainly during my spell with BR at Derby in the 1960s I learnt that Dennis's experience with de-zincification was a well-known problem in the Midlands, and would seem to extend to Mr. Counsell's part of the country. In my home area of the South-east I have no knowledge of a failure problem connected with the sifbronze process, and it appears to me that to condemn this practice as unsound is a little exaggerated, and yet another example of today's 'what if' syndrome that we have to contend with.

Indeed during my apprenticeship at Ashford Works in the 1950s as a locomotive-fitter and turner I remember seeing copper ends brazed on to the superheater flue tubes on the Maunsell N and U classes in a large coke fired rivet fire by the coppersmiths, not a practice that would have been acceptable by the railway or HMRI if there had been a risk of failure! I understand that the 'U' class 1638 which recently entered service on the Bluebell Railway also has copper ends on the steel superheater flue tubes which I can only presume have been brazed on.

It may well be that, with the movement of boilers/ locomotives/ traction engines around the United Kingdom these days, practices which have not given problems in one part of the country are not suitable on a national basis for all the reasons that Dennis and Mr. Counsell state. Of course dependant on the heating medium it can be much easier to silver solder rather than braze!

Clive R. Young, Kent.

Moore & Wright

SIRS, - I write in response to the letter from Mr. Brian Cutler (*M.E.* 4278, 21 July 2006), and wonder if the following might answer one of his queries. One of the boxes illustrated appears to be suitable for a try square.

I have in my possession a Moore & Wright catalogue No. 46A dated August 1946 which describes a number of try squares of different grades, and a variety of sizes which were supplied in strong wooden boxes up to a maximum size of 12 inches. Above this size they were supplied in strong wooden sheaths. The catalogue lists three grades of squares:

1: High precision engineers' squares for which an N.P.L. (National Physical Laboratory) certificate could be obtained at extra cost,

2: Hardened try squares,

3: Engineers' squares.

I hope the above information will be of help.

W. S. Wilkinson, Oxfordshire.

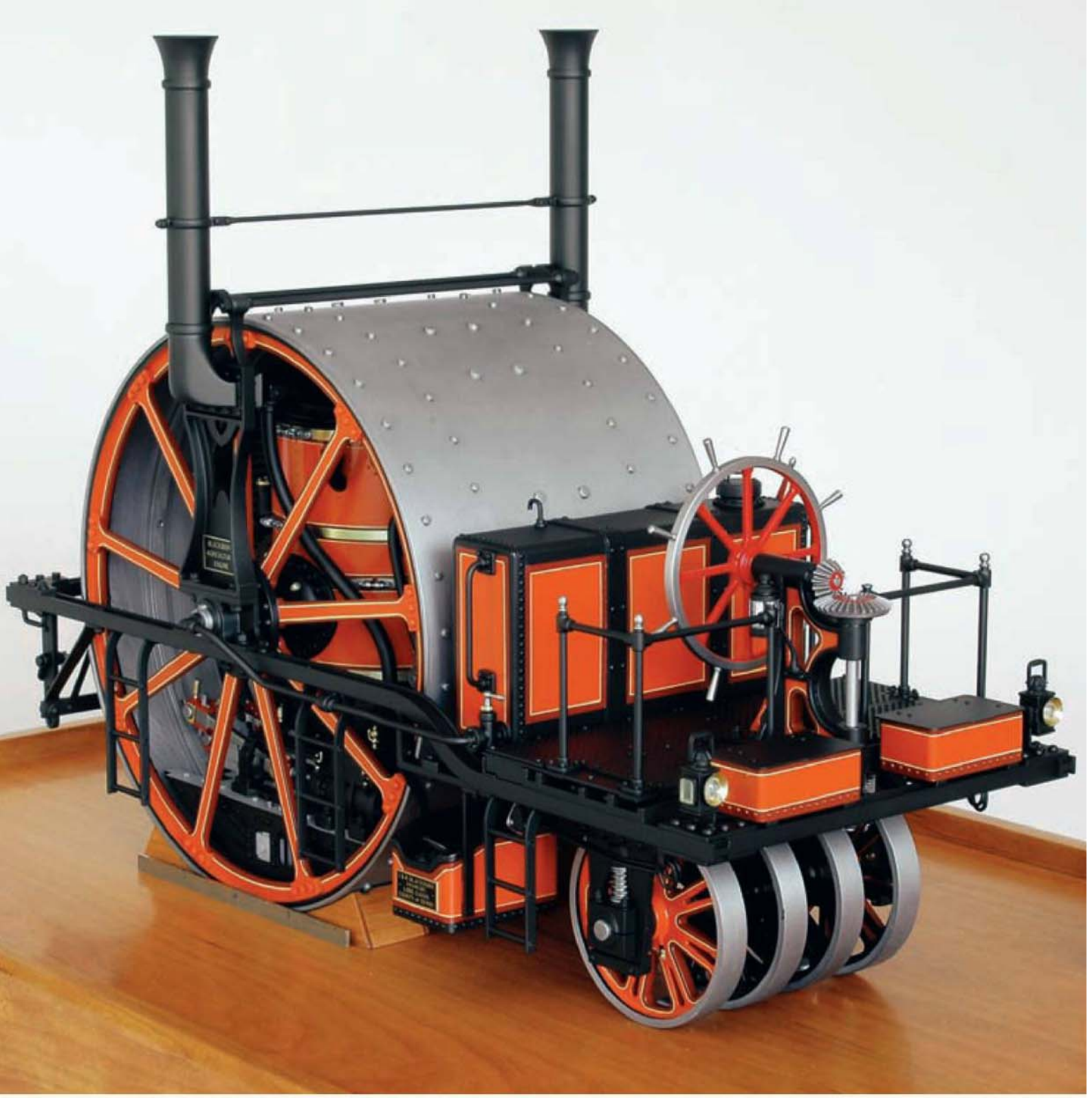
Drilling stainless steel scales

SIRS, - Referring to Peter Gain's letter regarding drilling digital scales (*M.E.* 4278, 21 July 2006) I suggest he tries FRHEI drills, supplied by South West Surplus Tooling Ltd. New Portreath Road, Bridge, Nr. Redruth, Cornwall TR16 4QL, Tel: 01209-843656, Fax: 01209-843654.

These are carbide tipped drills using a grade of carbide suitable for drilling metals. It is claimed that they will drill through *"High Speed Steel, Hardened Steel, Brakes, Discs, Concrete, Stone, Bricks, Glass, Wood, Plastic, Quarry tiles etc."*

I have successfully drilled through the hardened steel cutter-bar of a lawnmower, in the course of making a tool to dig dandelions out of the lawn. No difficulties arose with 8mm holes. Drills from 4 to 24mm are available.

Dr. C. L. Forbes, Cambs.



I & R BLACKBURN'S AGRICULTURAL ENGINE OF 1857

David Carpenter
reports on what went into Mrs Cherry Hill's latest Gold Medal winning traction engine.
Photographs by Cherry Hill.

The Blackburn Agricultural Engine by Mrs Cherry Hill is the latest in a long line of her superb models that have graced the Model Engineer Exhibition for decades past.

Just for the record the awards to date include eight Gold Medals, seven Bradbury Winter Memorial Awards, and seven Duke of Edinburgh awards, the highest accolade in model engineering. Then there is a bagful of other awards – Championship Cups, Crebbin Memorial, Aveling Barford, Sir Henry Royce, and Viewers' Choice.

Along the way Cherry has also collected an MBE, been made a Companion of Institution of

Mechanical Engineers, and an Honorary Member of the Society of Model and Experimental Engineers.

It all started with a Stuart No 9, now part of the collection of the SMEE. A few other early models were given to members of Cherry's family. More recently, all the later models have been donated to the Institution of Mechanical Engineers, and are prominently displayed in the Institution's central London headquarters.

Visitors to last year's Model Engineer Exhibition were treated to the latest in her series of traction engines, the Blackburn agricultural engine of 1857. Made in her usual scale of 3/4in. to the foot, the Blackburn is far from simple. Traction is applied through one great wheel, with the power applied from an engine inside the wheel. And, yes, the boiler is inside the wheel, too. Of all the power plant of the engine, only the pair of elegant chimneys is situated outside that wheel, one on either side. How they work, and some of the other tricky arrangements on this complex engine are explained later in this article.

Just how does Cherry go about producing her models?

The most important part of the process begins while the previous model is in the workshop being machined, assembled, and painted. That is when the next model is selected, and research undertaken into the original, which is a lengthy and rigorous process. People look at the finished model in awe, but generally can have little idea how much work is done before a single piece of metal is cut. Usually it takes several years.

Research is done through Patent Office records and contemporary publications, such as *The Engineer* and the lesser-known *Mechanics Magazine*, which is a real treasure trove for research into Victorian machinery. For some models there is a further stage of research that might uncover some works drawings, or even an example of the engine to be modelled, or the remains of one that can be examined and measured.

Research goes beyond garnering all available information about the machine itself. There are usually a host of parts that are not incorporated in a general arrangement drawing, which may be all that is available. So the research goes on into, say, contemporary valves that might have been fitted. Also into other products of the maker of the intended model, to give yet more clues to producing something as authentic as possible. So, what did the research into the Blackburn come up with? Certainly not an actual example, as it is quite possible that none were actually made.

The Engineer, in September 1857, showed an engraving of the first engine and gave a short description. That engine was the subject of patent No. 414, granted in the same year to Isaac Blackburn of Islington in the County of Middlesex, and Robert Blackburn of the City of Edinburgh, for:

"*Improvements in Engines or Implements to be employed in Agriculture, applicable also to the Transportation of Heavy Bodies, to the Traction of Carriages and the Conveyance of Passengers.*"

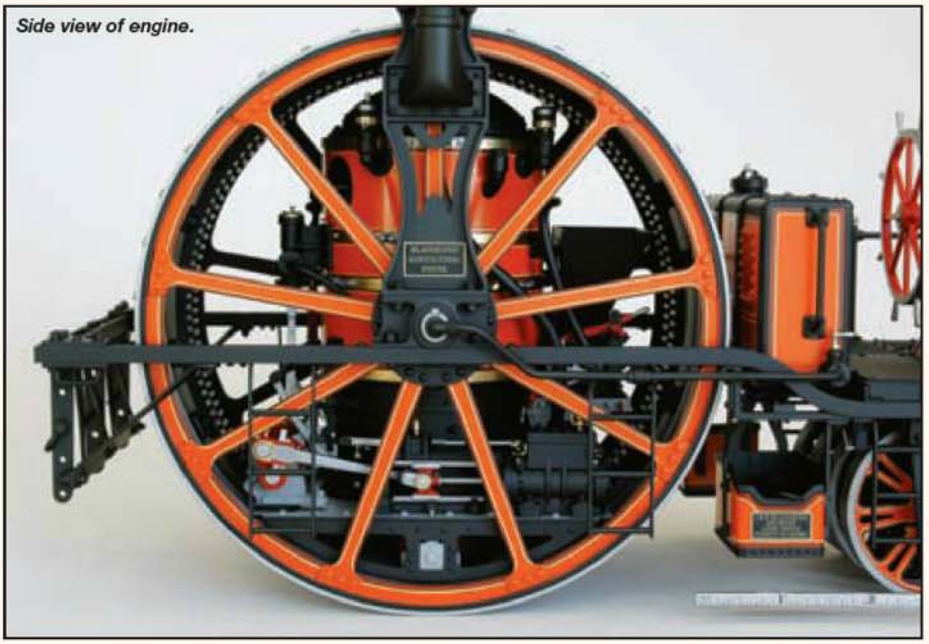
These contemporary sources provided the following description of the main elements of the

Large internal drum gear in place.

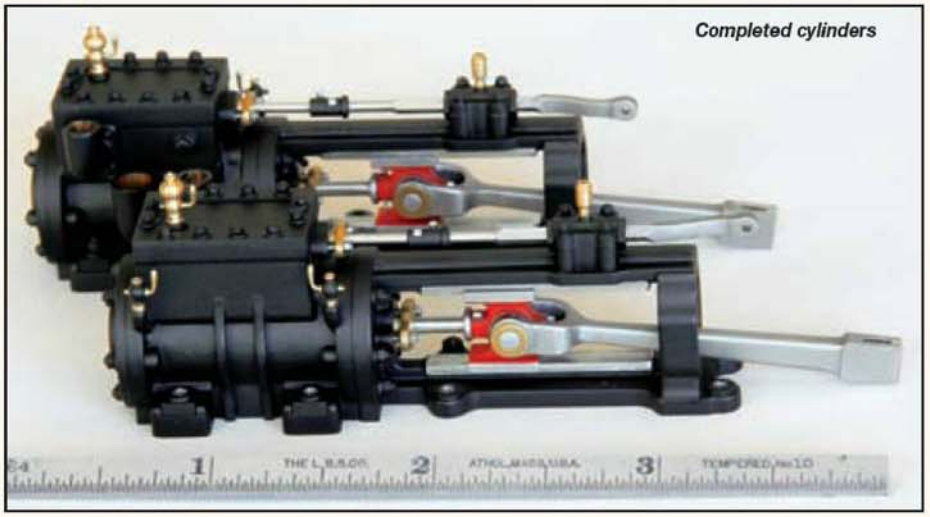
Blackburn engine, and helped to unravel the mysteries of how it worked, or perhaps that should be 'could have worked'.

A vertical boiler and a pair of cylinders are placed inside a drum of "*considerable diameter*", the drum being driven by an "*internal gear or other gearing*".

"*Friction wheels*" are fitted below the engine and the boiler plate. They run on rails inside the drum to "*give steadiness to the drum*". That



Side view of engine.



Completed cylinders

Completed boiler assembly

implies that they took part of the weight of the machinery inside the drum and prevented distortion.

The smoke box extends each side to just inside the drum spokes. At the same level and immediately outside the spokes are the base brackets of the chimneys. How did the smoke get from one to the other? Replying to correspondence in *Mechanics Magazine*, Mr .Blackburn stated that there was a 4-inch space between the openings and that the smoke "*readily finds its way therein and of course is carried upwards.*"

Boiler and reversing gear.

The regulator is "*situated in the boiler*" and is operated through the trunion on one side of the drum. The other trunion is employed to feed water to the boiler from the tank on the main fame in front of the drum.

Inside of the drum is a "*Fire Feeding Apparatus with Coal Hopper.*" The drive pinion is shown but there is no written information in the Patent. The boiler has conventional fire doors.

The Patent also states that the engine could be used as a stationary engine by disengaging the toothed gear. However, it does not explain how.

The Patent also covered reversing the engine through a drum trunion (although the drawing shows a separate lever for that, inside the drum). It also included adaptation of the engine to run on railways – now there's a challenge for you locomotive builders.

The Blackburn was by no means the first 'moving drum' design. *Mechanics Magazine* reported in 1857 that there had been attempts over a period of years, but that "*no useful result of importance was obtained.*"

Did it ever appear? There is an unconfirmed report that a Blackburn engine was shown at Salisbury in 1857. However, it failed to make promised appearances at the Royal Agricultural Show at Smithfield in the following two years.

Cherry analysed some of the reasons for the failure of this engine, such as:

- Initial assembly was difficult
- Servicing and setting had to be performed through the spokes of the drum
- The frame section is too light and would have flexed during operation. Recognising that, the model was built with a larger than scale frame, but still flexes.
- The pump and the automatic stoker would not operate while the engine was stationary. Consequent firing through fire doors on either side of the boiler would have been difficult, due to their location.

The machine had to be stopped to adjust boiler feed and safety valves, and shut off the drain cocks. Moving the reversing lever or disengaging the stoker meant reaching inside the drum.

Undeterred by all the difficulties shown up during research, Cherry proceeded to the design stages. Research and initial sketches for the model were done between 1996 and 1998, while also finishing off a previous model. The design, drawing and construction took the following six years, including making a mock-up of the engine, with many parts fully machined as on the model proper. She always makes a mock-up of her engines before going on to the real thing. Painting took a further 4½ months, with completion just in time for the 2005 Model Engineer Exhibition.

Something over 5200 components go to make up the Blackburn.

For Cherry it is this research and design phase that is the most fascinating part of tackling a new model. The actual construction is less so, even though anyone looking at her models will have their breath taken away by the craftswomanship.

And the meticulous care that goes into the research is matched by the care in construction. To give a few examples:

- All the rivets are hand made
- All the 'castings' are actually fabricated
- Boilers are made of steel
- Anything less than perfect is rejected.

Regarding the latter, Cherry has a Blackburn cylinder that she rejected after it had been completed following goodness know how many hours of work. Handing it over, she says: "*You'll see what's wrong with it.*" Examining it closely and searching for where the end mill dug in or the drill broke through or, well you know, the sorts of things most of us do, nothing is apparent.

After admitting defeat, she points to one of the bosses in the cylinder 'casting' into which the cylinder cover bolts are screwed. Still baffled. Eventually she explains that it is about a millimetre too long.

"*Cherry, no-one would have known.*"

"*I would.*"

Equally disarming is the response to questions about how this or that was made.

"*Oh, I just fiddle around until I get it right.*"

Just in case you didn't know, the lady is self-taught. Remember that next time you look at one

Close up of internal drum gear.

Underneath the boiler.

Steering bevel gears.

Front wheels.

of her traction engines, or take encouragement from it when you think that something you are building is impossible.

That doesn't mean that anything is casual. During the build she keeps notes of design details and how many of the parts are actually made. Designs are carefully and comprehensively drawn to a standard you would expect from a draftswoman who had 20 years experience with an agricultural machinery company.

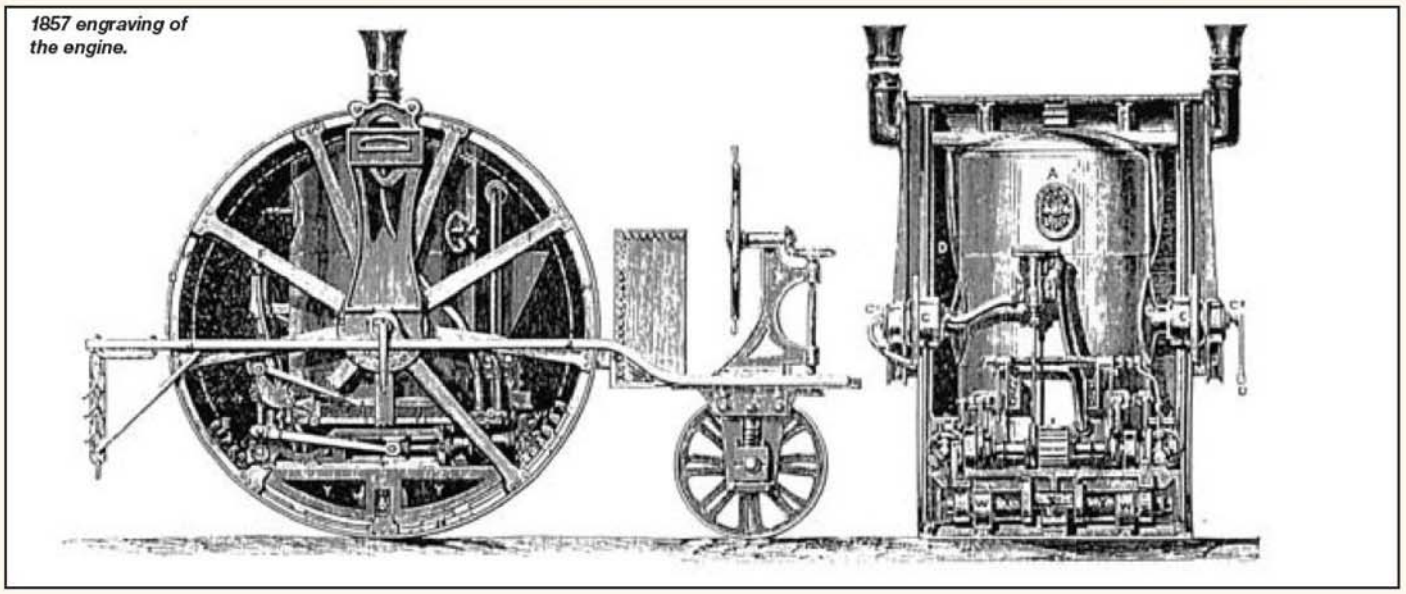
With the Blackburn, the design process started with a GA of the original. As building progressed a number of modifications were necessary, not least to produce a working model. Many people looking at the Blackburn and the other traction engines may think they are produced just to look right.

Not so. They will never get the use of a club locomotive, but they have to be able to work, and they are tested, usually on compressed air.

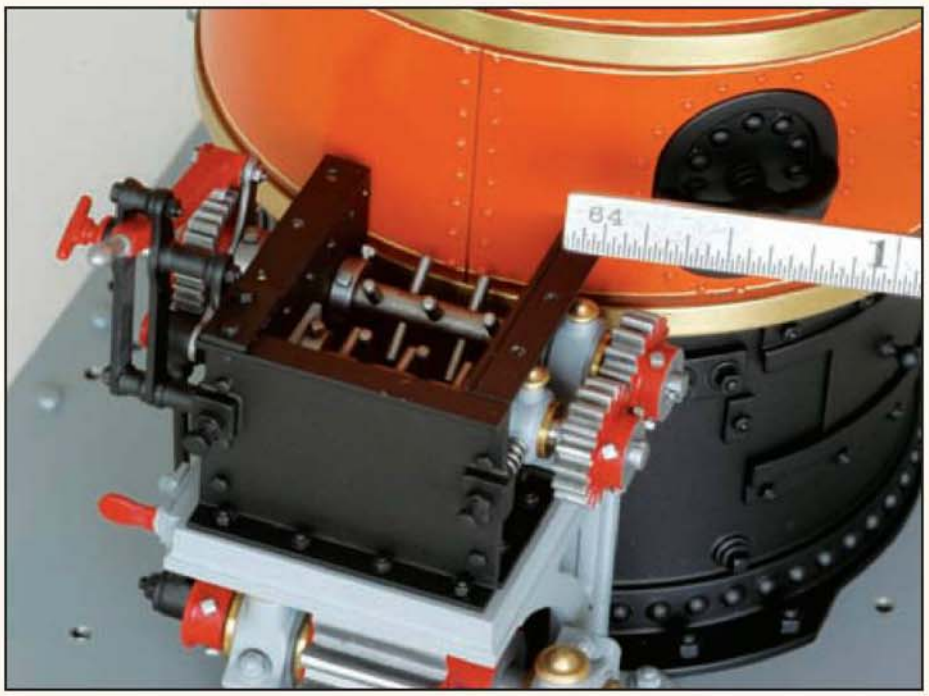
As work progressed on the engine a number of modifications were needed to produce the model. The following details give an idea of the challenge in modelling in great detail, even from a works drawing.

The diameter of the lower section of the boiler was reduced to clear the trunk guide housing, to fit the fire door with clearance for firing, and to leave enough space for the movement of the expansion link and primary valve link.

The regulator is mounted externally on the boiler, and is operated through a drum trunion. Additional linkage was given to provide a second operating position. You will never see it, but a shield is fitted inside the boiler at the regulator to ensure that only steam enters the regulator. The same applies to the safety valve outlets. Two

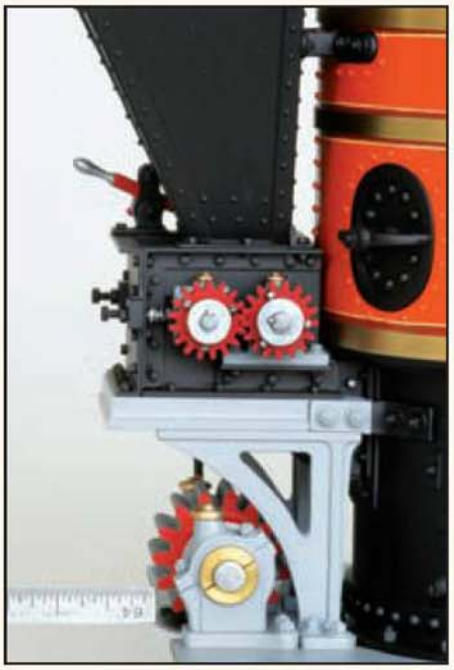


1857 engraving of the engine.



Stoker mechanism showing feeder shafts fitted with spikes.

Stoker drive gear and ratchet.



Stoker shaft gears.

safety valves having bronze seatings were fitted to the model.

It was necessary to alter the position of the weighshaft and reversing lever to give sufficient clearance for operation. A quadrant assembly was fitted.

The ash pan was made so that when dropped there is the equivalent of a 3in. gap for emptying. Emptying would have been difficult, even so.

On the Patent drawing the large internal drum gear is shown in eight sections. The one for the model was made in one piece, with pads where the break points would have been. Construction time just for this one gear and all the tooling necessary took some 2½ months.

Inevitably the business of stoking a boiler situated inside a large wheel, without stopping the wheel, requires some ingenuity.

There was no information for the final drive of the stoker, and its internal parts. The Patent states: "*The Boiler is furnished with a fire-feeding apparatus with a large hopper to hold fuel, which is set in motion by gearing of the drum, thus enabling the engines to work for two or three consecutive hours without stopping to fuel the furnace.*"

The model stoker is fascinating in its own right and was interpreted from the Patent information. It has a pair of rolls with spikes interspaced and set at 45deg. to each other. The outer roll is spring-loaded. It is operated by engaging a ratchet pawl and opening up the flap door on the boiler.

Foundation of the stoker assembly is a support frame attached to the engine base plate and the boiler. Two side plates house a pair of feeder shafts, one of which is spring loaded. The feeder shafts are fitted with the rods that feed the coal and restrict the flow from the hopper. Feeder shaft gears are 17 tooth 48dp. The two side plates are spaced just 0.64in. apart.

The main drive to the feeder is an auxiliary shaft with a 15-tooth 24dp gear, and is driven from the large internal gear in the drum. There is an eccentric boss on the auxiliary shaft with a drive rod to the drive plates of a 32-tooth ratchet wheel on one feeder shaft. The pawl arm can be disengaged.

The chute from the feeder to the firebox has a vertically suspended baffle gate at the delivery end. While feeding, the gate is pivoted outwards and secured. When feeding is complete the gate is lowered to cover the hole in the firebox, and that also clears any coal left in the chute. During testing the chute remained clear at all times. The feed rate can be adjusted by removing selected rods from the feeder shafts. The model was tested with maximum feed.

The hopper volume is just under 1 cu. in. and that is just over half an ounce of coal (equivalent to 1¼cwt in full size). Its sides are steeper than those shown in the Patent drawing.

Coal used to test the stoker was West Virginia coal, riddled through a grid 0.061in. by 0.165in. When tested, it took 373 turns of the stoker main drive shaft to empty the hopper. On completion the model stoker fed the boiler satisfactorily, at an acceptable rate, and there was no 'bridging' in the hopper.

It is hoped that this model will return to the Model Engineer Exhibition this year, and that these notes will help visitors to appreciate what they see. In addition to the model itself it is hoped to show a video of the Blackburn in action. Meanwhile, work is already progressing on Cherry's next engine, and we look forward to seeing that, when it is completed, at the Model Engineer Exhibition, perhaps in 2011.

●*To be continued.*

Front view of engine.

LETTERS TO A GRANDSON

M. J. H. Ellis

on the nature of light.

●*Number 93*

Dear Adrian, I still have a little more to say about the nature of light before moving on. It concerns the difference between white light and light of one wavelength only 'monochromatic'. The thing about white light is, that, 'white' is hardly a normal colour. When we speak of white light we usually mean the visible radiation. This radiation is a pot-pourri of light from the entire visual range, and indeed, it extends beyond it into the infra-red and ultra-violet. Because of this, white light is less productive of interference effects than monochromatic light.

If the atoms of a particular chemical element are made hot enough, they emit radiation of several characteristic frequencies, not necessarily in the visible range. These frequencies are determined by the internal structure of the atom. When it is desired to make use of monochromatic light it is usual to select light of one of the available frequencies by means of a suitable colour-filter. This is transparent to light of the required frequency, but opaque to the others. Having dealt with that, we can now move on to…

Optical interference

My sketch (**fig 1**) portrays two light-waves of the same frequency and equal amplitude.

At A they are in phase with one another, with the result that the combined effect is greater than either.

At B they are half a wavelength out of phase, so that the effects are always equal and opposite, and the result is darkness.

At C they are out of phase to some intermediate extent, and now the combination of the two may result in either partial reinforcement, or partial cancellation.

If the frequencies of the two waves are identical, but the amplitudes are not the same, the result will be similar to the above, but complete cancellation will be impossible.

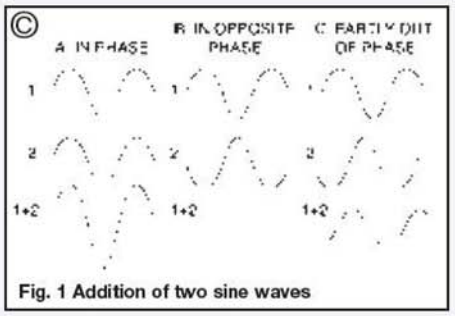


Fig. 1 Addition of two sine waves

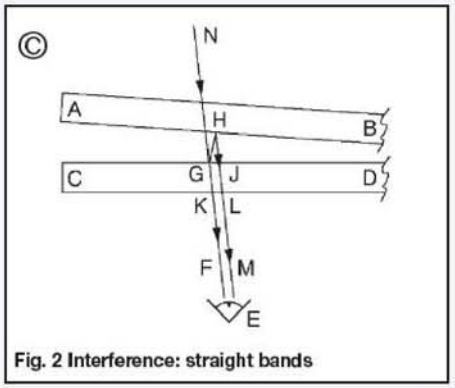


Fig. 2 Interference: straight bands

When interference occurs

Suppose that two sheets of glass, AB and CD each with flat parallel faces are placed very close together at a slight angle to one another, (**fig 2**). It is assumed that to the right they would, if long enough, touch along a line normal to the paper. Let a ray of monochromatic light N strike the upper plate almost normally. Undergoing refraction as it passes through the two plates, it emerges as KF. A certain amount of the light is also reflected at G, again at H, enters the lower plate at J, and continues as LM. To all practical purposes it is parallel to KF, since the inclination of plate AB to CD is too small to have any significant effect.

The path of the reflected ray LM exceeds that of the transmitted ray KF by the distance GH + HJ, and this will affect the phase relationship of the two rays. Let GH + HJ = d. Then if d is an integral number of wavelengths the two rays will be in phase; whereas if it is an odd number of half-wavelengths they will be in opposite phase. Suppose that in this case they are in phase, then an eye at E will see a bright band at right angles to the paper. Somewhere further to the left, however, the distance d would have been longer by half a wavelength, and here the eye would see not a bright, but a dark band.

Further leftwards again, the path length will be increased by a further half-wavelength, so giving rise to a second bright band, and so on in succession.

Under this arrangement the reflected ray would be weaker than the direct ray, but by lightly silvering the reflecting surfaces it is possible to make the two rays approximately equal in brightness, and so achieve the maximum contrast between the light and dark bands.

This interference effect is utilised when an optical flat is used to test the flatness of a polished metal surface. Later on, we shall see how Michelson used it in his interferometer.

A somewhat similar manifestation of interference arises when monochromatic light is used in conjunction with the apparatus shown in my next diagram (**fig 3**). Here, A is the light-source, B is a condensing lens to produce a convergent beam, and C and D are parallel flat glass plates, of which the inward-facing surfaces are semi-silvered, to make them reflect better. An eye at E sees a series of alternately light and dark concentric circular fringes. The explanation of this phenomenon is illustrated in my next diagram (**fig 4**).

The ray N is a little inclined to the normal, and part of the light is transmitted through plate D, emerging as KF. The rest of the light is reflected and follows the path GHJLM. The retardation of the reflected component is therefore a trifle greater than 2d, d being the distance between the two glass plates. Suppose that this results in the two rays KF and LM being in phase, the eye at E will see brightness. But exactly the same thing will happen to all the rays like R which fall on the circle passing through P_2 and having its centre at Q, on the axis of the system. Hence, the eye sees not a single spot of light, but an entire circle, centred on Q.

Somewhere further out, another ray R falls on plate C at a more oblique angle, but here, the difference in length between the paths of the direct and reflected rays, although it may not look it, is less than it was in the case of KF and LM. We may suppose that the transmitted and reflected rays are now out of phase when they reach the eye, so that now a dark circle is produced. The further out we go, the more does the difference between the length of the direct and reflected rays diminish, and, moreover, it diminishes at a progressively faster rate. As a result, a whole series of alternating light and dark rings is produced, looking like the growth-rings to be seen on the end of a sawn-off tree trunk, and becoming closer to one another, the further out we go.

I have left out any reference to the fact that when reflection occurs (as at H and J in the last diagram) some of the light will either be transmitted (as at H) and lost, or give rise to a further reflection (as at J). The light which merely gets lost does no harm. Where multiple reflection does take place, the brightness of the reflected ray rapidly falls off exponentially. Hence, if beyond JL one or two further reflected rays arise, (1) they will not be very bright, (2) if JL re-inforced GK, so, too, will any further reflected rays; whereas, if GK and JL were out-of-phase, subsequent reflected rays would be alternately in- and out-of-phase with GK, and thus, by tending to cancel one another out, do little towards brightening what would otherwise be a dark ring.

If you have understood so far, you are now over the brow of the hill, and a comparatively easy road lies ahead. Your weary, but still affectionate Grandpa.

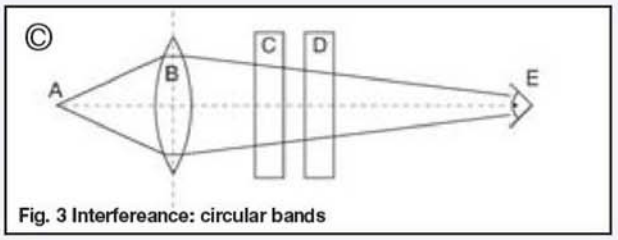


Fig. 3 Interfereance: circular bands

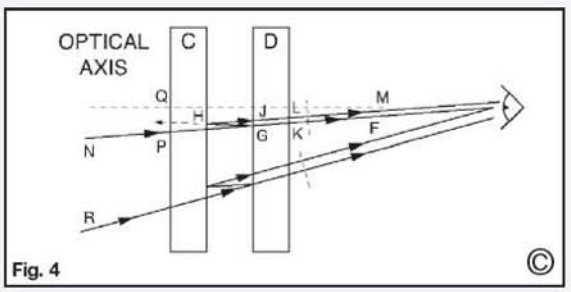
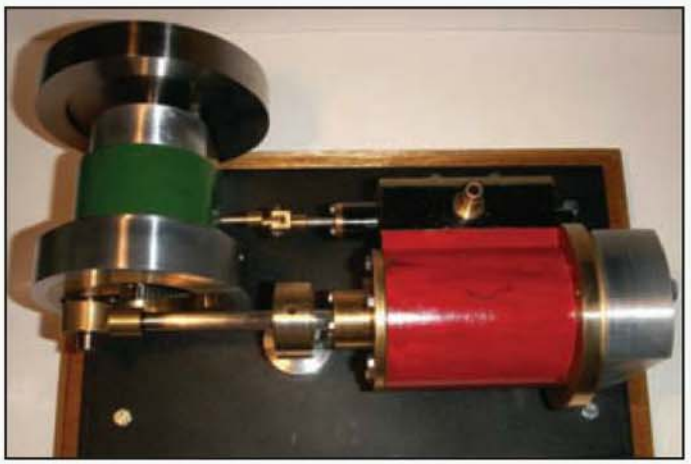


Fig. 4



Bird's eye view of the engine. The hypocycloidal crankshaft was devised by Matthew Murray to avoid patents held by others.

The inexpensive honing device used to finish the bore of the cylinder to a fine finish.

HYPOCYCLOIDAL DOUBLE ACTING ENGINE

Les Kerr
of Australia completes the cylinder and describes assembly and testing the engine.

●*Part III continued from page 259 (M.E. 4281, 1 September 2006)*

The cylinder, item 31, was fabricated from a piece of scrap bronze bearing bush 60mm O/D x 37mm I/D and a piece of brass bar 1.5 x 3/8 inch.

I initially centred the bush in the 4-jaw chuck faced the end and cleaned up the outside to 59.57mm diameter. I then parted off a length of 70 millimetres. This was transferred to the milling machine and a 33mm wide flat was machined on the outer circumference. While at the milling machine the flat piece of brass was reduced to 7 x 33 x 70 millimetres. The two pieces where then silver soldered together.

The assembly was again centred in the 4-jaw chuck and the cylinder was carefully bored out to 38mm diameter. The inside face was honed using a cheap tool purchased from an automobile supplier (see photo). While still in the chuck the assembly was transferred to the milling machine where the valve face was machined flat using a fly cutter. The steam and exhaust ports were then cut using a 4mm slot drill. The holes for the steam and exhaust passageways were drilled with the ends being plugged with small brass cylinders. These were held in place with high temperature Loctite 602.

The holes for the cylinder covers and the valve chest were left until the cylinder cover and chest were made. On completion of the machining operation it is necessary to smooth the valve face by rubbing it in a figure of eight pattern on fine emery cloth mounted on a surface plate or a sheet of plate glass.

Piston (item 32)
The piston was fabricated from a piece of 1.75in. dia. cast iron and a length of 8mm diameter stainless steel. As my engine was to be used mainly for display I didn't bother with piston rings but these could easily be added if necessary.

Chuck the cast iron and reduce the outside diameter so that it is a tight fit in the cylinder. Drill an 8mm dia. hole though the centre then part off to a 12mm length. Cut a 124mm length of 8mm dia. 304 stainless steel and, using Loctite, fit this to the hole. Mount the shaft in the lathe so that the piston head runs true. Using very fine emery cloth rapped around a file, polish the outside until a slide fit in the cylinder is obtained.

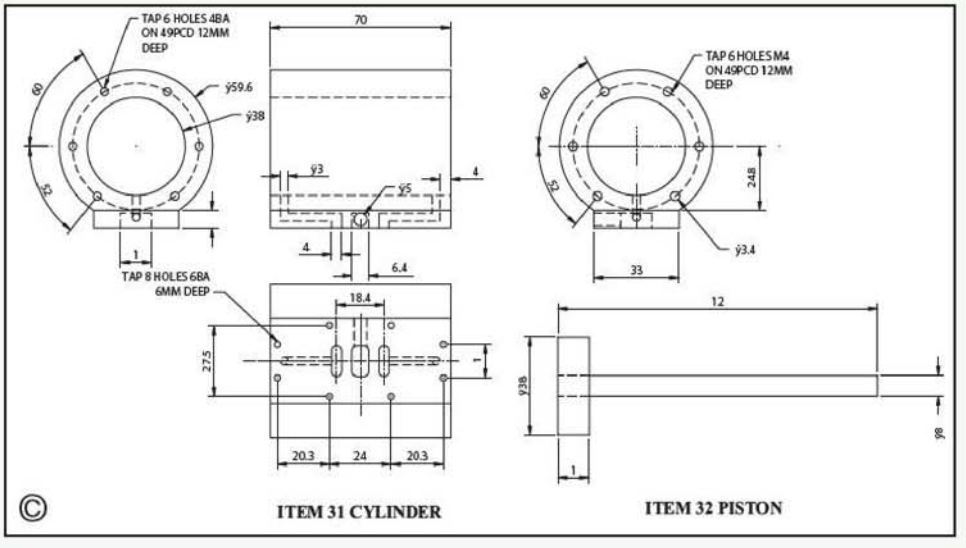
Top Cover (item 33), cylinder flange (item 34), bottom cover (item 35)
These were all made from brass. In machining make sure that they are a tight fit with their mating components.

Shaft support (item 36)
I added this later to reduce any wear in the O-ring and cylinder cover. The engine will work without it. The top was made out of brass, the shaft of 304 stainless steel and the base of aluminium alloy.

Mounting base (item 37)
For this part you need a strong, flat, steel plate at least 6mm thick. I prettied mine up by milling a step around its perimeter. The positions of the mounting holes are shown in the drawing.

Large gear (item 38)
This item was made from a sheet of 8mm brass. Using the milling machine and a small centre drill I marked the centre of the gear and the centres of the two 19mm dia. holes. I mounted the blank on the faceplate of the lathe so that the centre of one 19mm hole ran true. The 19mm hole was then bored. Repeat for the second 19mm hole. Next centre the gear and reduce the outer diameter to 78 millimetres. Finally bore out the 51.62mm hole. Using a piece of 19mm round check that it will just fit into what is left of the 19mm holes. On checking the size of the piece after it was removed from the face plate I found that it had sprung by about 0.02in into an oval shape. I corrected this by squashing it to true in the vice and then applying gentle heat.

Ring (item 39)
This was made from aluminium alloy round. The internal diameter being adjusted for a force fit of



the large gear. Fit the large gear and then drill the M3 and 5.9mm dia. holes,

Assembly

Gearbox

Refer to the sectional assembly drawing when reading the following instructions

Probably the best place to start with the assembly is to fit the ball races. The assembly drawing shows the position of each of these in the following items:

Item 1 gear housing (fit 1 bearing item 13)

Item 2 support (fit 1 bearing item 13)

Item 6 gear assembly holder (fit 2 bearings item 9)

Item 14 connector (fit 2 bearings item 9)

So that you don't damage the bearings only put pressure on the outer edge when installing them. I made up a recessed end tool for each of the two sizes.

The support (item 2) is attached to the gear housing (item 1) by using 2 off, M5 hexagon head screws 30mm in length. The bearing spacer (item 3) is fitted between the two bearings (item 13). Before tightening the screws ensure that the centres of the bearings are perfectly in alignment by fitting the shaft (item 16).

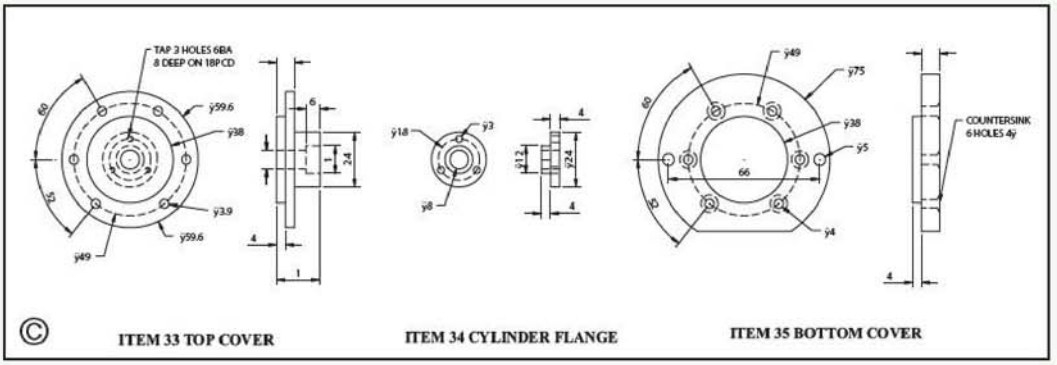
Next fit the eccentric strap (item 20) onto the eccentric body (item 4). Using 2 off, 6BA x 6mm countersunk screws attach the eccentric side (item 5). Fit a M3 x 3mm grub screw to the eccentric body. Slide the eccentric onto the flywheel shaft.

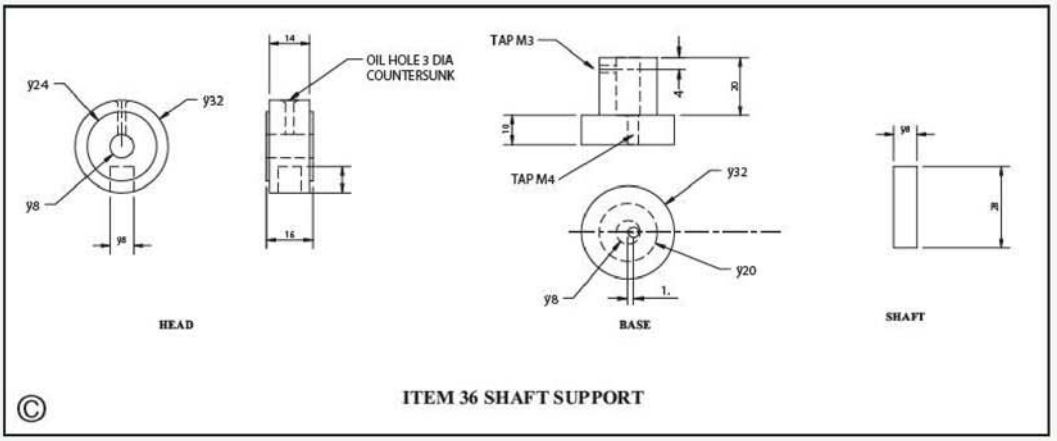
Add an M4 x 4mm grub screw to both the flywheel (item 15) and the gear assembly holder (item 6).

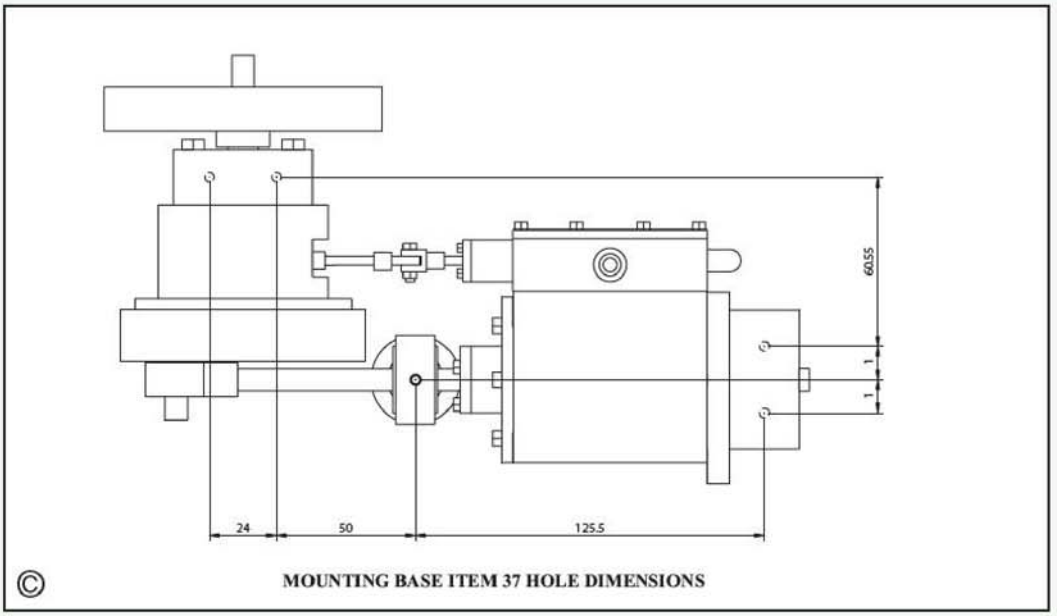
The shaft (item 8) is now inserted into the gear assembly holder (item 6) and is held in place with the gear (item 7). Fit an M3 x 3mm grub screw to the gear and tighten it so that the gear and shaft freely rotate in the bearings. This assembly is next attached to the flywheel shaft and, on the other side, attach the flywheel. Tighten both 4mm grub screws so that the flywheel and gear assembly holder rotate freely. Finally lock the eccentric onto the flywheel shaft.

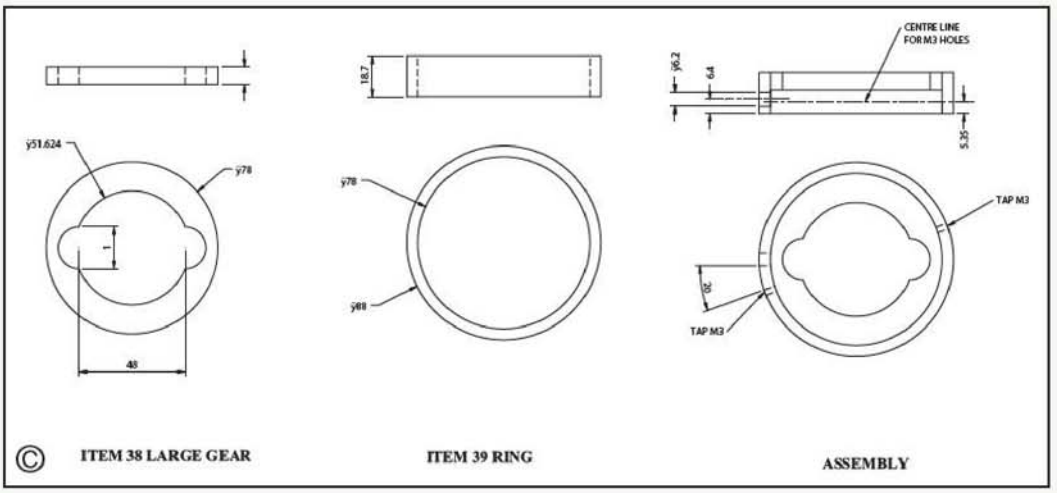
An M3 x 3mm grub screw is fitted into the outer edge of the gear housing to hold the internal tooth gear in place. Fit the internal tooth gear (item 12) and tighten the grub screw. If all is machined correctly the external tooth gear should rotate freely about the circumference of the internal toothed gear.

On the original Matthew Murray engine there was a single large tooth









(about ten times larger than the others) on the external tooth gear that mated with two female teeth, one at each end on the internal tooth gear. The position of these two teeth was set so that they aligned with the large tooth when the piston was at bottom and top dead centre respectively.

In my design the large tooth was integrated into the crank (item 10) and a separate large gear (item 38) was made.

Attach 2 off M3 x 3mm grub screws to the large gear and slide it over the perimeter of the gear housing so that the 5.9mm dia. hole is directly over the M3 grub screw in the gear housing. Lock it in place.

Fit two M3 x 3mm grub screws to the crank (item 10). Attach the crank to the shaft (item 8) so that the 18.97mm end meshes with the large gear. Tighten the grub screw. If all is well, when rotating the flywheel the crank should mesh nicely at both ends of the large gear.

Cylinder Piston Assembly

Using a smear of light oil, slide the piston (item 32) into the cylinder (item 31). Using 6 off, M4 x 15mm countersunk screws and a paper gasket 0.25mm thick attach the bottom cover (item 35). Next using 6 off, 4BA x 1/2in. hexagon head screws and a 0.25mm paper gasket attach the top cover (item 33). An 8mm O-ring is inserted into the top cover and it is held in place with the cylinder flange (item 34) by 3 off 6BA x 3/8in. hexagon head screws.

Fit a M3 x 3mm grub screw to connector (item 14) and attach it to the piston shaft.

If all is correct excellent compression will be obtained when the piston is moved and the valve inlet and outlets are blocked.

The cylinder assembly is bolted to the cylinder support (item 23) using 2 off, M5 x 30mm hexagon head screws.

Using Loctite 602 attach the connector (item 18) to the valve shaft (item 28). Slide the shaft through the valve flange (item 24) and a 1/8in O-ring and finally into the valve chest (item 25). Mount the valve flange onto the valve housing using 3 off, 8BA x 3/8in. hexagon head screws. Screw the connector (item 26) into the valve housing.

Fit an M3 x 3mm grub screw to the valve nut (item 30) and mount it onto the valve shaft. Make two 2.5mm thick paper gaskets to fit under and on top of the valve chest. Place the valve (item 29) under the valve nut and using 8 off, 6BA x 1in. hexagon screws attached the valve chest assembly and valve chest cover (item 27) to the cylinder.

Using Loctite 602 attach the connector (item 19) to the eccentric shaft (item 22).

Shaft Support

Using Loctite 602, attach the head to the shaft. Fit an M3 x 3mm grub screw to the base and slide the shaft with head into place.

The final step is to mount the assemblies onto the mounting plate. Firstly make sure that the height of the gearbox centre exactly matches that of the cylinder centre and their axes are 90deg. apart. Their positions can be slightly adjusted by loosening and re-tightening the screws in both the cylinder and gearbox supports.

Finally add the shaft support. The hole in its base is intentionally offset from the centre so its position in relation to the piston shaft can be varied. Similarly the height can be adjusted by moving the shaft up and down in the base.

Adjustments

Parallel motion

When the piston moves from top dead centre to bottom dead centre, the path traced out by the centre of the connector (item 14) is a straight line. Similarly when the flywheel rotates through one revolution the centre of the hole in the crank (item 10) also traces out a straight line. The object of the following exercise is to get the two straight lines to line up.

Slide the connector so that the piston is near bottom dead centre. Rotate the flywheel until the crank engages the large gear at the end closest to the cylinder. Slacken the M3 grub screws in both the crank and large gear. Hold the flywheel fixed and rotate the large gear until the conditions in the last paragraph are met at this point. Tighten the grub screws. Repeat the procedure this time with the piston near top dead centre and the crank engaged at the other end of the large gear. Keep going back and forth until you are satisfied that the conditions are met.

Line up the hole in the connector with the hole in the crank and insert the shaft (item 11). Lock it in place by tightening the grub screw. Now carefully rotate the flywheel. If you find that the gears bind on one side more than the other this can be corrected by rotating the internal tooth gear by a minute amount. If you can't reach either top or bottom dead centre then the piston needs to be centred.

Centring the piston

The clearance between the piston and the cylinder head covers should be the same at both ends. This distance should be about 1mm at each end and can be adjusted by loosening the grub screw in the connector (item 14) and manually moving the piston shaft.

Centring the valves

Screw the eccentric shaft (item 22) into the eccentric and connect it to the valve shaft using the coupling bolt (item 21).

Remove the valve cover and replace the screws so that the valve chest is held in place. Loosen the grub screw on the valve and, whilst rotating the flywheel, set the valve position on its shaft so that it opens the steam ports at top and bottom of the cylinder by as near as possible the same amount.

Timing

Rotate the flywheel so that the cylinder is at bottom dead centre. Using an Allen key loosen the grub screw (via the 5.9mm hole) in the gear assembly holder (item 6). Leave the Allen key in place so that the piston is locked at bottom dead centre. Turn the flywheel in the desired direction of rotation until the valve reaches the bottom of its stroke and begins to rise again. Watch it carefully and as soon as it starts to uncover the lower port, stop turning the flywheel and lock the grub screw. Now rotate the flywheel and see what the conditions are like at the top of the piston travel. The valve should have risen to its highest position and started to descend uncovering the top port by about the same as the bottom one when the piston had reached top dead centre. If it is not slacken the valve holder and slightly rotate the flywheel to split the difference between the top and bottom ports. Replace the valve cover and gasket and tighten down the screws.

Adjusting the flywheel position

Rotate the flywheel until the piston is at bottom dead centre. Loosen its grub screw and, while keeping the shaft stationary, set the balance weight furthest from the cylinder. Re-tighten the screw. The engine is now ready for operation.

MATTHEW MURRAY

In the series of articles on the hypocycloidal engine our contributor refers to the work of the engineer Matthew Murray (1765 - 1826). Murray was a contemporary of Boulton and Watt and is reported to have been an outstanding engineering craftsman and inventor. In partnership with David Wood and James Fenton, Murray established the Round Foundry in Leeds as one of the leading engineering enterprises of the day and is reputed to have built the world's first commercially successful steam locomotives in 1812. In fact, two locomotives were built each operating on the toothed rack rail principle developed by John Blenkinsop.

Murray is also believed to be one of the first of the early engineers to offer engineering machine tools for sale. Unfortunately, a disastrous fire in 1872 burnt the Round Foundry down and all of Murray's records and drawings were destroyed so it is difficult to assess the contribution made to engineering machine tools by this talented engineer.

Murray also introduced the D-slide valve to his successful steam engine designs and it is reputed that he designed a planing machine to finish the working surfaces of these - another possible 'first' for the inventor. Then, as now, competition in engineering circles was keen and Murray attempted to keep this new innovation secret from his competitors by housing the machine in a locked room away from the main factory area. Certainly, a planing machine was never offered to the trade by the Round Foundry.

If such a machine existed then Murray's strategy was effective as no records of the machine remain and its existence is only known about from the recollections of a former employee who was interviewed many years later.

Murray also improved the boring mill and may have been the first to introduce leadscrew feed to a heavy duty machine tool. The firm of Fenton, Murray and Wood went out of business in 1843 and the site passed into the hands of Smith, Beacock and Tannett.

I/C TOPICS

Nemett
continues construction of the NE15S with the valve gear and connecting rod

Before I continue with the construction details of the NE15S, it has been pointed out that the dimensions of the big end bearing shown in the purchased parts list (*M.E.* 4279, 4 August 2006) are not correct. The correct dimensions are 10 x 14 x 10mm and I apologise for any confusion caused. The bearing code number is correct, so if you quoted that you will get the correct bearing.

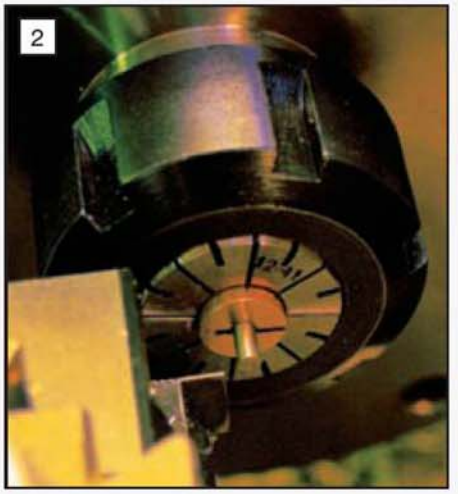
Setting valve length and cutting the e-clip grooves

We left the valves at the stage where they needed finishing to the correct length and then having the retaining clip grooves cut. Because there is no adjustment of the valve clearance, we have to set the length accurately during manufacture and readers will remember that the stems were left slightly long to allow for this.

Setting the length is easily accomplished by using a dial gauge set up on the cylinder head to allow it to register movement of the valve. I tapped a short length of suitable bar M4, bolted it through one of the cylinder head holes and used this to mount the dial gauge (**photo 1**) over the relevant valve head.

Using a dial gauge to measure the surplus valve stem length.

Assemble the cam box, tappets and valves (taking note of the identifying marks) to the head and bolt the cam box down, two bolts at opposite corners will be enough. Turn the camshaft so that the cam is at its lowest point.

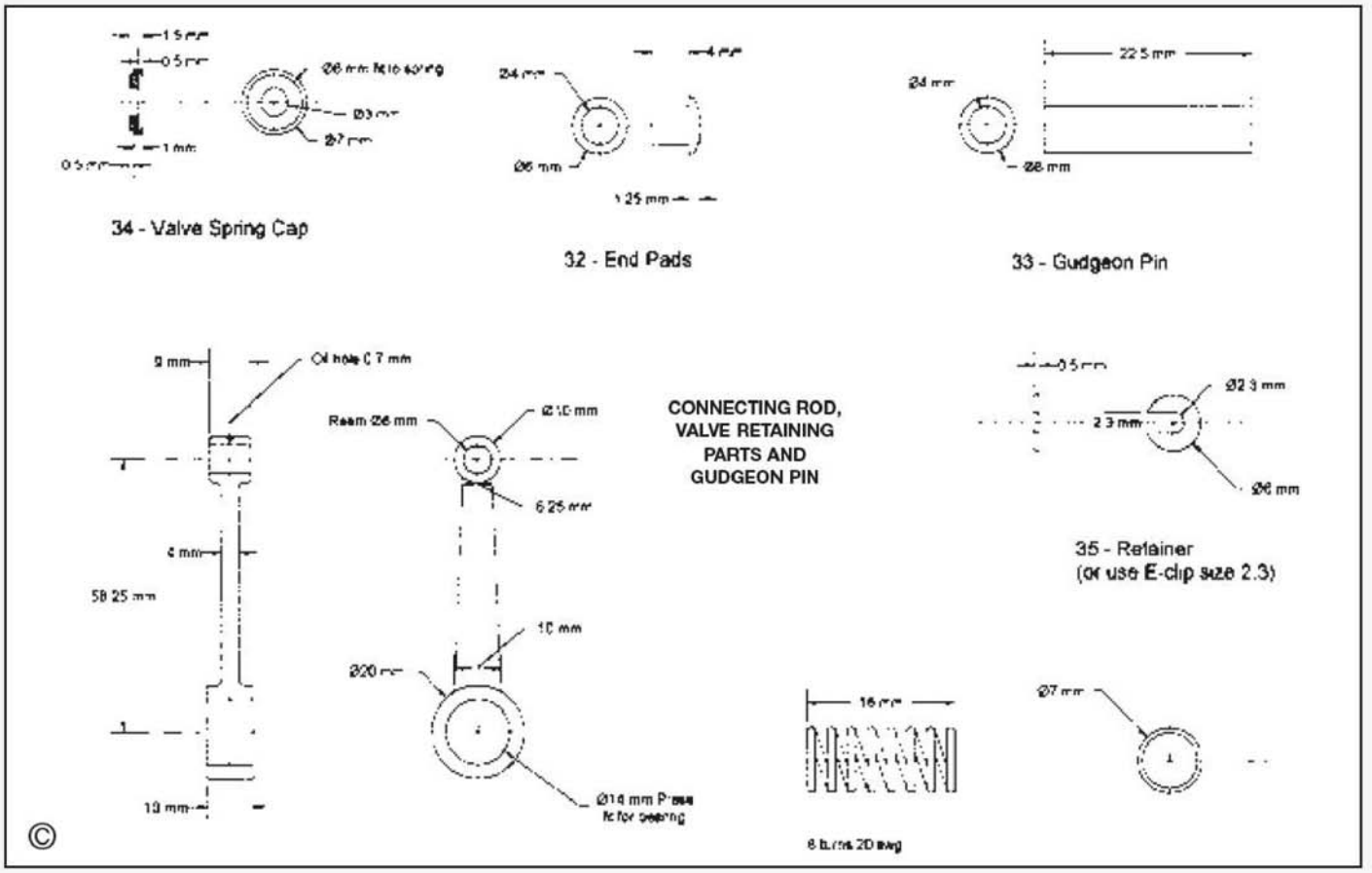


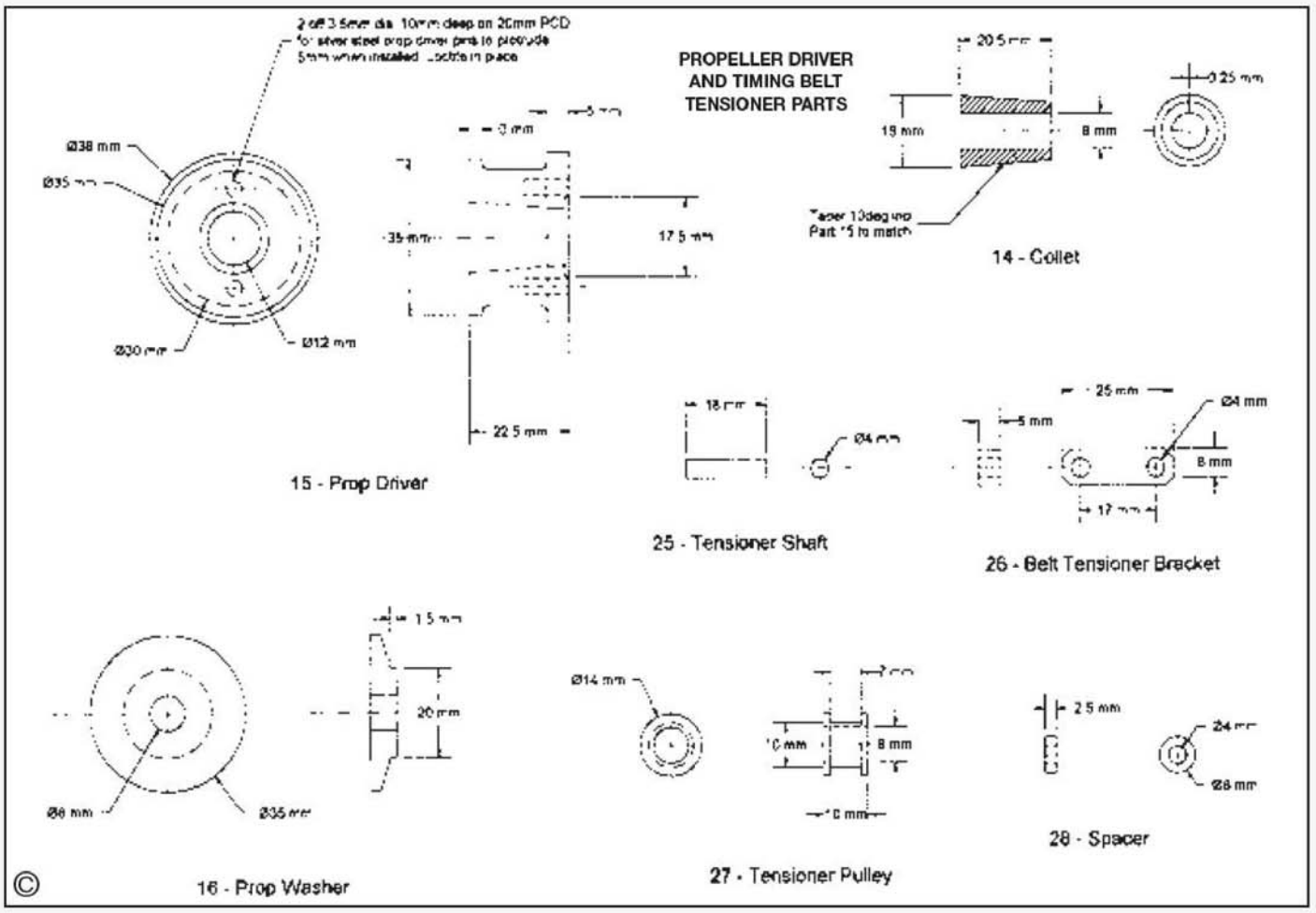
Cutting the valve stem groove.

Set the dial gauge to give a reading half way round the scale and then zero the dial. Carefully loosen the cam box bolts until the dial gauge stops moving and note the reading. This is the amount of excess length on the stem. Repeat the process for the other valve.

Now mount the valves in the lathe and remove the amount noted for each plus an extra 0.05mm for clearance. I made a split collet for this because the stems are not long enough to be able to hold the valve with sufficient length protruding using a normal ER32 collet. Check the lengths after this using the dial gauge again as before. This time the valves should not move when the cam box is fitted.

The e-clip grooves were cut 2mm from the end of the stem using a specially ground tool with the ▶



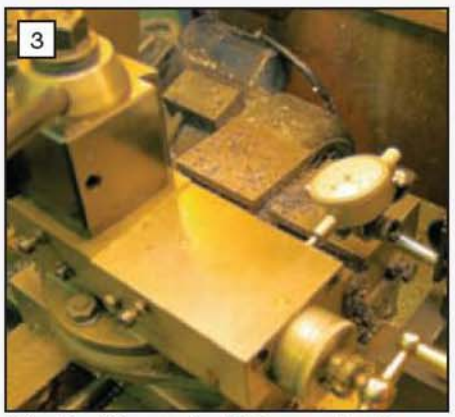


stem held using the same collet (**photo 2**) and a dial gauge set at the back of the top slide (**photo 3**) to enable an accurate depth to be cut. The clips do not need to be very tight because they are retained by the valve spring caps but we do not want to weaken the stems by cutting too deeply.

34 Valve spring cap

This item is the same whether the machined clip or an e-clip is used to secure the spring. Turn a suitable piece of HE15 alloy or mild steel down to 7mm diameter and drill and ream 3mm for the stem. I then used a 6mm diameter end mill to counter bore the top face (**photo 4**) for 0.5mm to form the recess for the retaining clip. Use a parting off tool to turn the correct diameter to fit inside the spring. In my case this was 5mm. Now part off to length.

35 Valve spring retainer



Using the dial gauge to obtain accurate valve stem groove depth.

I have shown a valve spring retainer on the drawing which should be made from mild steel by drilling and turning before cutting the slot to be a close fit in the groove using a small hacksaw (or slitting saw) and needle files. I have also provided details of suitable e-clips on the purchased parts list and would suggest using these. They can be obtained in small quantities from Modelfixings at **www.modelfixings.com** or tel: 0115-8548791.

31 Valve springs

I already had some suitable springs for the valves but they can be wound from suitable piano wire if desired but make sure the ends are squared off on the grindstone. Because the engine has overhead cams, the springs do not need to be heavy. Flexo Springs of Hill Street, Kingswood, Bristol BS15 4HB, tel: 0117-967-3313, show some at 7mm O/D x 15mm long on their web site which should be suitable. The Flexo code numbers are M145103 and M145203, either should be okay and the site quotes prices for small quantities although they do have a minimum order value.

Sleeving the large timing pulley

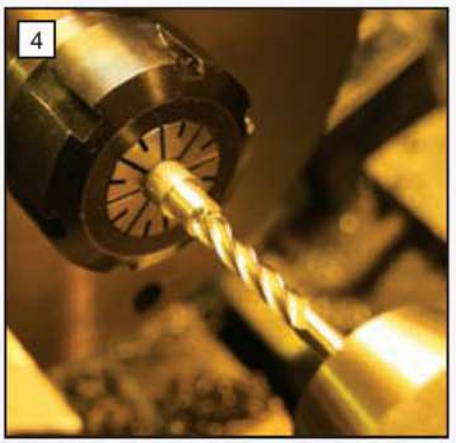
At this stage I decided to sleeve the large timing pulley to take the 4mm camshaft so that I could set the timing belt up for a trial. I turned a piece of HE30 aluminium alloy bar to be a slide fit in the pulley and after cleaning and degreasing everything I used Loctite to hold the sleeve place. I then mounted the assembly by the boss in a suitable collet and drilled and reamed the shaft hole.

One tip for holding short items in ER collets is to turn a short piece of scrap bar to the same size as the item being held (in this case the pulley boss) and to place this in the back end of the collet. The collet then tightens down on both pieces, thus keeping the collet bore parallel and providing a secure accurate grip.

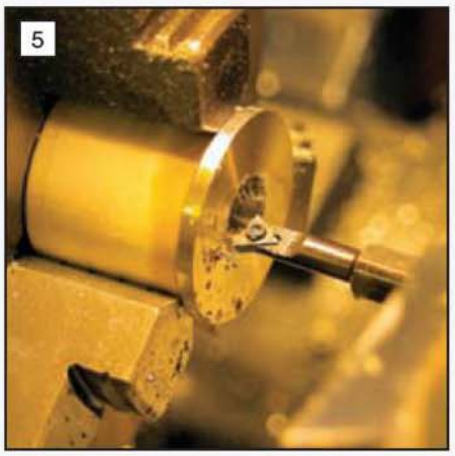
I drilled and tapped the grub screw hole through the sleeve. I mentioned boring the small camshaft pulley to fit the camshaft in *M.E.* 4279, 4 August 2006 but if you have not done this yet, now is the time.

Trial assembly of the cylinder head

You can now assemble the head and camshaft and check that all operates correctly. The best way I have found to assemble the valves and springs is to put the head with valves installed cylinder side down on a flat surface. The valve springs and caps can then be slid into place. I then used a thin Allen key to press the cap down whilst manoeuvring the e-clip into the groove

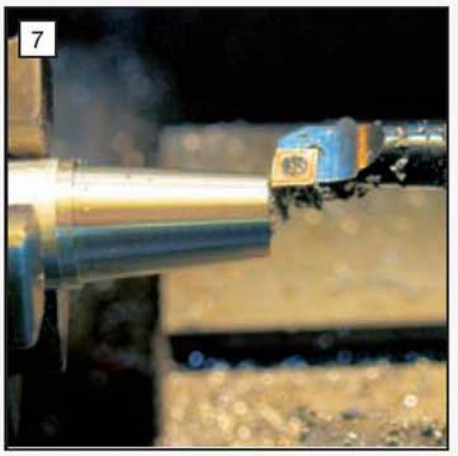


Recessing the valve spring cap using and end mill.



Boring the taper in the propeller driver.

Cutting the propeller driver face grooves.



Turning the taper collet with the lathe in reverse.

with a pair of pointed tweezers. Once in place the spring cap will prevent the e-clip moving out of line. Be warned, there is a knack and the e-clips fly a long way if not properly secure!

Check that the valves move freely in the guides. Assemble the camshaft into the cam box and bolt the assembly to the head. If you fit the camshaft pulley, do not tighten it yet, we will tighten it fully when we set the valves. You should now be able to turn the camshaft and watch the valves open and close.

15 Propeller driver

This is a basic turning job but needs to be carried out in the right sequence. First turn the outside of a suitable piece of HE30 aluminium alloy bar to 38mm diameter. Then turn the front 20mm down to 35mm (the same as the crankcase nose front) diameter. Reduce the centre section of this portion if required but if you do, leave a shoulder at the propeller end to allow for reversing in the chuck later.

Drill the centre hole 9mm dia., allowing extra depth so that the boring tool has room to cut the full length of taper required. Set the top slide over 5deg. and bore the taper (**photo 5**) taking small cuts, it is easy to overdo things when cutting shallow tapers. Note that the photograph shows the original propeller driver design, so yours will look slightly different.

Check the depth of the tapered portion of the bore to ensure that the taper is a full 22.5mm long. Leave the top slide offset for turning the corresponding taper on the split collet later.

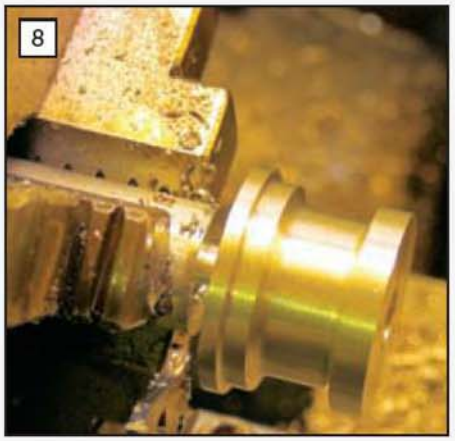
Transfer the driver to the rotary table in the mill with the propeller face uppermost and cut the grooves in the front face with a pointed mill. I used a stiff 45deg. spade centre (**photo 6**) and milled the grooves offset from the centre so that the grooves almost touched each other on the outer edge.

I also drilled the 3.5mm driving pin holes at the same setting. Now return the driver to the lathe, with the propeller face outwards and relieve the centre to a depth of 0.5mm and a diameter of 17.5mm. The driving pins are from silver steel and are fitted with Loctite to protrude 5mm.

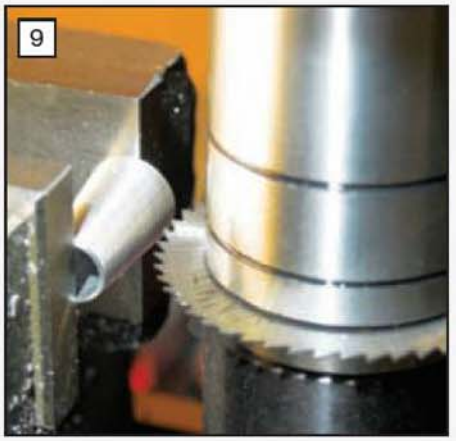
You may wish to make a propeller drilling jig at the same settings as the driver pins or do what I did and drill two 3.5mm holes in the propeller washer so that this could be used as a drilling jig.

14 Split taper collet

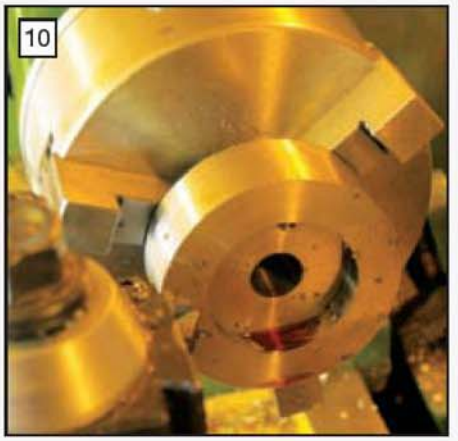
Turn a piece of HE30 aluminium alloy bar to slightly larger than the largest diameter of the tapered hole in the prop driver. With the lathe running in reverse, use the same boring tool used for the driver (**photo 7**) to turn the taper. ▶



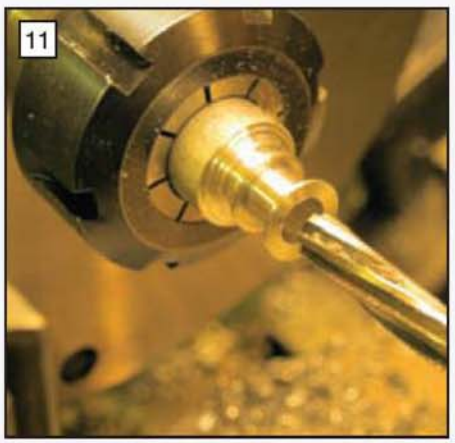
Setting length of the collet with the propeller driver.



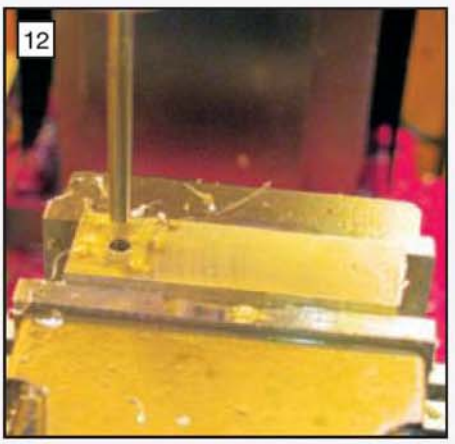
Slitting the taper collet in the mill.



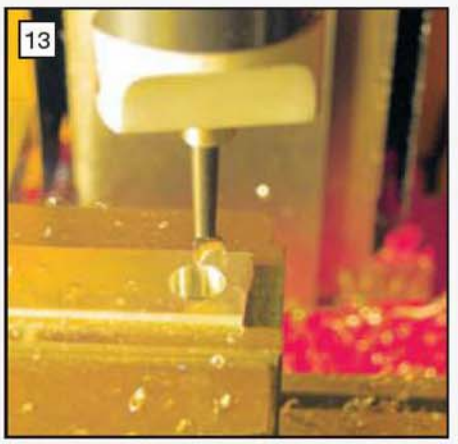
Turning the flywheel outside faces.



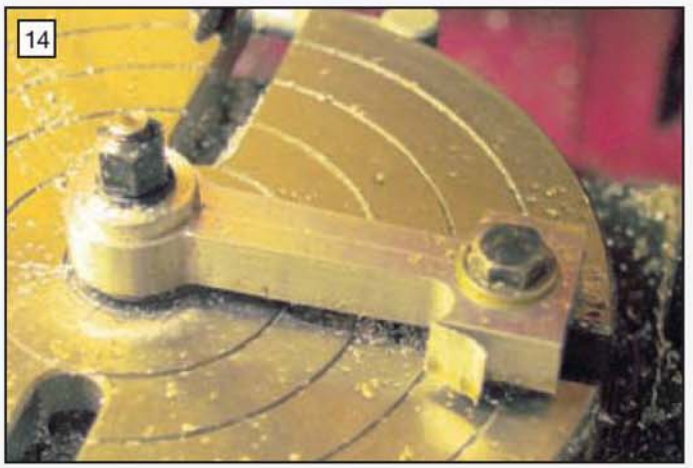
Reaming the belt tensioner pulley for the bearing.



Reaming small end bearing on the connecting rod.



Boring the big end bearing to fit the needle roller.



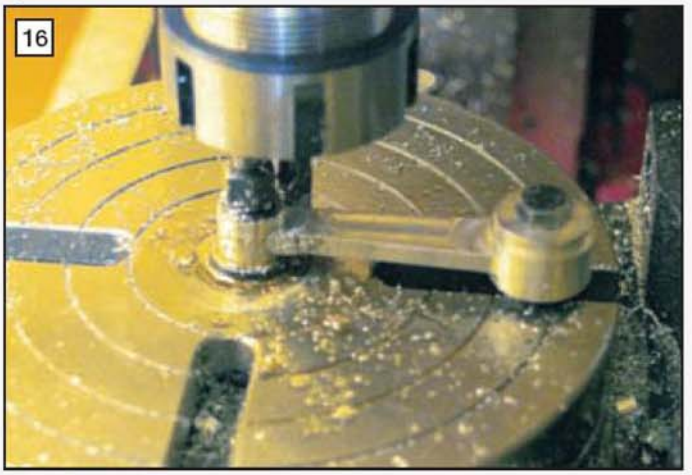
Milling the outside edges of the connecting rod.

The front and rear faces of the connecting rod milled to size.

With a quick-change tool post this avoids having to change the top slide angle and if the same tool is used ensures an accurate taper.

Turn the taper until the driver slides on with the front of the collet about 2mm back from the front face of the driver. Take very small cuts at this stage because it is easy to overdo things. Drill and ream 8mm for the shaft which must be a close fit in the bore with no slack.

Use the driver on the collet to set the parting off tool 2mm from the rear face (**photo 8**) of the driver. This clearance is important to avoid the driver touching the crank case nose when things are assembled. The collet is now parted off to this length. The slit is best cut using a thin slitting saw (**photo 9**) in the mill.



Finishing the small end of the connecting rod.

16 Propeller washer

This is a simple turning operation and the shape is not critical. The outside dimension is the same as the prop driver front so start by turning a piece of HE30 aluminium alloy bar to this diameter. Shape the front face as per the drawing and drill and ream 8mm before parting off to the correct thickness. Reverse in chuck and clean up the rear face.

The crankshaft can now be assembled and the length of the long spacer checked. With the collet pulled right up to the front bearing there should be approximately 0.2mm longitudinal play to allow for expansion. Adjust the front spacer length if needed to bring the crankshaft and camshaft pulleys into line and then adjust the rear spacer to give the correct amount of play.

Check that the rear face of the prop driver is a fraction clear of the front of the crank case nose when everything is clamped up tightly. Adjust if needed.

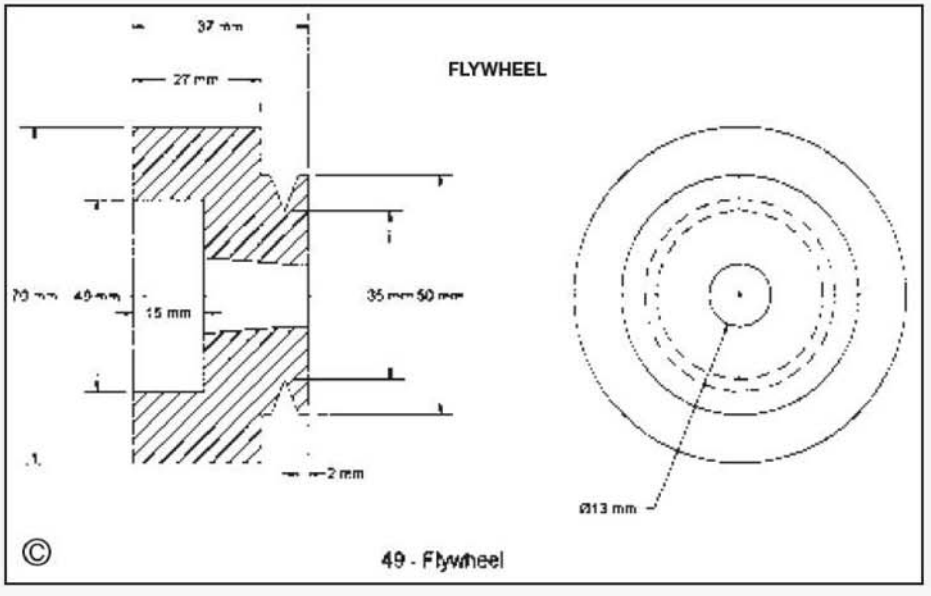
49 Flywheel

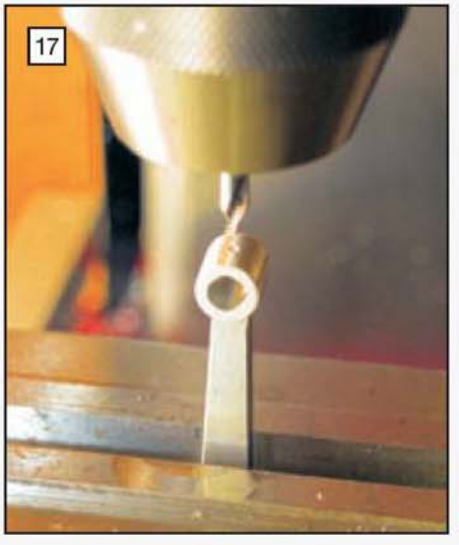
It is sensible to cover the machining of this item at this point. If you are making the engine to run in both marine and aero versions, then the taper can be turned at the same setting as the propeller driver which will mean that only one collet will be needed. The order in which the flywheel is machined is important if it is to remain balanced and run truly on the shaft.Start with a suitable piece of mild steel or brass bar just over 70mm in diameter and about 40mm long. Mount in the 3-jaw chuck and turn down the starting pulley section to 50mm dia. for a depth of 10 millimetres. Now reverse the flywheel in the chuck, holding by the pulley section. Turn and face the outside to size (**photo 10**) and bore the 40mm recess. Drill and bore the taper in the same way as described for the propeller driver and check the fit of the collet.

Using the above sequence, all the major faces and taper are turned at one setting and will therefore be true. Reverse the flywheel in the chuck and check that the outside runs truly before finally facing off the front of the pulley section and turning the starting cord groove to suit the size of cord to be used.

25 Tensioner shaft

This is a piece of 4mm diameter silver steel faced off to length.





Drilling the small end oil hole.

Finished valve spring caps.

Valve, spring, cap and e-clip assembled.

Finished timing pulleys.

26 Tensioner bracket

This is milled or sawn and filed from some 8mm thick mild steel. One hole is drilled 4mm for the clamping bolt. The other should be drilled for a press fit on the shaft. I drilled mine 3.9mm which worked okay. The shaft is pressed into the hole in the vice.

27 Tensioner pulley

This is machined from HE15 aluminium alloy with the bore reamed (**photo 11**) for the needle roller bearing. The belt groove is cut using a parting tool. Ensure that the inside edges of the groove are chamfered to avoid belt wear and that there are no sharp edges on the pulley to cause damage to the timing belt. Press the bearing into the pulley with its round edge going in first.

28 Tensioner spacer

This is turned from a piece of brass or bronze bar and is really optional since the pulley position is dictated by the belt. Ensure no side pressure is put on the belt if a spacer is used. I have not shown any means of retaining the pulley on the shaft because again it will be held by the belt.

If you have not drilled and tapped the M4 bolt hole for the tensioner bracket in the crankcase, this can be spotted through now whilst the timing belt is in place. Earlier photographs of the complete engine show the position to aim for. The slack in the belt should be taken up with the bracket at about 45deg. to the vertical.

10 Connecting rod

I have shown a needle roller big end but, as I mentioned when covering the crankshaft, if you wish to use a plain bearing, then just ream the big end 10mm and use a plain silver steel crank pin of the same diameter.

The connecting rod is milled from a length of suitable section HE15 aluminium alloy bar. Start by milling the two wide sides flat and to the correct 10mm thickness. Ensure that the bar is set truly horizontally in the mill so that the big and small end holes will be perpendicular to the surface and parallel with each other.

Set the quill to the centre of the bar and use a centre drill to spot the small end hole. Zero the X axis reading at this point. Drill and ream (**photo 12**) the small end. Index the quill along 58.25mm and centre drill the big end hole.

The big end bearing needs to be a tight press fit into the connecting rod so I suggest boring the hole (**photo 13**) with a boring head. If you have a 14mm reamer then this could be used but test it first on a piece of aluminium bar to check the final size against the bearing. It pays to turn a short piece of bar to the same diameter as the big end outside and try the bearing fit in this because the connecting rod big end will stretch slightly when the bearing is pressed in thus affecting the fit.

If you are boring the hole then drill out to about 12mm and then use the boring head to machine to final size. If you have not got a small hole measuring tool then turn up a go no-go gauge to use for measuring. It is better that this hole is on the tight side. If you cannot bore the bar in the mill, then use the 4-jaw chuck in the lathe but ensure the bar is parallel to the chuck face and at right angles to the lathe axis. I used the rotary table on the mill to shape the outside shape of the rod.

Crankshaft assembly minus the front bearing.

Belt tensioner pulley with bearing fitted.

Completed connecting rod and gudgeon pin.

First mark two lines on one face to show the outside edges of the centre part of the rod (the taper). Set the rod on the rotary table clamped with the big end centred and the little end clamped firmly. When machining connecting rods I always use clamping washers which are the same diameter as the final diameter of the big and little ends. This gives a guide when milling the shape.

Set the rod so that one of the guide lines is parallel to the X-axis and then mill the edge to the line with an 8mm end mill. This will leave a radius in the corners of the big and little ends. Repeat for the other side of the rod. Now using the rotary table mill the big end to the correct diameter (**photo 14**) with the same cutter. With the cutter still set to that diameter, set the cutter 3mm down from the top face and mill the big end diameter across the bottom of the rod.

Now with the mill still set at that setting mill along the top face of the rod up close to the little end. Turn the rod over and repeat for the other face. This should leave the rod thickness at 4 millimetres. You should now have a rod which is basically shaped (**photo 15**) apart from the little end.

Now set the rod up on the table with the little end centred and the big end clamped and mill the little end (**photo 16**) to the correct diameter. With the cutter set to the correct depth mill the part of the diameter over the rod in the same way as for the big end. Turn the rod over and repeat for the other side. The rod is now completely shaped and only needs cleaning up. Using fine needle files clean the shape up and slightly round all the edges. Aim to blend all edges smoothly and give a final polish with very fine emery cloth.

Drill the oil hole in the little end (**photo 17**) and finally press in the big end bearing. Check the fit of the bearing on the big end. It should rotate smoothly with no stiffness. If it is tight then press out the bearing and set up the con rod in the mill and either lap the hole or enlarge with the boring tool until the press fit is correct.

I have to admit to being in favour of a smear of Loctite when finally fitting the bearing but I am careful to keep it out of the bearing!

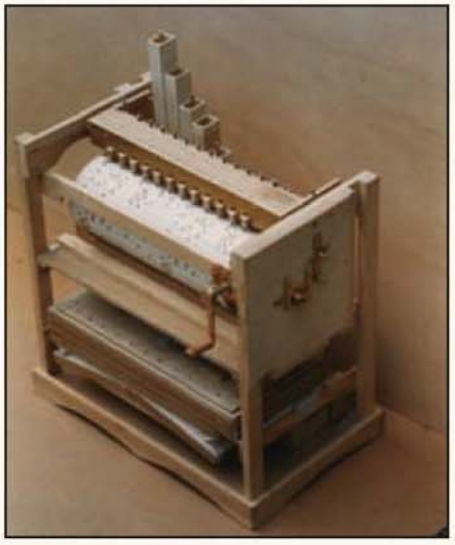
33 Gudgeon pin

This is simply turned to length from a piece of silver steel and then drilled 4mm for lightening. I do not harden silver steel gudgeon pins.

34 End pads

These are turned from brass bar to be a tight fit in the gudgeon pin bore. The ends are rounded and when assembled should be just clear of the bore.

●*To be continued.*



Right-hand three-quarter view of the author's delightful barrel organ.

A SMALL BARREL ORGAN

David Wilcox

continues his description starting with the tracker bar.

●*Part II continued from page 265 (M.E. 4281, 1 September 2006)*

The tracker bar holds 12 keys and is shown in **fig 4**. The hardwood keys, see **fig 5**, pivot about a 1/8in. dia. steel rod let into a longitudinal slot cut in the underside of the bar frame. Transverse slots in the frame, each the width of a key cut at 20mm intervals together with a brass comb or guide at the front, ensure that each key tracks to an accuracy of better than 1/2 millimetre. The tip of each key is made from a 10mm length of 2mm dia. silver steel hardened and ground to a chisel point driven into a pilot hole in each key at an angle such that it intercepts a barrel pin at an angle of about 25 degrees. The width of each tip should be 2 millimetres. A brass strip is screwed to the tapered rear end of each key and a small hole is drilled in the end of the strip for the sticker. Each brass strip is adjustable by means of a 6BA screw in the top of the key and this enables any end play to be taken up in the sticker/ valve action.

There is another set of adjusting screws, one for each key, but this time 4BA, on the top of the bar frame in order to set the 'at rest' position of each key which is 1mm above the barrel surface.

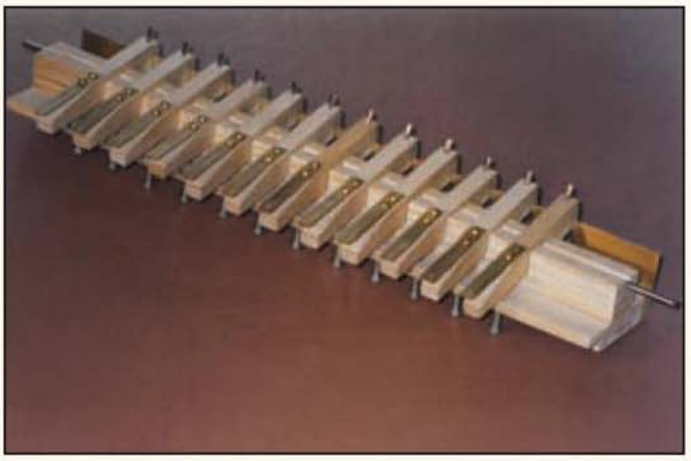
Arms are attached to each end of the tracker frame so that it may pivot as a whole in the organ frame to enable the key tips to clear the barrel pins when changing tunes or barrels. A key and its adjustment are shown in more detail in **fig 6**. The ratio of the distance tip to pivot and pivot to sticker should be about 2:3, so that if the key is lifted 2mm by the barrel pins, then the key tail should depress the sticker by 3mm in order to open the valves sufficiently. Hence barrel pins and stickers should protrude 3mm from the barrel. Clearly, with moving wood/ metal parts interfacing to an accuracy of better than 1 mm, this calls for a model engineering rather than a woodworking approach and, wherever necessary, hardwood such as ramin strip is used.

Bellows

The bellows is double acting and works on the see-saw principle. This design has the advantage that, whilst double acting, only one crank and reciprocator is required. It is also quite compact. Traditionally, fine quality sheep skin leather was used for bellows however a much cheaper alternative, but not as long lasting, is to use heavyweight rubberised black-out material obtainable from most textile material shops.

The frames are constructed as shown in **fig 7** using softwood battens and 1/8in. plywood, all mating surfaces glued generously with PVA, not pinned. Note that the fixed centre board forms the top of the twin bellows and the bottom of the reservoir.

Altogether five flap valves are required, an inlet valve in each bellows bottom board, two transfer valves in the centre-board and a relief valve in the reservoir top board. First the wind-way holes are carefully drilled and then the hinged flap valves are made up, each a small rectangle of 4mm MDF glued to a larger piece of soft suede leather extended to one side to act as a hinge. A sliver of leather is loosely looped over each valve and glued the board to prevent the flap valve getting stuck open should the bellows be turned upside down. Next the material is cut to the profile shown in the drawing. To ensure that the material folds correctly when in the bellows or reservoir, pieces of cardboard of the thickness of a cornflake packet, as shown in the drawing, are glued to the inner surface of the material. The see-saw hinge, made from a piece of chamois leather, is inserted, pinned and glued between the battens of the respective boards at the hinge



The tracker bar. This is an underside view showing details of the key tips and adjusters.

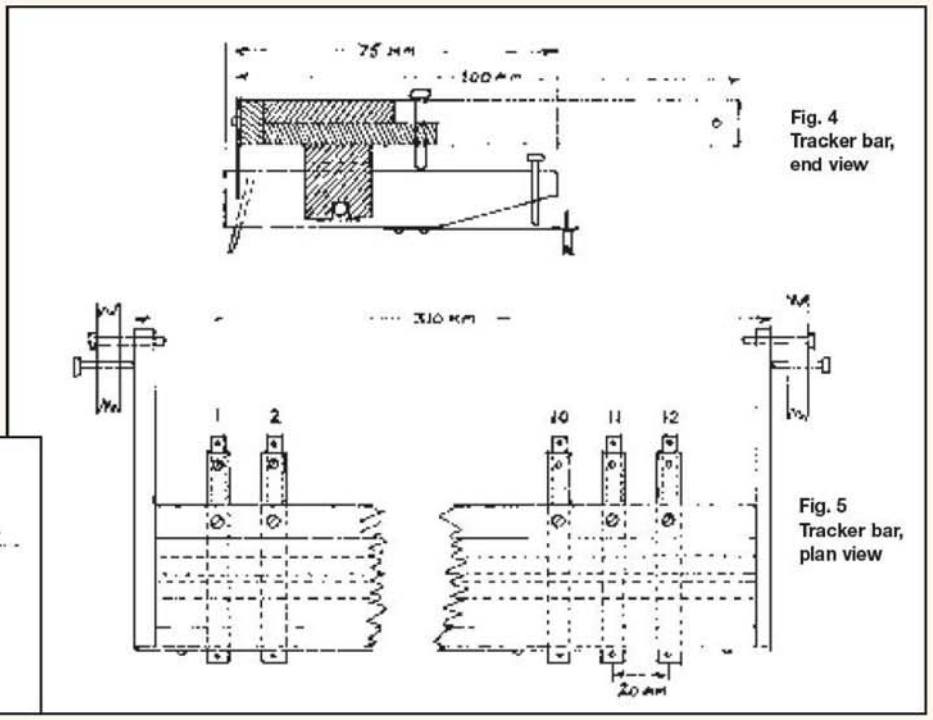


Fig. 4 Tracker bar, end view

Fig. 5 Tracker bar, plan view

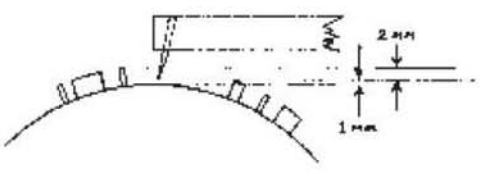


Fig. 6 Key depth adjustment

The bellows and reservoir frame before fitting with material. Black out material was used to cover the frame rather than traditional leather.

Bellows material shown with its cardboard reinforcement prior to being fitted to the wooden frame.

point. Before the material folds are put in place, strips of material are first glued along the inside angles of the see-saw hinge and the reservoir hinge and along the outside of the reservoir hinge. The material with cardboard stiffeners is then folded to the approximate shape and tried in position. When satisfied with the fit, the fringes are glued to the sides of the battens using a liberal quantity of glue but ensuring that no glue touches the cardboard. Finally, to safeguard against any leakage, narrow strips of 2mm MDF are screwed to the battens over the glued material. The air outlet from the air reservoir is a 20mm square hole near the right hand front corner of the centre-board. The relief valve on the top of the reservoir is similar to the other flap valves but it has a short, wood lever glued to the top. When the reservoir is full, the tip of the lever touches the underside of the barrel shelf, causing the valve to open and the reservoir top board to drop. This valve is normally held closed by a spring. The reservoir delivery pressure is determined by a strong spring, which is fixed between the top board and the bottom of the barrel shelf. The strength of this spring is fairly critical in order to optimise the pressure and since my bellows/ reservoir design proved to be a bit too small, I was unable to get more than about 3in. water gauge out of it. The alternative to a spring, and often used on old organs, is a lead weight. The bellows/ reservoir may now be tested by taping over the outlet, operating the see-saw and restraining the blow off valve. As the bellows are rocked, the reservoir should fill and retain its pressure for 10 to 20 seconds..

Gauge for the bellows test. Scale is marked at 1/2in. intervals for each inch of water pressure.

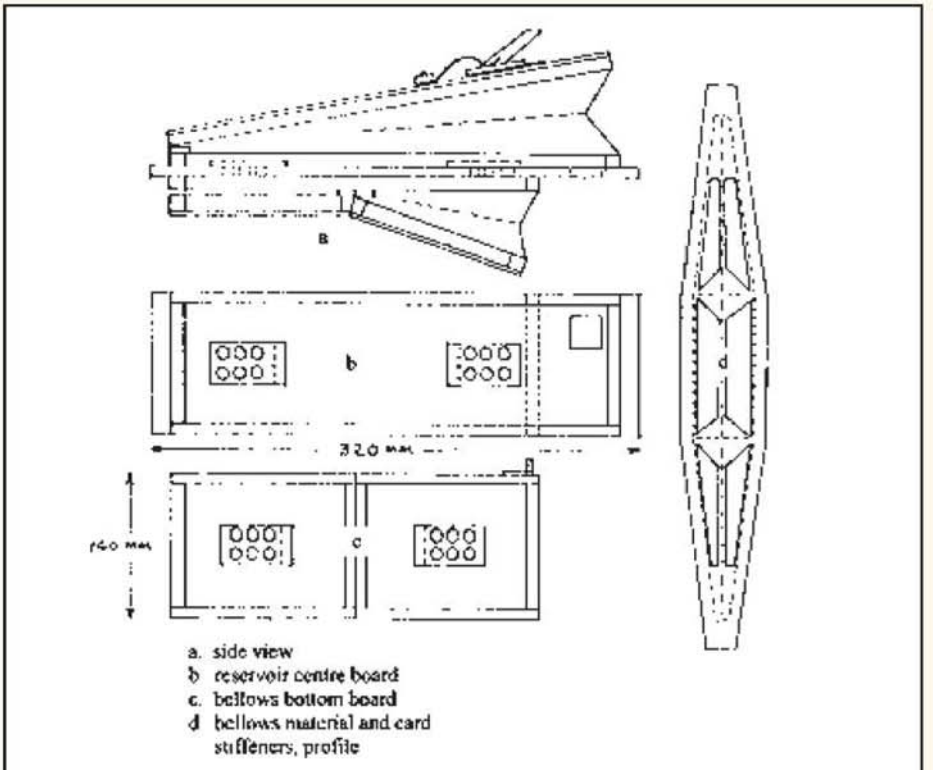


Fig. 7 Bellows and reservoir

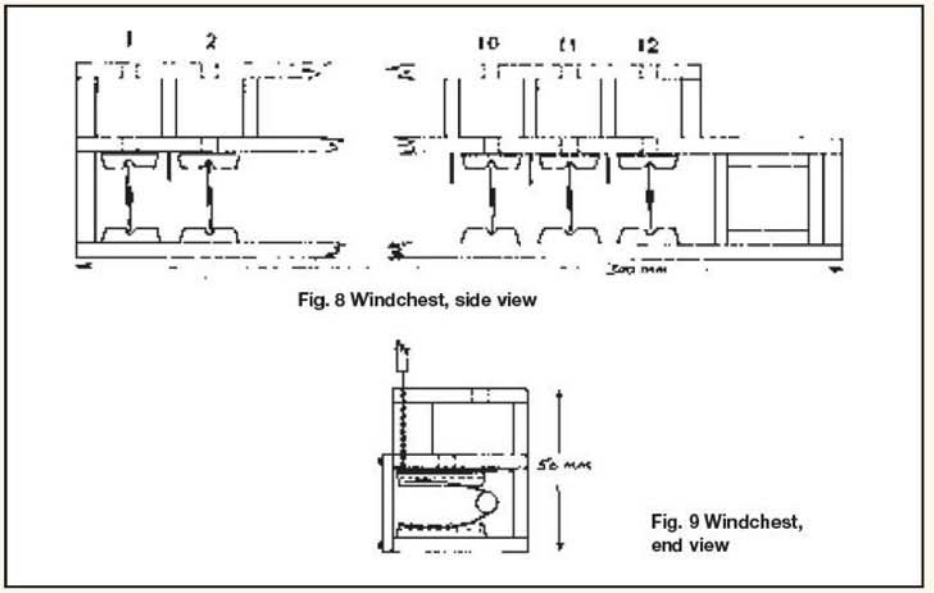
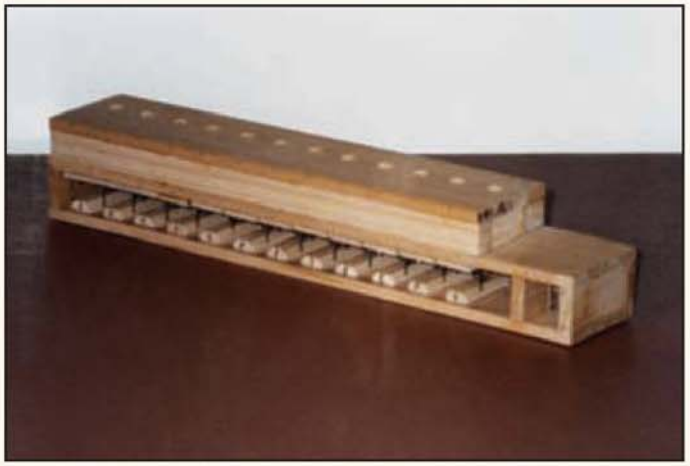


Fig. 8 Windchest, side view

Fig. 9 Windchest, end view



View of the wind-chest showing the pallet valves. Each valve is capped with suede leather , which also forms the valve hinge.

Selection of wooden pipes. the choice of material is not critical and hardwood, softwood or MDF can be used.

Wind-chest and soundboard

The wind-chest, shown in fig 8 and 9 enables wind from the reservoir to be sent to the selected pipe or pipes. The elongated chamber is fitted with twelve spring loaded pallet valves each of which can be opened by depressing the selected sticker. Twelve holes are drilled, one for each valve, close to the front edge of the wind-chest, aligned with the centre of each valve. Each hole is lined with a brass tube having an internal diameter which provides a close friction-free sliding fit to the 1/16in. brass rod on the bottom end of each sticker. Each sticker consists of a length of thin dowel, 3 to 4mm in diameter. Each end was carefully drilled in the lathe to accept, as a tight fit, short lengths of 1/16in. diameter brass rod protruding about 10mm at the top end and about 40mm at the bottom end. The pallet valves, set at 20mm intervals are each 18mm wide and about 40mm long.

Each valve is faced with suede leather, the tail of the leather forming the hinge which is glued to the back of the chest. A groove is milled in the top surface of each pallet and likewise in a piece of wood the same size as the pallet which is glued to the base of the wind-chest opposite each pallet. A spring in the shape of a hairpin is set between the grooves and the tension adjusted so that the pallet valve is closed and the weight of the sticker is just supported in the rest position. A moulding pin between each pallet valve ensures that each valve closes accurately over the hole leading to the soundboard.

The soundboard is divided into cells, one for each note, and a pipe is fixed into a hole on the upper side of each cell. On larger organs, each cell may lead via sliders to two or more pipes having the same note but different tonality, each set of pipes forming a register. A square section duct constructed from 3mm thick hardwood with a right angle mitre in the middle, feeds air from the reservoir to the wind-chest. Each end of this duct is very slightly tapered and faced with chamois leather so that as push-fit joints, they are as airtight as possible.

Pipes

This organ is limited to twelve pipes and to a single diatonic scale. For simplicity and being unmusical, I decided to keep to the key of C, i.e. the white notes only on a piano keyboard, although it appears that most early 19th century makers chose the key of G Major. It seemed important to choose a key in which simple tunes could be found in piano primers. The problem of tuning the pipes is completely overcome by purchasing an electronic tuner, cost about £20, which indicates directly the note being sounded and the degree to which it is sharp or flat of the desired note. Nothing could be simpler for the musically illiterate.

As an alternative metal pipes can be used. These were made from copper tube.

There are several different options for the pipes, none of them difficult to make and it is a matter of personal choice. Pipes may either open or stopped. Open pipes support both even and odd harmonics and generally sound brighter than stopped pipes, which support only odd harmonics. For the same note, stopped pipes are half the length of open pipes and so lend themselves to a compact design. Remember that the length of pipes (be they open or stopped), as the frequency decreases, double in length for each octave. One further matter is that of scaling. In order to maintain the same tonal characteristics across a set of pipes, the cross section of each pipe should increase with pipe length in accordance with a certain if often rather arbitrary law. Herbert Jutterman's book suggests how this should be done. However I believe from illustrations that I have studied that makers of cheap and cheerful organs did not always follow scaling laws when dimensioning pipes. In my limited experience, and for a short scale, it appears to make little discernable difference but no doubt pundits will label me a heretic! Therefore for constructional simplicity so that the pipe interval for the pipe rack matches the key interval on the tracker bar, all my pipes have the same cross section, that is 20mm wide by 25mm deep.

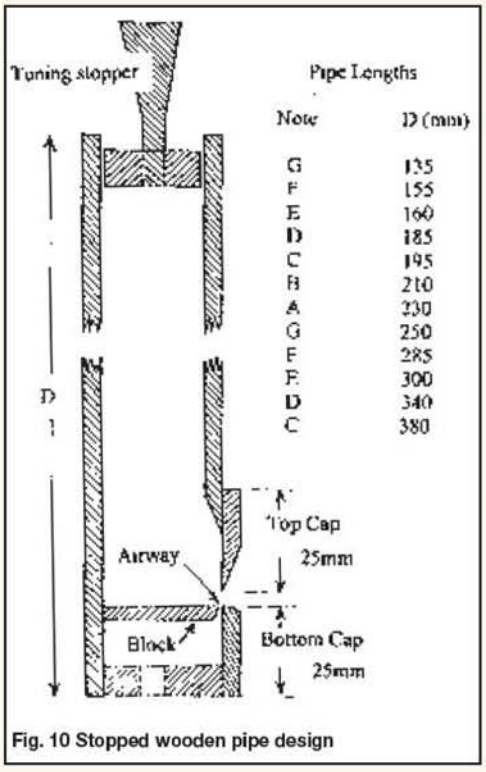


Fig. 10 Stopped wooden pipe design

Wood or MDF pipes

These follow the design used by John Smith in his Busker Organ. They are shown in fig 10 and may be constructed either from, say, 3mm softwood, hardwood or MDF. In each case, the front caps are made from a hardwood such as ramin or mahogany.

The slit or airway between the bottom cap and the block is set by the thickness of a piece of cardboard. This should be about 1/2mm thick and cereal packet cardboard seems to serve well. The top cap, the position of which is critical to voicing, should initially be secured in place with a rubber band, a preliminary voicing being carried out by blowing gently into the bottom of the pipe. If the pipes are to be stopped, then close fitting sliding stoppers lined with chamois leather should be made up to tune each pipe. If the pipes are open, then an open slider of some kind is incorporated in the top of the pipe. Final voicing and gluing the top cap in place is carried out in situ in the organ using wind from the bellows. Note that the length dimensions given for the set of stopped pipes which I used are plus 5% so that at the initial voicing, the pipes may have to be shortened so that the tuning stopper can be positioned just inside the top of each pipe.

BRISTOL BONANZA

Malcolm Stride
makes an annual pilgrimage to the popular west country exhibition staged by Bristol SMEE

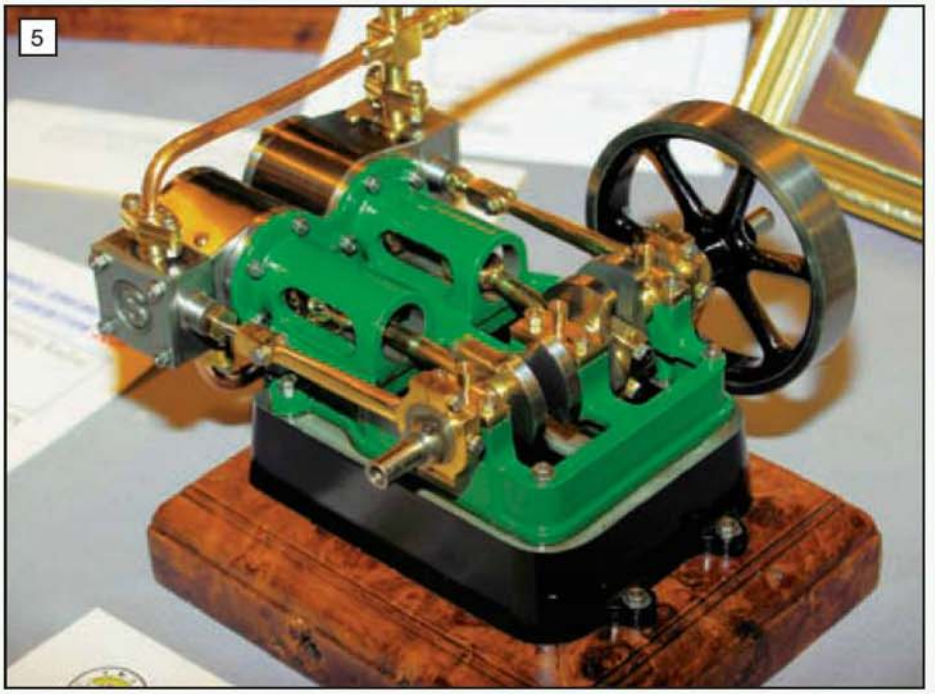
The exhibition at Bristol in August has become one of the 'must visit' exhibitions since its inception a few years ago and so it was that I found myself heading down the motorway to 'Brunel Country' early one morning with a model in the car. I was looking forward to meeting many of the regulars at the show and enjoying what is always a good display of models of all types.

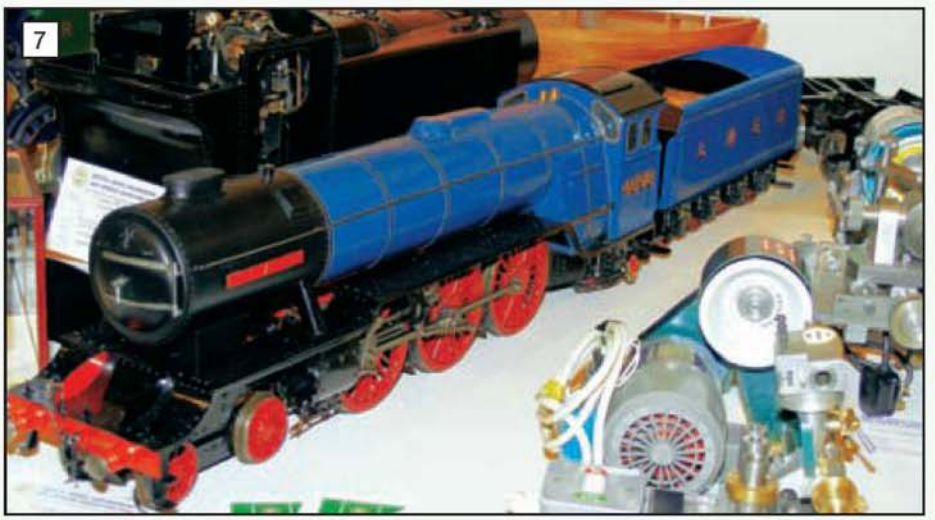
After a wet journey, I arrived to find preparations well advanced and after registering my model I set off to have a look round and take some photographs before things got too crowded. One of the delights of this show is that the gangways between the stands are wide enough so that it never seems crowded even when things are busy.

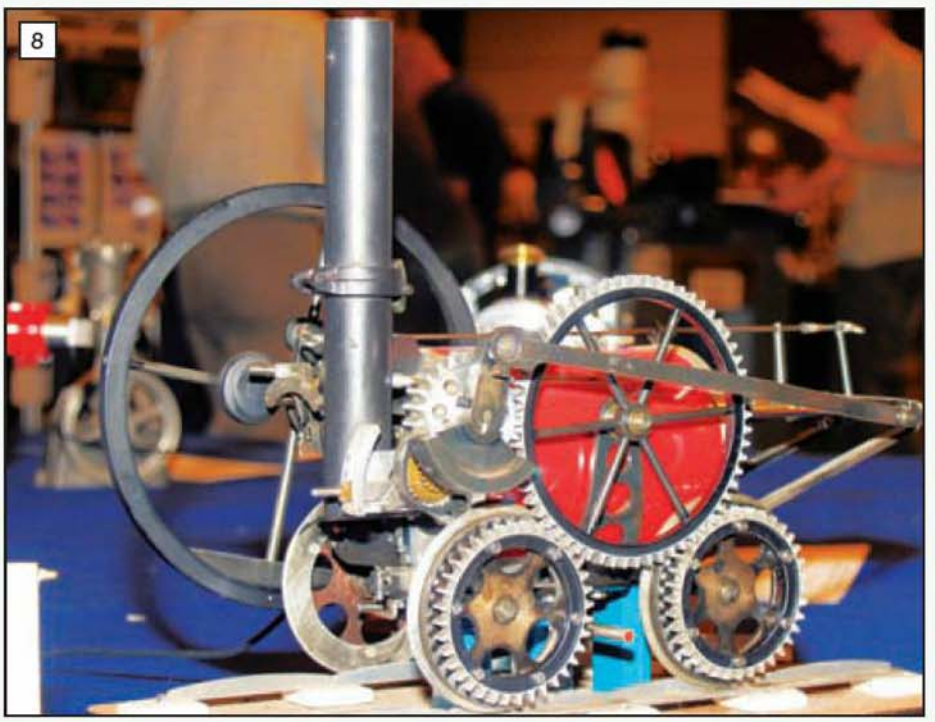
Geoff Sheppard and his exhibition committee had produced yet another superb show with a wide range of excellent models on display, several excellent club stands, and a good selection of traders to tempt the visitors. The Best Club Stand award was taken by the Gas Turbine Builders Association stand this year for both an excellent display, and the way in which club members interacted with visitors.

As with any exhibition report, the difficulty is deciding what to leave out, so the selection of models in these pages is again, very much a personal choice and if your model is not mentioned that is no reflection on it at all. ▶

1. *The superb Burrell Showman's engine* **The Griffin** *by Stephen Harbach. Displayed complete with patterns and castings and Duke of Edinburgh Trophy.*
2. *Lady Kitty GWR 2-8-0 locomotive built by LBSC, and shown by Paul Wiese from the home society.*
3. *The fine Savage Electric Light Engine complete in a superbly detailed horse drawn wagon built and exhibited by Reuben Smith.*







4. *This nice exhibit of a vertical boiler during construction by Alan Hooper from the Bristol Society showed the visitors exactly what goes into such things.*
5. *One of Stuart Turner's well known but less common designs, the horizontal twin cylinder Score. This excellent and well presented example is by Ian Hall. This design is another variation on the very popular 10V engine.*
6. *Anthony Mount showed a wide range of his designs, including the Kientzy oscillating engine.*
7. *A3 1/2in gauge 4-6-2* Heilen Lassie, *looking very attractive in Caledonian Railway livery, by Cyril Chandler from Cardiff MES.*
8. *Visitors were fascinated by this hot air powered model of a Trevithick locomotive of 1804 by David Hanstead of the Bristol SMEE.*

Everyone should find something of interest in the following pages. Rather than rather than taking up space with lots of words, only brief details are give to let the pictures do the talking.

The exhibits are grouped into categories and start with the steam models on display. These covered a wide variety of models including locomotives, traction engines and stationary engines. One of the stars of the show must be the superb Burrell Showman's Engine, *The Griffin*, by Stephen Harbach (**photo 1**) which was displayed with its Duke of Edinburgh Award trophy awarded at the 2006 Model Engineer Exhibition.

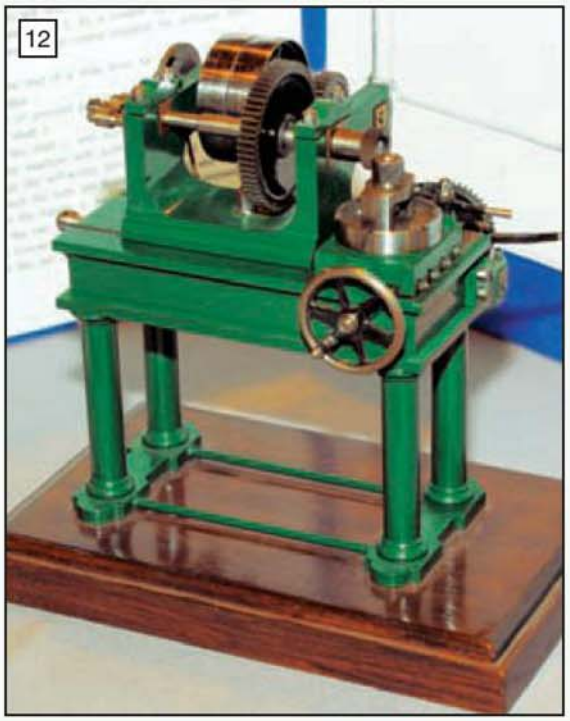
9. Arthur Bodily's sensational 1:4 scale 747cc DOHC supercharged Austin racing car was chosen as top model at Bristol.

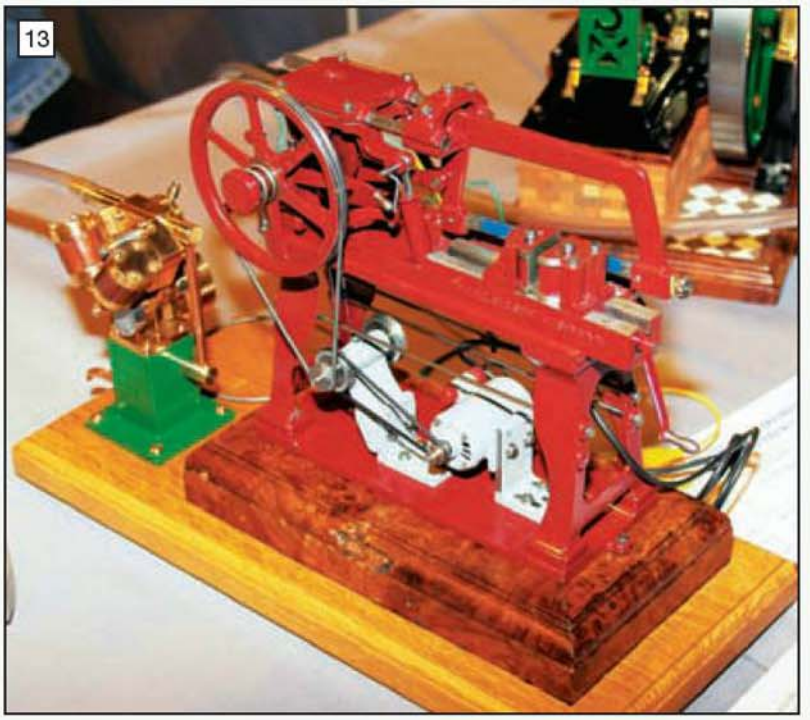
10. Front wheel and suspension detail on Arthur Bodily's Austin.

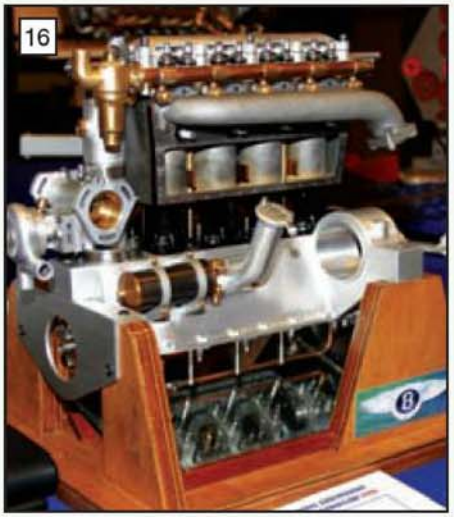
11. Ingvar Dhalberg brought his imposing model of the Mercer T35 Raceabout all the way from Sweden for the show.

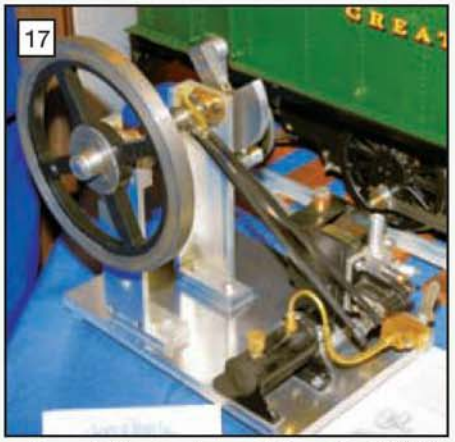
12. Unusual model of Archibald Milnes Nut Cutting Machine in 1:12 scale built by Maurice Turnbull.

13. Another unusual subject was the Rapidor 12in hacksaw machine in 1:5 scale by Ian Hall.









A special locomotive model was the GWR 2-8-0 locomotive *Lady Kitty* (**photo 2**) which was built by LBSC and exhibited by Paul Wiese. It is not common to see a Great Western locomotive actually built by the great man although he produced several GWR designs.

A very different type of model in the steam group was the Savage Electric Light Engine (**photo 3**) by Reuben Smith. Reuben has produced a superb and complete model including the wagon, dynamo and switch board all of which made a very nice display. Other models in the steam section are shown in **photographs 5 to 8**.

The next group I have called 'general engineering' and it includes a variety of models. One of the things that struck me this year was that there were several excellent car models on display. I suspect that most readers would, like me, agree that the highlights of the cars must be Arthur Bodily's 1:4 scale Austin racing car (**photos 9 and 10**) and the Mercer T35 *Raceabout* (**photo 11**) by Ingvar Dhalberg who had come over from Sweden with a collection of fine models. An unusual model in this section was the 1:5 scale Rapidor hacksaw machine (**photo 13**) by Ian Hall.

A category with a good number of models was that for I/C engines with a varied collection, both on the I/C Engine Builders Group stand, and elsewhere including Brian Perkins' superb 1:4 scale Bristol *Hydra* 16 cylinder double row radial engine (**photo 15**) which is nearing completion. This was the only radial engine with an even number of cylinders in each row and only two were built. Another fine part built engine on the same stand was the 1:3 scale 1923 3-litre Bentley engine (**photo 16**) by Mike Sayers.

The last group of models contained some unusual items. The first was the Congreve clock

14. Stuart Turner 'Nodding Donkey' oil field pump by Owen Jones of the East Somerset SMEE.

15. Brian Perkins' 1:4 scale Bristol Hydra 16-cylinder radial engine is nearing completion after 3000 hours work.

16. Another fine engine on the I/C Engine Builders Group display was the 1:3 scale 1923 3-litre Bentley engine under construction by Mike Sayers.

17. A very different I/C engine is the Atkinson cycle engine in which the normal four stroke engine cycle is compressed into two strokes. This example was by Brian Cole from the Stroud SME.

18. Meccano is still popular and this Congreve clock made by John Wilding was displayed on the Rite Time Publishing stand alongside a book on making clocks using Meccano.

in Meccano (**photo 18**) displayed on the Rite Time stand. Another Mecccano model was the well known block setting crane (**photo 19**) on the South West Meccano Club stand.

The Bristol show always has some fine model boats on show and this year was no exception as will be seen from **photo 20**.

An exhibit that really caught my eye was the lovely shepherd's hut by Brian Simpson (**photo 23**) from the Guild of Model Wheelwrights.

As always at major shows, there were many trade stands in evidence providing a wide range of buying opportunities from machine tools down to individual tool tips.

An area that is gaining a lot of interest these days is that of CNC machining and Arc Euro Trade were offering the X3 mill (**photo 24**) fully converted to CNC use. The machine uses the well known Mach 3 software and was in operation at the show.

In the outside areas, when the weather permitted, were the working displays including traction engines, stationary engines, boats and gas turbines. Visitors could also have a train ride on the host society portable track.

So that was another excellent show from Bristol SMEE and visitors seemed to be having a good time and enjoying the displays. It was also a pleasure to meet so many readers at the show, and to be able to put some names to faces from the club newsletters I see every month.

19. The well known Meccano block setting crane on the South West Meccano Club display.

20. Ebenezer is a Cornish mackerel drifter of 1869 and was modelled by Mike Mayhew.

21. The unmistakable outline of a Pitts Special, this nice example by Chris Pavey from the Beaufort Model Flying Club.

22. The Avon and Bristol Woodturning Club had a fine display of the wood turners art including this chip carved bowl in lime by Peter Dugdale

23. The Guild of Model Wheelwrights always has an excellent display and this shepherd's hut by Brian Simpson created a very relaxing atmosphere.

24. The CNC version of the X3 mill being demonstrated on the Arc Euro Trade stand.

The pulley spigot needs to be machined to a good standard of finish.

The table gear spindle with its associated gear attached. The gear is supplied ready made.

The hand wheel is turned from 7/8in. dia. mild steel bar.

BUILDING A STUART MODELS PILLAR DRILL

Anthony Mount

describes further parts for this delightful miniature of an industrial machine tool.

●*Part IV continued from page 267 (M.E. 4281, 1 September 2006)*

There are two washers (part 6) required either side of the drive pulley, made from 1/2in. mild steel they are turned down to 15/32in. and drilled 5/16in. before parting off from the bar.

Pulley spigot (part 7)

Also made from 1/2in. dia. mild steel bar is the pulley spigot. The shaft requires a good finish and should not be too difficult to achieve, as the material supplied is the free cutting variety, which takes a good finish.

There are a number of ways to arrive at a good finish; the first requirement is a sharp tool. As you are working up to a shoulder the tool will need to be a knife tool, stone a short flat on the end of the tool and blend it in with the front edge with a tiny radius. If you look on the front edge as turning a very fine thread the flat will bridge the peaks and blend them into a smooth surface and the tiny radii will help as well. The above refers to a high speed steel tool. If you are using a replaceable tipped carbide tool you will have to work with whatever geometry has been formed on the tip.

If all else fails you can turn the shaft very slightly oversize and dress it down to size with a very fine file. Full size the shaft would have been turned oversize and finished dead to size with a grinding operation. So you can try and convince yourself that the filing stage is emulating the grinding operation. The completed shaft is shown in **photograph 25**.

Table gear (part 9)

The gear is supplied ready-made and does not require any further work done to it.

Table gear spindle (part 10)

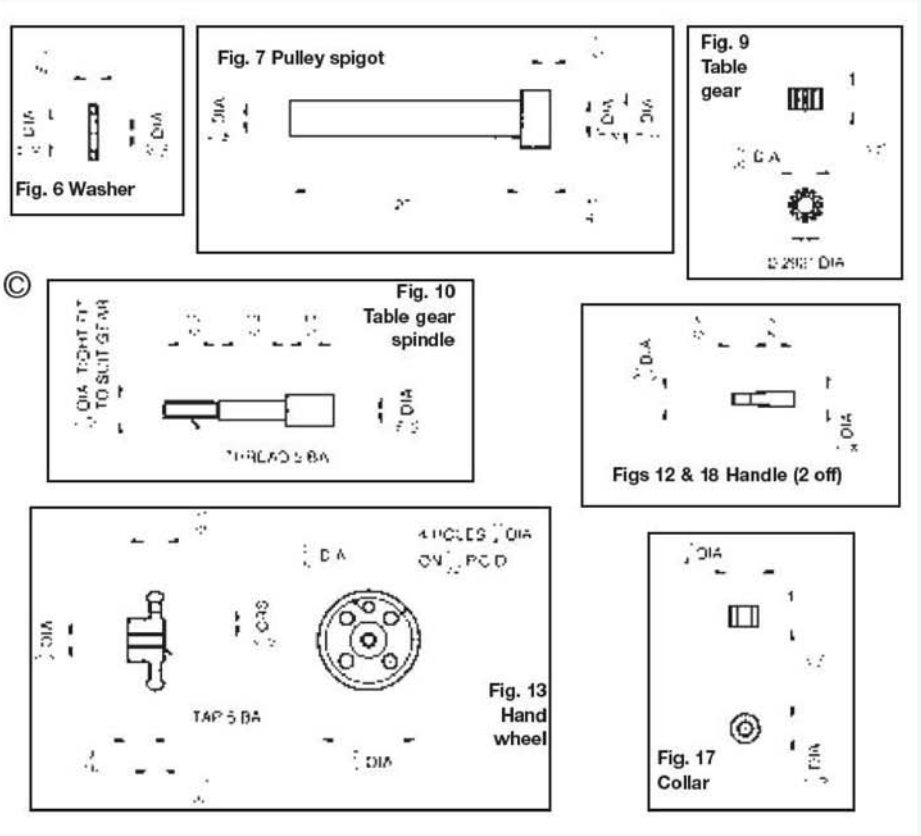
Another shaft with a shoulder is needed for the table gear. Made from 5/16in. dia. mild steel it is turned down first to 5/32in. diameter a tight fit on the gear and then reduced at the front to 1/8in. for threading 5BA. The major diameter is turned down to 19/64in. and parted off. Reverse in the chuck and face off and lightly chamfer. The spindle with gear attached is shown in **photograph 26**.

Handles (parts 12 and 18)

Two handles are required and are simple little turning jobs. But they do need care as they are of small diameter and easily bent. Start by holding a short length of 1/8in. dia. mild steel in the self-centring chuck and have only about 3/8in. sticking out. Turn down to 3/32in. dia. then set over the top-slide and turn the taper, part off, reverse and lightly radius the end with a file. On completion they can be fixed with Loctite into position on the hand wheel and clamp.

Hand wheel (part 13)

The hand wheel is machined from 7/8in. dia. mild steel. Hold in the chuck and turn down the spigot to 3/8in. for a depth of 5/32 inch. Drill down 2.7mm and tap 5BA. Form the recess on the underside, which will require a tiny recessing tool to be made up. Make up a tool from 1/8in. high speed steel and grind down to half the thickness



Jockey pulleys look better with the face groove decoration shown.

Jockey pulley spacers are a simple turning job in mild steel.

The jockey pulley bolt is a long thin component and needs careful machining.

like a D-bit. Reduce the width to 5/64in. and grind on some front rake to make a cutting edge.

The tool can be mounted in a 3/8in. square holder and used like a trepanning tool but go slowly and carefully to avoid chatter as it is a very delicate tool. Part off and hold by the spigot to clean up the parted off face bringing the part to finished thickness then, with the recessing tool, put in the sunken surface in the face.

To put in the five holes mount your dividing head on the lathe cross slide with a chuck on the spindle. Hold by the spigot and index around with a small centre. Then drill four holes at 1/8in. dia. and one at 3/32in. diameter. The handle (part 12) can be either pressed in or fixed with Loctite, as seen in **photograph 27.**

Collar (part 17)

Machined from 1/4in. dia. mild steel rod the collar is drilled 1/8in. and parted off from the parent bar. As most drills seem to drill oversize if used direct into the metal, drill a size under and open out to the finished size with the correct drill.

Clamp lever (part 19)

The clamp lever is machined from 1/4in. dia. mild steel rod. Drill down and tap 5BA, the drawing shows the hole blind at 5/32in. depth. But I drilled and tapped it right through and made the spigot on the handle longer to pass right through the clamp. The clamp lever can be held in the machine vice at an angle and, after using a small centre drill to start the hole, can be cross-drilled at 3/32in. right through the clamp.

The handle can be tapped home with a small hammer if tight or fixed with Loctite.

Jockey pulleys (parts 20 and 25)

The jockey pulleys start off as a length of 5/8in. dia. mild steel. Face off the end in the lathe and after centring drill down and ream to 3/16in. diameter. Put in the V-groove with a 60deg. screw-cutting tool then part off. Reverse for facing off to length. As the edges of the V-groove on which you are gripping with the chuck jaws are so thin it would be a good reason for using some bored out soft jaws with which to hold the pulleys.

Both sides have little sinkings in the face but they are only decorative. They are 5/64in. wide and 1/32in. deep. Because of the small diameter, which will create clearance problems, you will need to grind up a small tool from round high speed steel. I expect you will use 1/8in. diameter HSS, grind one end to 5/64in. diameter for about 1/8in. length, then grind to half the thickness like a D-bit. Mount in a little tool holder and present to the work end on and carefully feed in to 1/32in. depth. I was going to say plunge in but thought better of it. The pair of pulleys can be seen in **photograph 28**.

Jockey pulley spacers (parts 21 and 26)

Though they have different part numbers the two jockey pulley spacers are identical. Made from 5/16in. diameter mild steel, face off the end and drill down and then ream at 1/8in. diameter. Turn down to 3/16in. diameter for 3/8in. length, and then put in the recess forming the two flanges, then part off. The pair are shown in **photograph 29**.

Spacer washers (parts 22 and 27)

Two little spacer washers are required in mild steel and are simple turning jobs.

Jockey pulley bolt (part 23)

A jockey pulley bolt is required made from 7/32in. mild steel hexagon material and is shown in **photograph 30**. This is a long bolt of slender diameter. Start with about 1/2in. proud of the chuck jaws and turn down to just over finished diameter, pull out another 1/2in. and repeat, pull out some more and finish up to the shoulder, take a final pass over the whole length to remove the last couple of thousandths of an inch.

Thread the end 5BA. Use a tailstock die holder for this operation. The action of forming the thread usually raises a burr above finished diameter so it will need to be dressed down with a very fine file.

Part off and reverse in the chuck then face off the end and give the edge a small chamfer to finish it off.

Spindle rack (part 29)

The spindle rack is supplied complete and does not require any extra work (**photograph 31**).

●*To be continued.*

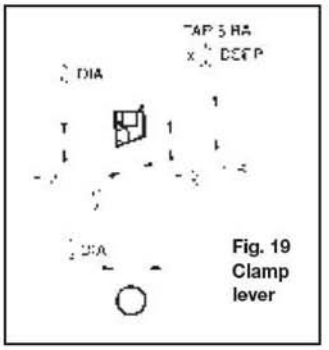
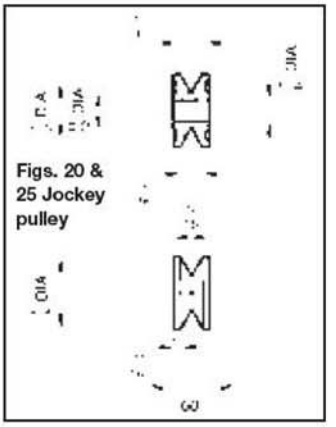
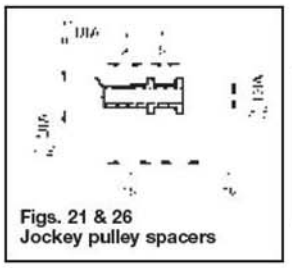


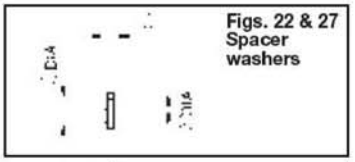
Fig. 19 Clamp lever



Figs. 20 & 25 Jockey pulley



Figs. 21 & 26 Jockey pulley spacers



Figs. 22 & 27 Spacer washers

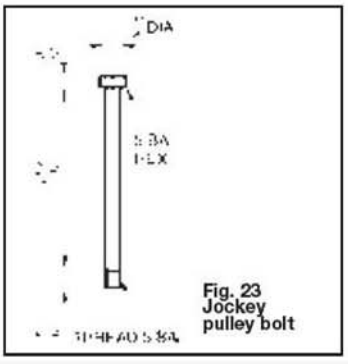


Fig. 23 Jockey pulley bolt

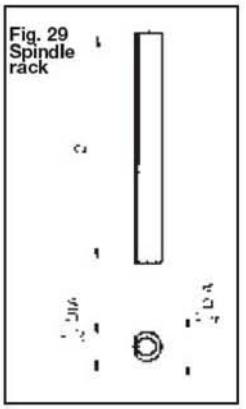
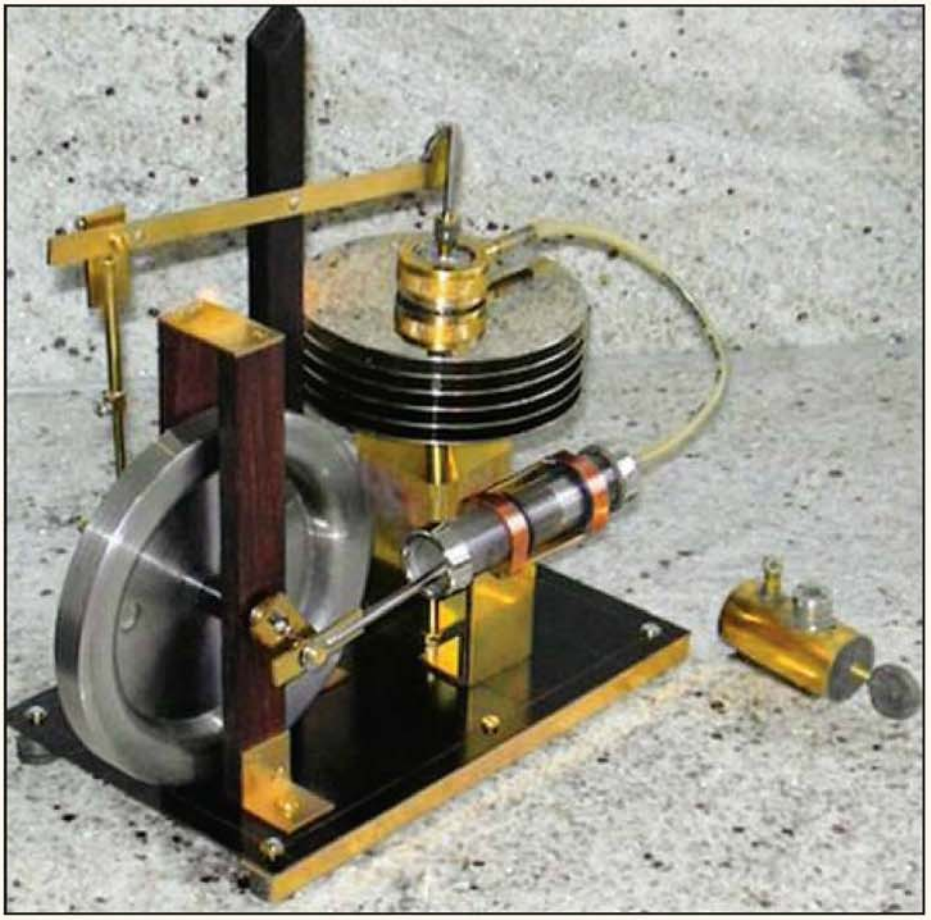


Fig. 29 Spindle rack

The ready made spindle rack that comes with the kit for the machine.

Kjeld Hoejfeldt
in Denmark tells how he reawakened his boyhood interests.



BEAM STIRLING ENGINE WITH REGENERATOR

As boy I was very interested in things technical, and still am. At that time I built a steam engine where the boiler was a Nescafé tin and the oscillating cylinder was a brass tube from a scrapped radio set. However, I also acquired other interests, and when I left school I did not choose a technical higher education. In 2000, after retiring as a chartered accountant, I began to search the Internet to find some model steam engines as I thought about continuing the model building that I had left 50 years ago. Among the steam engine models I also found a few Stirling engines. I lost my heart to this amazing engine. I also learned, that a lathe is not always necessary to build some of these engines.

The first engine I built was a 'Can and Balloon' Stirling engine. Later on I built more advanced models, like a fan driven by one of these engines. I have also built gamma engines equipped with syringes as a power cylinder/piston. However, I felt isolated and decided to join a Model Steam Club and the Danish Association of Inventors. In both of these societies I have met very kind and clever people. I have attended most of their meetings and public shows. At these events I like to show off my engines and tell visitors all about the Stirling Engine. While trying to make a leaflet concerning the 'Can' Stirling engines, which the club could sell at shows, I found that my notes were too extensive for a leaflet and looked more like a book chapter. I therefore decided to write about my other engines and, as a result of this, had a small book published by Camden Miniature Steam Services in 2004.

I still do not possess a lathe but, in my small workshop, I have a good bench drill with a cross-slide, a vice, hand tools, soldering equipment and so on. My method of building model engines is to break-up scrapped items and put parts from them into stock. Then, if I am in a technical mood and maybe have got some ideas about a new model engine, I examine the stock and take out likely useful items for further evaluation. Not an effective way of building model engines, but it is exciting and I never know beforehand what the result will be.

Part of my activities include trying to make other people interested in technical matters and to show them how to build an engine or some such, even if they don't possess a lathe or a fine workshop. A beam Stirling engine with a regenerator is my latest engine. It was built as a 'left-hand job' among many other projects over three weeks in October 2005. The construction of the engine and how the single parts were designed and made is now described. Here is how I did it.

Displacer

In stock in my small workshop I had set aside a brass cylinder, which had been a part of a bracket lamp. The outer diameter was 2.48cm (the inner 2.2cm) and the length 8 centimetres. It was closed at the bottom, and I had noticed, that this cylinder fitted very well with the diameter of the hole in the centre of the hard disc, which I had on stock from breaking-up some personal computers. These made fine cooling fins.

Brass is not the best material for making a displacer cylinder but anyhow it is useable and, because of the cooling fins available, I thought that I still could try to make a displacer from the brass. My next problem was to find something, to be used as the displacer piston. I didn't succeed and as an example, the diameters of some aluminium cigar tubes were too small. I then believed, that I could try to place some brass mesh around a cigar tube and thereby enlarge the diameter. Perhaps the brass mesh at the same time could function as a regenerator?

I decided to give it a try and so I shortened a cigar tube to a length of 6cm and pressed a piece of balsa wood into it, like a cork. I then made a groove in the centre of the top of the balsa cork to make room for a small iron ball, joined to the end of the piston rod (a rod from a floppy disc drive). The piston rod was then joined to the displacer piston by a little metal disc (with a hole in the centre) fastened to the balsa wood by two small screws. In this way the piston is hanging in the piston rod, and because of this, the piston is able to move a little inside the cylinder. Finally, the inner edge of the piston was sealed by a little epoxy repair-sealer.

I succeeded in fitting the brass mesh with a tight fit to the piston and then fastened it using two small nails passing through the tube and into the balsa wood inside the piston. When tried, the piston did fit into the cylinder and I ascertained that it fitted well and also that the friction between the two walls was of no particular importance. The finished piston is shown in **photo 1**.

The next job was to close the displacer/cylinder at the cool end. First I made a brass disc with the same diameter as that of the cylinder. In the centre of the disc I drilled a hole for the piston rod and the matching guide bush. Afterwards, when I found a guide bush that seemed to be good, I soldered this onto the centre of the disc.

To keep the disc in place and for making the cylinder airtight I put a brass ring (part of a water pipe union, which matched the outer wall of the displacer/cylinder) around the disc and soft soldered it all together when the piston had been placed inside the cylinder. Before that I drilled a hole through the upper part of the brass ring and soldered the output tube of the displacer in there. The displacer now seemed to be finished so I then equipped the cylinder with six cooling fins (from the hard disc).

I had an idea about a design with the displacer mounted vertically. Not such a good idea because of the heat from the furnace would probably also

heat at least the lowest cooling fin. Nevertheless, I decided to try, and mounted the displacer on a base (an old lithographic copper plate with a black surface) by four threaded iron bars 12cm in length. This could be done because I had drilled four holes in five out of the six the cooling fins. The bars could then be taken up through the fins and be held there by nuts above fin No. 5 and nuts below fin No. 1. The uppermost fin is only resting upon the other fins.

Now the question was, whether the displacer could work, and if it could be a usable part of an engine? If not I had to stop right there. To find out I connected the output tube of the displacer and a glass syringe using a plastic tube and then heated the hot end of the displacer cylinder using a piece of solid alcohol fuel.

Fortunately, when I moved the rod of the displacer piston up and down by hand, the piston inside the syringe also moved, and quite a lot. This gave me some hope, but the next question was, whether the output from the displacer cylinder would be sufficient for the working piston to turn a suitable flywheel and drive other parts of an engine?

Power cylinder and piston

I chose the glass syringe previously mentioned as the power piston/cylinder mostly because I had one available and because my experience from former engines with these had been good. The heat from the displacer is not a problem as the syringe is connected to the cold end of the displacer cylinder.

The diameter of the glass cylinder is 15.4mm inside and the length is 88 millimetres. I didn't shorten the cylinder and I have not in any way tried to hide that the cylinder is a syringe. It is important to me always to enable people to judge all of the parts and the materials, which are used to build an engine, at least to encourage them to try to build something for themselves.

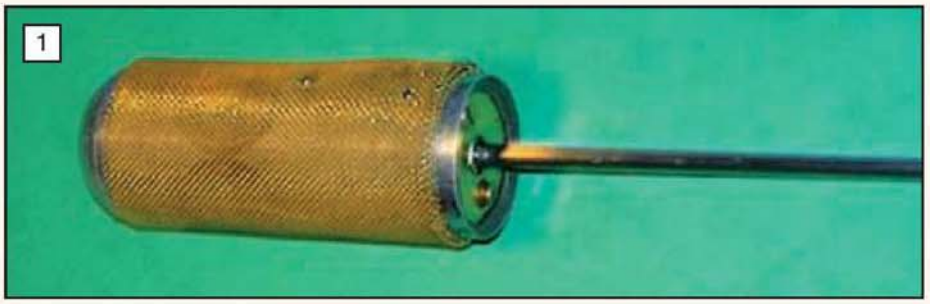
Thinking about the crankshaft I cut the piston rod close to the piston, and made in the ends of the rods a coupling block, and then joined them again.

Flywheel

The next item to source was a flywheel. Going through the selection of flywheels on stock in my workshop I chose a wheel from an old reel-to-reel tape recorder. The weight of this wheel is 300gm and the diameter 12 centimetres. I then made a provisional stand for the flywheel and the shaft and equipped the shaft with a very provisional crankshaft. It was important to find out if the flywheel was fit for the power that the power piston could finally develop.

When heating the hot end of the displacer/cylinder and moving the displacer shaft up and down by hand I ascertained that things worked fine together and that the flywheel was probably usable.

You can see the parts in **photo 2**. The flywheel stand here is not the provisional one but the final one in progress. So far so good, but there was still a long way from here to a final working engine. And how would the engine look?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Design of the engine

As I have never built a beam engine before I was persuaded to use the following configuration in spite of the heating problems mentioned above. On the other hand, a vertically mounted displacer was preferable because of the 'hanging' displacer piston. My first job when designing the engine was to decide where to place the power cylinder and how to make a stable stand for it. Also, where was I to place the flywheel on the base so that the crankshaft lined up with the beam and also the rod of the displacer piston.

When I had marked out the positions I didn't make small centre dots but drew some straight lines across the copperplate base to mark the positions. Why not use the black surface and in this way provide the surface with a form of decoration?

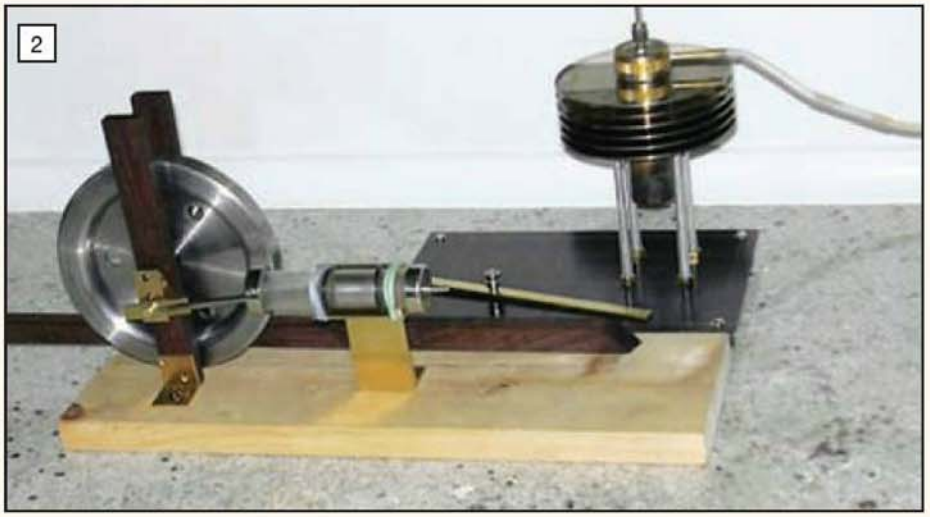
The power cylinder had to be situated at the same level as that of the shaft of the flywheel and be mounted on a stable non-rocking base. For this purpose I made an upright, which could be fastened to the base by a nut and bolt. On the top of the upright I soldered a shelf (angle shaped) for the cylinder with both parts made from brass. After this I provided the cylinder with two O-rings and placed the cylinder on the shelf and fastened it with sewing thread. The O-rings made the mounting on the shelf a little elastic but afterwards a lot of turns of sewing thread pressed the two units safely together and kept the cylinder stable. The copper bands around the cylinder are only decorative and just cover the sewing threads.

For the flywheel I made a stand from hardwood provided with two pieces of an angle shaped brass bar making up their base. Hardwood is not elastic and therefore this is often better than metal bars and much more attractive. In this case I used rose wood (still a bit in stock) and provided the stand with ball bearings for the flywheel shaft 65mm above the base.

The crankshafts on each side of the flywheel are identical. The crankshafts are made from a brass bush (stemming from the flywheel inside a video player) provided with a grub screw to fasten them to the flywheel shaft. The bush has then been provided with a 3cm long brass bar through which I have milled a slot beginning 10mm from the centre of the crankshaft. In this slot I mounted a bolt making up the crank pin and I then provided the pin with a small ball bearing. As you will see the slot makes it possible to adjust the distance between the centre of the shaft of the flywheel and the crank pin from 10 to 13 millimetres. On the ball bearing I mounted the piston rod, which was lengthened with a piece of brass bar soldered to the rod.

The crankshaft of the beam is identical to that of the power piston, but here the rod has been made from two brass tubes, which fit like a telescope and can be locked together by a screw in a muff soldered around the outer tube. In this way it is possible to adjust the length of the rod.

The beam proved not to be a problem and is situated on a pillar 16cm above the base. It is fastened to a double ball bearing (a fine little thing) pressed into a hole drilled through the pillar. It should be mentioned that all of the ball bearings used are items from my scrapping computer parts. The beam is joined to its crankshaft rod by a bolt provided with a ball bearing. The bolt can be moved forwards and backwards inside a slot milled through the beam. In this way it is also possible to adjust the angle ▶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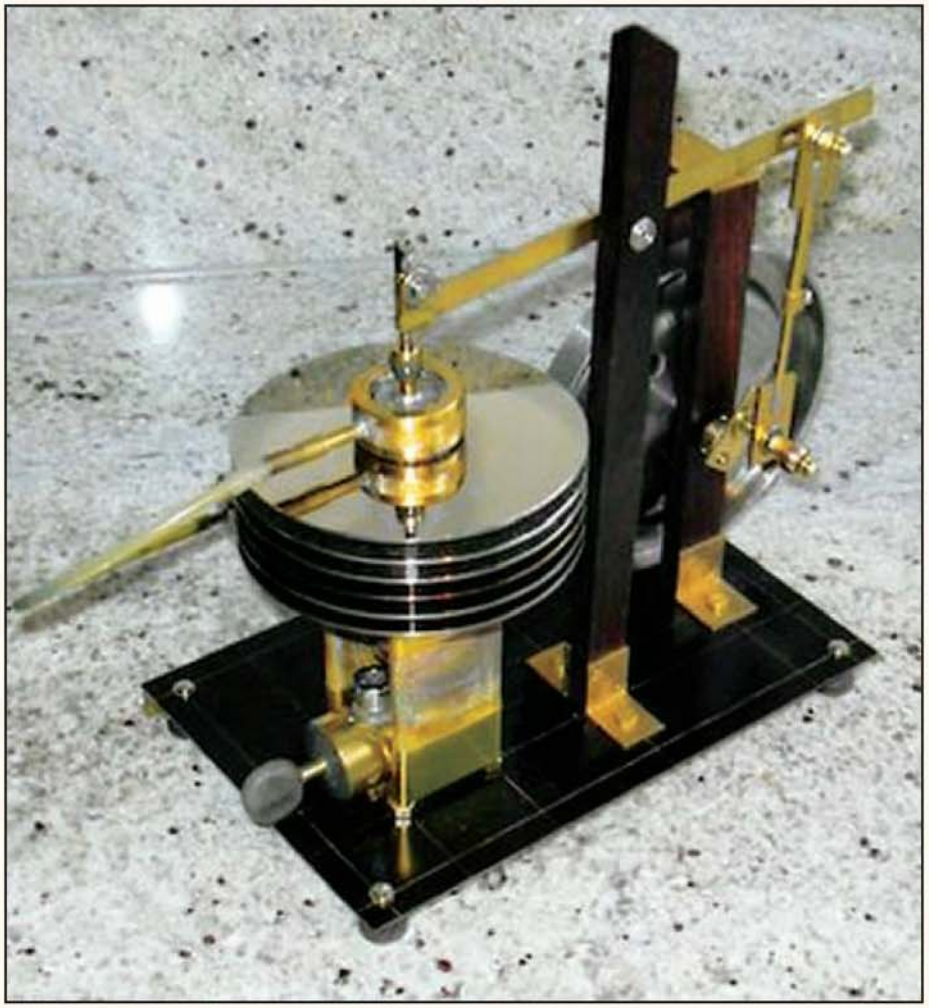


of the beam and the position of the piston inside the displacer/cylinder.

As the ends of a beam, when moving, describe a part of a circle the position of the end of the beam above the rod of the displacer piston moves a little from the centre of the piston rod and would immediately cause some friction. In the early days of steam engines many designs were tried out to avoid this.

In my case, with a tiny engine, I thought that the solution could be to let a ball bearing joined to the piston rod move a little forwards and backwards upon the beam. I had calculated that it was only a question about 1 to 2 millimetres. In my stock I found a small ball bearing provided with a collar. Good find, I thought, and screwed it on an electrical sleeve. Then I placed the ball bearing upon the beam and put the upper part of the displacer piston rod into the sleeve and fastened it by the other screw in the sleeve. Later on I provided the design with a small spring and a collar beneath the beam in order to ensure that the piston moves downwards even if the speed should be very high.

As I do not produce drawings, just a few sketches when I begin to build an engine it is important that all of the parts of the engine can be adjusted when the engine has been finished. That's why I have mentioned all of the possibilities.

But it is not only a question of advantages because in this way it is also possible to make incorrect adjustments of more than one part of the engine at the same time.

You can see all of the parts of the engine mentioned above in the photos of the finished model on this and the title page.

Furnace and burner

The furnace is a rather simple one but good. It consists of the four iron bars mentioned above. These have been surrounded by a brass mesh on three sides. On the top and in the bottom, the walls have been equipped with a thin brass plate mostly for decoration.

It is well-known that it is impossible for a flame to burn through a metal mesh. Here the brass mesh prevents the escape of the flame of the burner and even the heat seems to me to be kept back. The brass mesh is then an important part of the solution of the heat problem mentioned. Another considerable thing is that I have also stuffed rock wool into the upper part of the furnace and around the displacer/cylinder but not around the lowest part of that.

The engine can be heated by solid or liquid alcohol. The burner I made for liquid alcohol is a part of a brass tube. It is 25mm dia. and 50mm in length. The bottoms have been closed by brass discs and silver-soldered. As my soldering is not very beautiful the plates have afterwards been covered with a black repair-sealer.

First run

I did the very first run before finishing the furnace and I used solid alcohol as the heating source. From the outset many problems arose. The first one was insufficient power from the power piston, especially the power from the pressure phase which was disappointing. I therefore thought that the reason could probably be a leak. I then discovered that the guide bush didn't fit tightly enough around the rod of the displacer/piston. This surprised me, but luckily I found a better bush, but the question was now, how to remove the bad bush? With soldering the risk could be that the piston rod could be soldered into the guide bush. I therefore decided to let the old bush stay in place and put the new bush upon the old bush and then sealed them with epoxy repair-sealer. This succeeded very well and until now it has been a durable solution.

However, the engine would still not run so I tried several adjustments. I enlarged the diameter of the crankpin from 10mm to 12.5mm, turned the phase of the pistons from 90deg. to 60deg. and at last I threw a cool wet cloth upon the upper cooling fin, which was rather hot. I was, I believe, somewhat disappointed but suddenly the engine began to run and, after some adjustments and finishing the furnace, the engine has been kind to me.

Later results

The engine performs with a speed between 500 and 900rpm when the rate of heating is high. However, it does not run for a very long time because of the temperature on top of the displacer/cylinder gets too high. At low heat the engine runs at 200 to 500rpm, but then it can do this for hours. I prefer low revolutions as they are better for watching the individual parts of the engine working and enjoying the sound of almost complete silence.

I think that the economy is very good. One day I measured that the engine ran for 2 hours and 22 minutes on about 17 millilitres of liquid alcohol. Here we are back again to the beginning and the question is: does the brass mesh around the power piston really work as a regenerator? I don't know for sure, but the result is satisfactory to me.

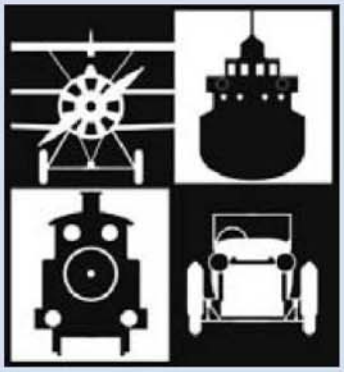
Concerning the glass syringe, this has to be kept very clean in such a tiny engine. Some gases from the displacer, arising from oil and the material used I think, deposit impurities upon the inner surface of the cylinder. This means that some friction arises and therefore it is important to clean the cylinder and the piston at short intervals.

I have calculated the swept volumes in this way:

	Power cylinder	Displacer cylinder
Diameter	1.54cm	2.20cm
Radius	0.77cm	1.10cm
Stroke	2.50cm	2.00cm
	0.77 x 0.77 x π x 2.50 = 4.65 cubic cm	1.10 x 1.10 x π x 2.00 = 7.60 cubic cm

These calculations show that the ratio of the swept volume of the displacer cylinder to that of the power cylinder is 1.63. About the 90deg. phase, it should be mentioned that the engine is not particular about this phase, but in my opinion it likes the 90deg. one best.

I am satisfied with the engine but I am still working on the heat problem and I am studying how the engine runs and why also this engine does it 'in this way'.



THE MODEL ENGINEER EXHIBITION

Please return completed form to:
Model Engineer Competition,
9 Tranmore Lane, Eggborough,
E. Yorkshire DN14 OPR

ENTRY NO.

OFFICE USE ONLY

CLASS	ENTRY NO.

ENTRY FORM - COMPETITION & LOAN MODELS

PERSONAL DETAILS (Please print)

Surname _____ Forename(s) _____ Age: _____

Address _____

_____

_____ Post Code: _____

Home Tel No _____ Daytime Tel No _____

Model Club or Association _____

Have you entered before? (Y/N) _____

Do you purchase or subscribe to an Encanta Media Ltd magazine? (Y/N) _____

How many years have you been a modeller? _____

Mail Order Protection - please tick this box if you would prefer not to receive mail from other companies which may be of interest to you ☐

MODEL DETAILS – PLEASE TICK BOX IF MODEL IS FOR LOAN ☐

Entry Class (competition entries only) _____

Model Title (to be used for catalogue and display card) _____

Model Description _____

_____

_____

Model Scale _____ Length _____ Width _____ Height _____ Weight _____

Type of construction _____

_____

Parts not made by you and commercial items _____

_____

Have you supplied a photograph? (Y/N) _____

Are you supplying Judges Notes? (Y/N) _____

Value of Model (Encanta Media Ltd will not insure the model unless a value is entered) £ _____

Name and address of your local newspaper _____

_____

N.B. Please make a copy of this form and any photographs enclosed for your own reference.
Please note that Encanta Media Ltd will not accept liability for any loss of documents or photographs submitted with this form.

TO HELP YOU GET THE BEST FROM THE MODEL ENGINEER EXHIBITION

These notes are written purely for guidance. Full information is contained in the Competitors' Information booklet which is sent to every entrant as part of the information package. If you have an item and are unsure as to the Class into which it should be entered, leave that section blank and we will take care of it. The Judges have the right to move any competition exhibit into another class if they feel that by doing so its chances of gaining higher marks or a more appropriate award are improved.

If the item is offered as a Loan exhibit please indicate this by writing Loan on the form in the box identifying the Class. Loan models are not judged but carry all other privileges associated with competition entries.

Part built models are particularly welcome in the Loan Section; visitors like to see work in progress, and entry does not preclude the item being entered in competition when completed.

The classes listed below are those associated with mainstream model engineering.

Club exhibits

Where a club is exhibiting, each model should be entered on a separate entry form and clearly identified as a club exhibit by entering Loan/Club in the class section box. This ensures that we have a full record of all models on display during the show and facilitates matters of administration and insurance.

Additional forms

If you do not wish to deface your copy of the magazine we are happy to receive photocopies of the entry form, one for each model. We will be pleased to send out extra forms if required, so if you know of a modeller who is not a reader of one of our magazines but who you think may wish to participate, please advise them to contact our Exhibitions Office, or simply photocopy the entry form for them.

The success of the show depends largely on the number of models on display. Your work could well be the stimulus which inspires someone else to start in the hobby. There can be no doubt that this event is our showcase on the world of modelling in all its aspects. Every modelling discipline needs more and more participants, and it is by displaying not only the crème-de-la-crème, but also examples of work of a more achieveable standard, that people are encouraged to join into the wonderful world of modelling, in whatever aspect.

We look forward to seeing a sample of your work at the show!

Engineering Section

- A1 Hot air engines.
- A2 General engineering models (including stationary and marine engines).
- A3 Internal combustion engines.
- A4 Mechanical propelled road vehicles (including tractors).
- A5 Tools and workshop appliances.
- A6 Horological, scientific and optical apparatus.
- A7 General engineering exhibits – not covered by the above

Railway Section

- B1 Working steam locomotives 1" scale and over.
- B2 Working steam locomotives under 1" scale.
- B3 Locomotives of any scale, experimental, freelance or based on any published design and not necessarily replicas of full size prototypes, intended for track duties.
- B4 Scratchbuilt model locomotives of any scale, not covered by classes B1, B2, B3, including working models of non-steam, electrically or clockwork powered steam prototypes.
- B5 Scratchbuilt model locomotives gauge 1 (10mm scale) and under.
- B6 Kitbuilt model locomotives gauge 1 (10mm scale) and under.
- B7 Scratchbuilt rolling stock, gauge 1 (10mm scale) and under.
- B8 Kitbuilt rolling stock, gauge 1 (10mm scale) and under.
- B9 Passenger or goods rolling stock, above 1" scale.
- B10 Passenger or goods rolling stock, under 1" scale.
- B11 Railway buildings and lineside accessories to any recognised model railway scale.
- B12 Tramway vehicles.

Marine Models

- C1 Working scale models of powered vessels (from any period). Scale 1:1 to 1:48
- C2 Working scale models of powered vessels (from any period). Scale 1:49 to 1:384
- C3 Non-working scale models (from any period). Scale 1:1 to 1:48
- C4 Non-working scale models (from any period). Scale 1:49 to 1:384
- C5 Sailing ships and oared vessels of any period – working.
- C6 Sailing ships and oared vessels of any period – non-working.
- C7 Non-scale powered functional models including hydroplanes.
- C8 Miniatures. Length of hull not to exceed, 15in for 1:32 scale, 12in for 1:25 scale, 10in for 1:16 scale; 9in for 1:8 scale. No limit for smaller scales.
- C9 For any model boat built from a commercial kit. Before acceptance in this class the kit must have been readily available for at least 3 months prior to the opening date of the exhibition and at least 20 kits must have been sold either by mail order or through the retail trade.

Scale Aircraft Section

- D1 Scale radio control flying models
- D2 Scale flying control-line and free flight
- D3 Scale non-flying models, including kit and scratch-built
- D4 Scale flying radio controlled helicopters

Model Horse Drawn Vehicle Section

- G1 Carriages & other sprung vehicles. (Omnibuses, trade vans etc.) Wagons, carts and farm implements. Caravans.

Junior Section

- J1 For any type of model, mechanical or engineering work, by an under 14 year old.
- J2 For any type of model, mechanical or engineering work, by an under 16 year old.
- J3 For any type of model, mechanical or engineering work, by an under 18 year old.

All entries will be judged for standard of craftsmanship, regardless of the modelling discipline, i.e. a boat will not be competing against a military figure. Providing a model attains sufficient marks it will be awarded a gold, silver or bronze medal.

Model Vehicle Section

- K1 Non-working cars, including small commercial vehicles (e.g. Ford Transit) all scales down to 1/42.
- K2 Non-working trucks, articulated tractor and trailer units, plus other large commercial vehicles based on truck-type chassis, all scales down to 1/42.
- K3 Non-working motor bikes, including push bikes, all scales down to 1/42.
- K4 Non-working emergency vehicles, fire, police and ambulance, all scales down to 1/42.
- K5 Non-working vehicles including small commercial vehicles (e.g. Ford Transit,) scale from 1/43 or smaller.
- K6 Any available body shells including Concours, in any scale or material, to be judged on appearance only.
- K7 Functional model cars/vehicles which must be able to move under its own power of any type. Can be either free-running, tethered radio controlled or slot car, but must represent a reasonable full size replica.

DUKE OF EDINBURGH CHALLENGE TROPHY Rules and Particulars

1. The Duke of Edinburgh Challenge Trophy is awarded to the winner of the Championship Award at the Model Engineer Exhibition.
2. The trophy remains at all times the property of ENCANTA MEDIA LTD.
3. The name of the winner and the date of the year in which the award is made will be engraved on the trophy, which may remain, at the discretion of ENCANTA MEDIA LTD, in his/her possession until required for renovation and display at the following Model Engineer Exhibition.
4. Any piece of model engineering work will be eligible for this Championship Award after it has been awarded, at The Model Engineer Exhibition, a Gold or Silver medal by ENCANTA MEDIA LTD
5. No model may be entered more than once.
6. Entry shall be free. Competitors must state on the entry form:
   (a)That exhibits are their own bona-fide work.
   (b) Any parts or kits which were purchased or were not the outcome of their own work.
   (c) That the model has not been structurally altered since winning the qualifying award.
7. ENCANTA MEDIA LTD may at their sole discretion vary the conditions of entry without notice.

COMPETITION RULES

1. Each entry shall be made separately on the official form and every question must be answered.
2. Competition Application Forms must be received by the stated closing date. LATE ENTRIES WILL ONLY BE ACCEPTED AT THE DISCRETION OF THE ORGANISERS.
3. Competitors must state on their form the following:
   (a) Insured value of their model.
   (b) The exhibit is their own work and property.
   (c) Parts or kits purchased.
   (d) Parts not the outcome of their own work.
   (e) The origin of the design, in the case of a model that has been made by more than one person.

NOTE: Entry in the competition can only be made by one of the parties and only their work will be eligible for judging.

4. Models will be insured for the period during which they are in the custody of ENCANTA MEDIA LTD
5. A junior shall mean a person under 18 years of age on December 31st in the year of entry.
6. Past Gold and Silver medal award winners at any of the exhibitions promoted by ENCANTA MEDIA LTD are eligible to re-enter their model for the 'Duke of Edinburgh Challenge Trophy'.
   Past winners at any of the exhibitions promoted by ENCANTA MEDIA LTD will not be eligible for re-entry into the competition unless it has been substantially altered in any way.
7. ENCANTA MEDIA LTD reserve the right to:
   (a) Transfer an entry to a more appropriate class.
   (b) Describe and photograph any models entered for competition or display and to make use of any such photographs and descriptions in any way they may think fit.
   (c) Refuse any entry or model on arrival at the exhibition and shall not be required to furnish a reason for doing so.
8. Entry into the competition sections is not permitted by:
   (a) Professional model makers.
   (b) Anyone who has a financial interest in the direct supply of materials and designs to the public.

NOTE: If unsure, please contact the Competition organisers prior to the show.

9. The judges' decision is final. All awards are at the discretion of the judges and no correspondence regarding the awards will be entered into.
10. Exhibitors must present their model receipt for all models collected at the end of the exhibition and sign as retrieved.
11. The signed release for each model must be presented to security staff when leaving the exhibition complex with display model(s) after the close of the exhibition.

IMPORTANT NOTE: PLEASE MAKE COPIES, INCLUDING PHOTOGRAPHS, OF ALL INFORMATION RELATING TO YOUR MODEL, AS ENCANTA MEDIA LTD *WILL NOT ACCEPT LIABILITY FOR ANY LOSS.*

CLOSING DATE 12TH DECEMBER 2006

KEITH'S COLUMN

LILLIAN
A NARROW GAUGE LOCOMOTIVE
for 7¼in. gauge

Keith Wilson
continues the work on *Lillian*, chats about the Evesham Vale Light Railway and discusses the work of Herman Finke.

●*Part XXV continued from page 283 (M.E. 4281, 1 September 2006)*

As a matter of possible interest, there are four *Lillians* under construction or about to start, including the two in my work house. I am (perhaps naturally!) doing the first, and my work house sharer is doing the other. His is not so far advanced as mine, so he has the advantage of seeing how I do it and then occasionally noticing a better way. His will be 'pure *Lillian*' and mine will be *Gwrillian*, reason obvious. One of the other two is in the Norwich area; t'other is 'down under' in New Zealand. I now have only one set of laser-cut frames 'superfluous to my requirements'.

A few errors have shewn up, and as far as I know drawings have been corrected, but I cannot promise absolute accuracy. It is amazing how long it can take for mistakes to be reported back, one of mine on the 5in. *King John* took about 20 years to get back to me, and I understand that now and again some errors yet surface on Juliet and Tich (described, if memory is correct, in the late forties/early fifties). The number of these being made must be well into the hundreds, so errors must have been noticed. I have begged before about feedback - positive or negative - but it is very rare.

For some years I have been using a 21in. CRT monitor with the computer; the size is much more convenient for design work. However, I recently purchased a 19in. TFT type, which on careful checking shewed up as the same effective screen size as the 21in. - good news indeed! So the smaller is about the same size, begorrah!

Although to make a locomotive from one's own drawings as they are drawn shews the advantages of this practice in correcting mistakes, it is not always possible to carry out this procedure - regretfully. However, the errors still tend to shew up and some drawings can at least be 'brought up to date' so to speak. Even making the locomotive from your own drawings some time later only helps to a certain extent.

> ***Wilson's Words of Wisdom***
>
> *As long as human beings divide themselves into groups marked off by trivial culture differences and consider these differences worth dying for.....we shall have wars.*

For example, my first locomotive made commercially was 1366, drawings now held by G.L.R. Distributors of Hertfordshire. I understand from the grape vine that this design is the second most popular of all - Romulus being by far the first. I built one about four years or so after doing the drawings and lost count of the corrections needed; fortunately few. I immediately made another pair, still corrections required.

Several years later I made a batch of five, still at least one correction seen; however I think it might well be that this design is now clanger-proof - at least I have heard of none, fingers crossed!

Regulator

On doing some work on the regulator and cross-section drawings (back to *Lillian*) I noticed that, as drawn, the regulator operating arm fouls one of the long stays in the closed position - unhelpful. Also, although there is plenty of room inside the steam dome for the regulator, assembly of it would not be one of the lighter matters. Likewise if the steam dome is silver-brazed in as per initially planned, it is rather vulnerable to knocks as well as being rather awkward. Sod's law applies also.

So as an alternative, I suggest the new design shewn here. It means that the regulator can be installed somewhat more easily and then the dome can be bolted into place. Of course, since *Lillian* is not a true-scale miniature of a known prototype, there is much scope for assorted embellishments. Detailed correctional drawings dealing with the problem of regulator fouling will be published later.

Evesham Vale Light Railway

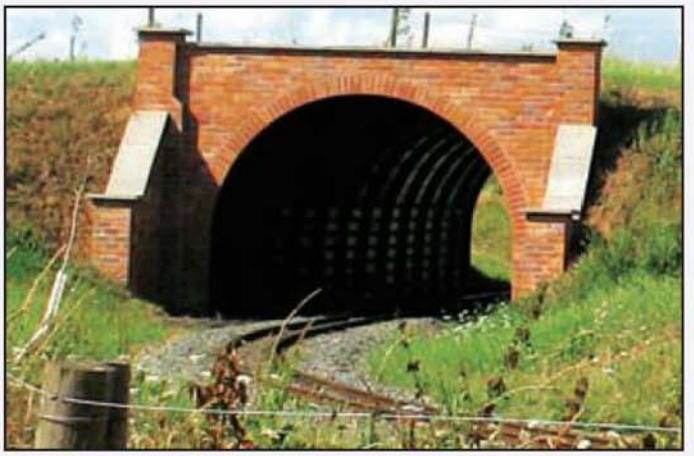
As might possibly be expected amongst the cynical, this fine light railway (15in. gauge) is actually on the top of a hill. This gives the advantage on a clear day of fine views over the Vale of Evesham and surrounding areas.

I took several photographs, but the one I particularly wanted is too blurry to be much use. It shews an unusual modification to its Walschaert's valve gear. Presumably from the point of clearance, the weigh shaft is in the usual position, but lever downwards instead of the more usual upwards position. This has the effect of reversing the usual system of 'the pole' being forward for forwards or 'chimmock first' running, and vice versa. I was not able to examine closely (at time of writing 'getting about' is difficult and soon painful) but this 'reversed reversing' is compensated for by using the top of the expansion link for forward running. The combination lever is as normal.

Perhaps, needless to state, the locomotive is a good runner as is the line's other locomotive (both are outside-frame tanks) which has Baker valve gear. A nice roomy tunnel is provided (photograph) and as the train comes up to it the guard switches the train lights on. I don't think there are too many other small railways with the feature of internal lighting.

I can see no reason why *Anna's* tender cannot be fitted to *Lillian*, it has many good points (not ▶

The Baker valve gear on one of the Evesham Vale Light Railway locomotives.



A view of the splendid tunnel on the Evesham Vale Light Railway. The track is 15in. gauge.

The Evesham Vale Light Railway engine sheds shown together with both locomotives.

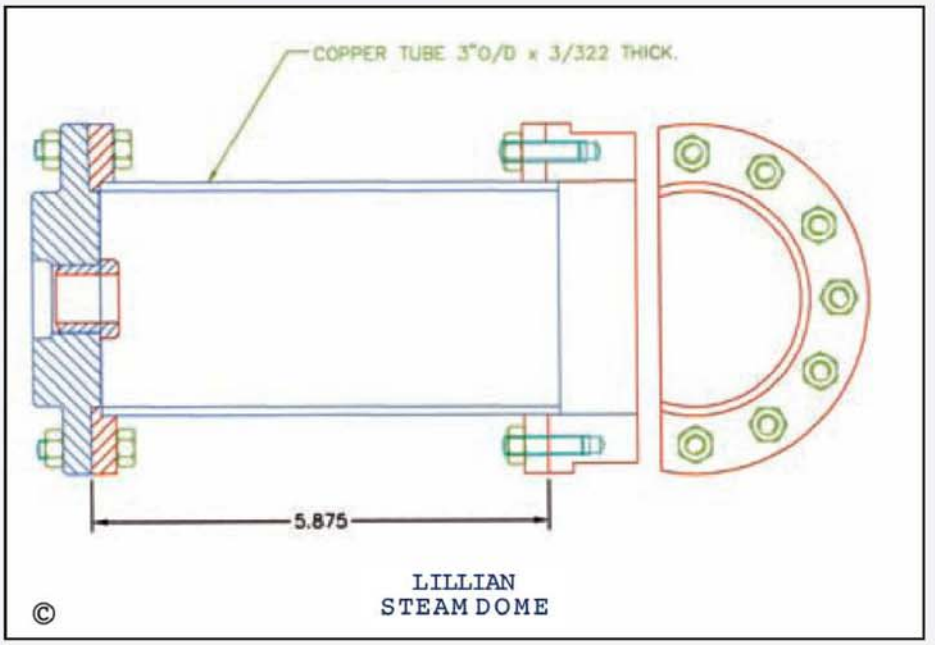
Out on the track and one of the trains and two of the carriages are shown on a left-hand curve.

Railway points!) but what may be described perhaps as ergonomic points for its purpose. I am trying to work some of these into a *GWRillian* tender; not too much success at time of writing this (5 August).

I must emphasise D. A. G. Brown's remarks on a power-braked tender, in this gauge it is well that this measure is not overlooked. I remarked recently on Simple vs. Automatic brakes, vacuum operated. Air brakes (Westinghouse type) have the advantage of smaller brake cylinders; but the disadvantage of a considerably larger 'box of tricks' to produce compressed air - plus automatic control of the device - compared to the size of a supplier of vacuum.

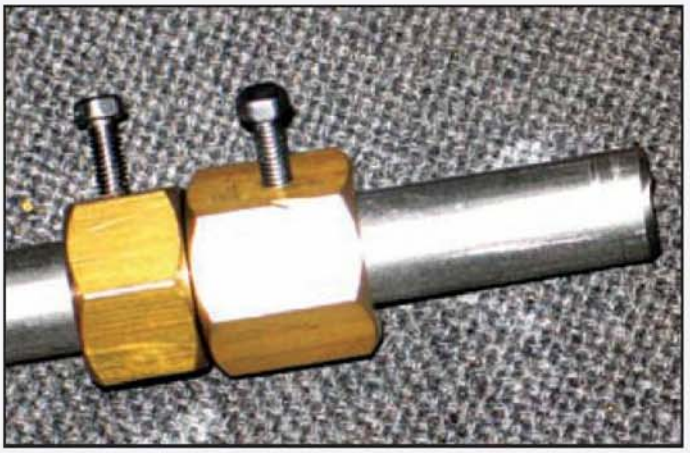
There is a small matter to remember, to wit that it is easier to track down leaks of compressed air (stethoscope highly recommended) than leaks in a vacuum system. The Malden Society or Club has, or did have, two sets of permanently-coupled carriages with a small diaphragm pump driven from one of the axles that pumped a up a goodly supply of compressed air. The brakes were controlled by a lever on the leading end of the front carriage - easily reachable by the driver concerned. On my first operation of my first 7¼in. locomotive I was unaware of which way this lever worked and as the train went round the track the locomotive puffed louder and louder, whilst the speed got slower and slower - I realised that with the lever in the wrong position the brakes were being pumped on! Perhaps needless to state, the train had started from 'all cold' so there was no initial brake power to contend with.

Does anyone 'out there' know of the Fink valve gear? Apparently, it has just one eccentric, with a curved link pivoted near the centre to enable reversing. I understand that it was used on an infernal combustion engine, so why it was required to reverse same is a bit of a puzzle. I was asked for details recently, but was unable to help. The only Fink I know of was one Herman Finke, a composer and conductor. Amongst other things, I believe he wrote the piece called *Glowworm*, but an unfortunate claim to fame lies in his conducting a piece which included the line *"Hush Hush Hush. Here comes the bogey man"*. For some reason, the King was walking down the aisle. Oops!

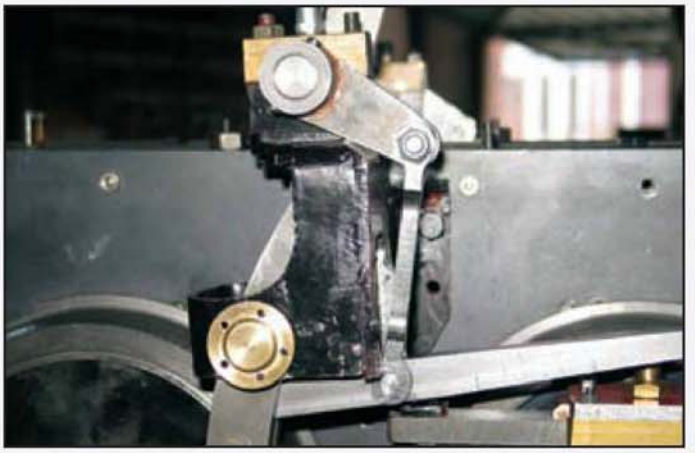


Errors

Have discovered an error or two in the *Lillian* design, cannot understand why or wherefore.



Two collars with radial holes tapped for screws are used for setting the piston rod length on Lillian.



The modified expansion link bracket shown with the guide bar, cross-head and other parts.

The expansion link bracket needs two slight modifications, shewn on drawing. The chamfer in the top front outside edge is to get a bit more movement towards forward running in the lifting links, likewise a bit more clearance in the width of the slot in the front where the radius rod emerges.

I noted that on the original, the lifting link is left as a plain 'block', whereas I shew a neater-looking part which only takes a few more minutes to make. Please yourself.

A problem that always arises in steam locomotives (except perhaps in full-size, particularly at Swindon) is eliminating the effect of the build-up of machining tolerances where they affect cylinder clearance, for as may be well understood, tolerances cannot really be scaled. The Swindon tolerance on coupling rod centres was 0.006in. maximum as far as I know, so work it out for yourselves just what it would mean for us.

Prepare two piston rods - or same as number of cylinders - leaving them about 2in. longer in 7 1/4in. gauge - with tapered end fitting into cross-heads. Pin them with a taper pin, probably best to leave this pin full length at this stage. Make two collars, with tapped hole so they can be locked. One at least should be fairly short - say about 1/2in. long, t'other may be longer but 'tis not important.

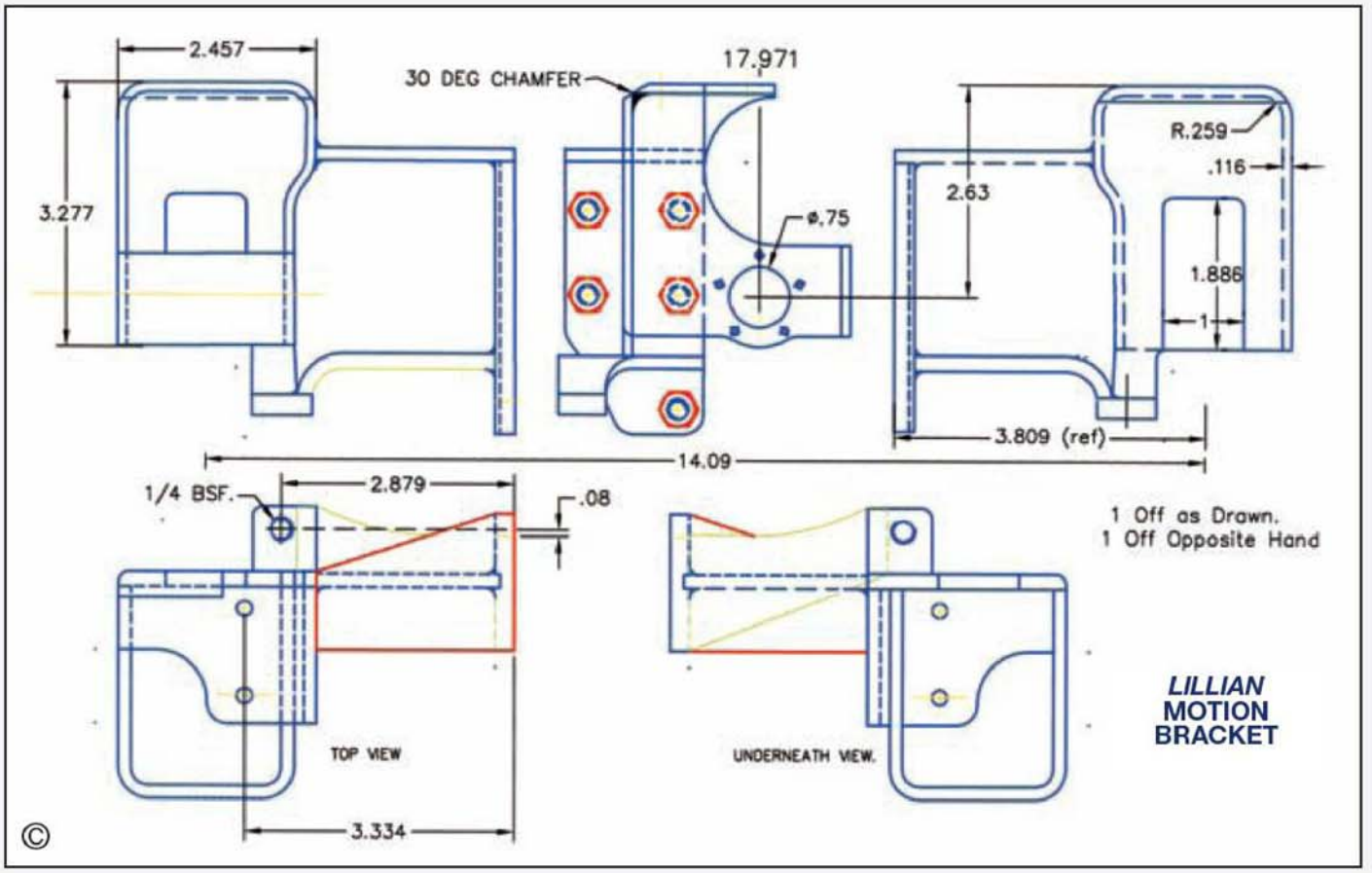
With at least the drive centre wheels in place in the chassis and connecting rods assembled and cross-head located between guide bars, put one piston rod into its cylinder and cross-head; note that the rear cylinder cover must be in its place; the long collar should be lightly gripped by its screw on the piston rod, fairly near to the cross-head end but a) inside its cylinder and b) with a thin washer between it and the cylinder cover. Now if the wheels be rotated the collar plus washer will come up against the rear cover, and it doesn't take a genius (modest blush) to realise that the rear end of the collar will mark the place where the rear face of the piston must be. To make a quick check, remove rod from cylinder and tighten the locking screw/bolt. Put another thin washer on the rod, and re-assemble into cylinder. By turning the drive centre wheels gently the system should lock up just before reaching back dead-centre; this acts as confirmation of the line-up.

A view of the expansion link bracket complete with modifications.

If the short collar be put on and locked touching the first collar, the front edge of this will mark the exact location of the end of the shoulder to locate the piston. Grip this rod in the lathe with this smaller collar touching the chuck jaws, taper part inwards, and you're all set to machine the shoulder. Do it to 'mike' measurements for diameter, and screw-cut the thread on the end to get concentricity, using a die as a chaser to get the best thread you can. With the piston roughed out, about 0.002in. undersize diameter-wise, screw it onto the piston (dry at this stage) and screw the locking nut finger-tight. Put assembly into cylinder, pin finger-tight to cross-head, and check backward and forward clearances.

When satisfied with clearances, the piston may be mounted on the rod permanently - a spanner-tight fit, with Loctite 601 on all mating surfaces, do up the brass nut as tightly as possible, allow to set (24 hours best) and machine off the front face of the piston flush. There is no need to set the drive centre wheels in running position, for a simple calculation using Pythagoras shews almost undetectable changes to clearances, unless your cylinders are sloping quite a bit. As an illustration, 1/4in. vertical at the drive wheel centre equals 0.001736in. - not quite 2 thou! - difference in cylinder end-clearance - any questions?

●*To be continued.*



CLUB CHAT
With Malcolm Stride

Before I start the main news this time, we have received notice that the secretary of the **Tyneside SMEE** has changed. The new man is Malcolm Halliday who has taken over from Ian Spencer. Malcolm can be reached at 13 Elgin Gardens, Walkerdene, Newcastle upon Tyne NE6 4EJ.

UK News

Ashcombe Miniature Railway has made progress on the construction of mechanical point operating equipment at the Ashcombe School site. It is hoped that this project will be completed by the winter. The summer trip this year was to the Kent and East Sussex Railway.

Richard Shepherd has presented a challenge to members of the **Bedford MES** which involves discovering what useful work can be obtained from a standard spring mousetrap. Members may use the trap to produce movement, fire a missile, lift objects, and generate power or any other idea of their own choosing. I shall await the results with interest. Proposals are being discussed for changes to the clubhouse and buildings to enable the club to stop using the existing rented barns thus reducing expenditure.

Progress continues to be made on the signalling system at the **Frimley and Ascot Locomotive Society** with the shunting mode operational throughout the departure area and local signals. Phase two of the development is under way and will provide remote operation of almost all of the points. Software has also been installed that allows trains to be identified round the track. This means that the track staff will know who is breaking the speed limit, so visitors, be warned. During the July hot weather, the track fishplates were checked and lubricated on sections exposed to the sun. This seems to have prevented any track buckling this year. The newsletter contains a spoof set of health and safety regulations to provide some lighter reading. Coincidentally I read this on the day that the top man from the Health and Safety Executive launched a campaign to stop people interpreting the regulations in a ridiculously overzealous and bureaucratic manner. Perhaps some sanity is emerging at last?

Fylde SME has several members with electric-powered locomotives

Bob Duck from Fylde SME with his electric-powered locomotive.

including Bob Duck with his small 0-4-0 which has the battery following along behind in a goods container truck. The society has suffered the attentions of a cheeky thief who, after the grass inside the track had been cut shorter than usual, removed a large square of turf, presumably to repair his (or her) own lawn.

Another society bemoaning the increase in Health and Safety bureaucracy is the **Isle of Wight MES** whose chairman comments on the way the general public have adopted the approach of suing for every little thing which in the past would have been treated as a minor accident and put down to experience. I wonder how many clubs are thinking about closing their doors to the public because of this. A small group of members paid a visit to the Ascot and Pinewood societies on one day in June and were very impressed with the facilities at both sites. Later in June, children from Medina House School paid their annual visit to the track and reporter Mike Rose saved himself for the jelly and ice-cream but discovered that the children had devoured it all before he got there. All parcels of jelly direct to the Isle of Wight please!

The newsletter of the **Model Steam Road Vehicle Society** contains an interesting tip for those who have trouble spraying paint. Bruce Fleet uses enamel but thinned 25% with cellulose thinners. This apparently works with several different types of paint and allows the next coat to be sprayed on after

CLUB DIARY

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

SEPTEMBER

29 **Ickenham DSME.** *AGM.* Contact David Sexton: 01895-630125.
30 **Brighton & Hove SMLE.** *Trackday.* Contact Mick Funnell: 01323-892042.
30 **Dockland & E. London MES.** *Public Running.* Contact P. M. Jonas: 01708-228510.
30 **Guildford MES.** *SMEE Day.* Contact Dave Longhurst: 01428-605424.
30 **National 2½in. Gauge Ass'n (Southern Region).** *Autumn Rally.* Contact John Cook: 0208-397-3932.
30 **New Jersey Live Steamers, Inc.** *Special Work Day.* Contact Karl Pickles: 718-494-7263.
30 **Romney Marsh MES.** *Boiler Testing.* Contact John Wimble: 01797-362295.
30 **St. Albans DMES.** *Annual Club Exhibition at Francis Bacon School.* Contact Roy Verden: 01923-220590.
30 **West Wiltshire SME.** *All-Day Steam-Up & Barbecue.* Contact R. Nev. Boulton: 01380-828101.

October

1 **Basingstoke DMES.** *Public Running.* Contact Guy Harding: 01256-844861.
1 **Dockland & E. London MES.** *Public Running.* Contact P. M. Jonas: 01708-228510.
1 **Ellenroad Engine House.** *Saddleworth Clog & Garland Dancers.* Enquiries: 01706-881952.
1 **Frimley & Ascot LC.** *Public Running.* Contact Bob Dowman: 01252-835042.
1 **Malden DSME.** *Public Running.* Contact John Mottram: 01483-473786.
1 **National 2½in. Gauge Ass'n.** *Midlands Area Autumn Rally.* Contact Clive Young: 01233-626455.
1 **Nottingham SMEE.** *Public Running.* Contact Gerry Chester: 0115-9259096.
1 **Plymouth MSLS.** *Public Running.* Contact John Brooker: 01752-671722.
1 **St. Albans DMES.** *Annual Club Exhibition at Francis Bacon School.* Contact Roy Verden: 01923-220590.
1 **Guild of Model Wheelwrights.** *Hartlebury Castle, Nr. Kidderminster.* Contact Biddy Hepper: 01492-623274.
2 **Northampton SME.** *Public Running.* Contact Pete Jarman: 01234-708501 (eve).
2 **Peterborough SME.** *Bits & Pieces.* Contact Ted Smith: 01775-640719.
3 **Romney Marsh MES.** *Roy Clench: Picture Show.* Contact John Wimble: 01797-362295.
3 **Taunton ME.** *Joint Meeting with Taunton Model Boat Club.* Contact Don Martin: 01460-63162.
4 **Bradford MES.** *Charley Bolt: Campaigns & Medals.* Contact John Mills: 01943-467844.
4 **Bristol SMEE.** *Canon Brian Armal: A Broad Gauge Journey Pt.1.* Contact Trevor Chambers: 0145-441-5085.
4 **Chingford DMEC.** *Bits & Pieces.* Contact Ron Manning: 020-8360-6144.
4 **Guildford MES.** *Talk by London Transport.* Contact Dave Longhurst: 01428-605424.
4 **Leeds SMEE.** *Meeting.* Contact Colin Abrey: 01132-649630.
5 **Cardiff MES.** *Bring & Buy.* Contact Don Norman: 01656-784530.
5 **Rugby MES.** *Bring & Buy Sale.* Contact David Eadon: 01788-576956.
5 **South Lakeland MES.** *Meeting.* Contact Adrian Dixon: 01229-869915.
6 **Canvey R&MEC.** *Meeting.* Contact Brian Baker: 01702-512752.
6 **Maidstone MES (UK).** *Photo Competition.* Contact Martin Parham: 01622-630298.
6-8 **New Jersey Live Steamers, Inc.** *Fall Meet.* Contact Karl Pickles: 718-494-7263.
6 **North London SME.** *Colin Gent: The Merlin Engine.* Contact David Harris: 01707-326518.
6 **North Norfolk MEC.** *AGM.* Contact Gordon Ford: 01263-512350.
6 **Portsmouth MES.** *John Warren: Lubricators.* Contact John Warren: 023-9259-5354.
6 **Rochdale SMEE.** *Competition Night. George Howard: More Unusual Tools.* Contact Mike Foster: 01706-360849.
6 **Romford MEC.** Contact Colin Hunt: 01708-709302.
6 **Sutton MEC.** *Bits & Pieces.* Contact Bob Wood: 0208-641-6258.
7/8 **Hornsby ME.** *Anniversary Weekend.* Contact Ted Gray: 9484-7583.
7 **Ickenham DSME.** *Public Running.* Contact David Sexton: 01895-630125.
7 **Leighton Buzzard NG Rly.** *Steam Glow.* Enquiries: 01525-373888.
7/8 **Malden DSME.** *Visiting Clubs Day.* Contact John Mottram: 01483-473786.
7 **Oxford (City of) SME.** *Family Day.* Contact Chris Kelland: 01235-770836.
7 **Romney, Hythe & Dymchurch Railway.** *Double-Header Day.* Information: 01797-362353.
7 **SM&EE.** *Brian Woodward: Coal Mining Machinery.* Contact David Boote: 01202-745862.
7 **Sunderland (City of) MES.** *Meeting.* Contact Albert Stephenson: 01429-299649.

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.

Anthony Keene — *Romney Marsh MES*

Phil Waugh — *Adelaide Miniature Steam Railway Society*

about 45 minutes. Bruce advises those trying it not to flood the paint on as this traps the cellulose and it will then attack the previous coat instead of flashing off quickly. For all the sceptics out there, Bruce has one message; *"Try it"*.

The membership of **North Cornwall MES** is on the increase, partly due to mentions in this magazine. Three new members have joined, with more in the pipeline. One of the potential newcomers would be the first junior member.

Three members attended the driver's training day held at Norwich DSME and all three passed the tests for raised track operation with both steam and electric hauled trains. A further session is to be arranged for the ground level track. Member Barry Gayton gave a demonstration of brazing at the July meeting and answered many members' questions on the topic.

Now that the 7¼in. gauge track extension is nearing completion, members of **Nottingham SMEE** are to start work on the steaming bay canopies. The first to be constructed will be those over the 3½ and 5in. gauge bays, with the 7¼ bay following on next year. Is there an implication here that 7¼in. gauge drivers are tougher than those on the smaller gauges? The society hosted its first diesel and electric gala weekend in June which was sponsored by Phoenix Locomotives Ltd. The turnout was very good in spite of the Saturday being the day of one of the England World Cup matches. Phoenix provided a display of some of their locomotive kits and a local specialist battery supplier had a stand with a wide range of batteries and fittings on sale.

The **Romney Marsh MES** newsletter is now 150 issues old, which is a significant milestone for past and present editorial staff. The issue was marked with a series of short notes from the officers of the society describing their thoughts and experiences with the hobby and the society. Thoughts are being given to extending the 45mm lines on the garden railway because it is so popular that it becomes quite crowded at times. The midsummer track meeting was bright and dry with many members, friends and visitors attending. There was lots of activity on the track and 175 burgers were consumed during the evening. After 28 years of holding meetings in the Methodist Church Hall, they are now being held at the Rolfe Lane clubhouse.

The weather for the **St. Albans DMES** visit to the Severn Valley railway was near perfect and members were very impressed by the *"friendly volunteers who run the line so efficiently"*. I am sure many readers who have visited the railway will echo those sentiments. Tim Hopkins won the Editor's prize this year for his contributions to the newsletter.

The gauge one track at **Sutton MEC** is to be extended by some 45% and work is well under way. The outer circuit of the new track will be dual 0 and 1 gauges. The civil engineering work for the relief siding on the ground level track is now almost complete and just requires the fitting of the buffer stop produced by John Gates. A member who signed himself 'Sweet Pea Owner' has proposed a bunkhouse for the club to save members from the inconvenience of having to go home.

Brian Barrow from **Wigan DSME** describes the situation we all know as model engineers when the neighbours discover that you have got a workshop and are versatile enough to mend or make things. You know the conversation *"My so and so has developed a fault and I can't get spares, I wonder..."* This reminded me of an unusual request I received from a neighbour who as a sideline ran a small business providing and supplying chocolate machines in offices. These used special aluminium discs in the coin mechanism to sort out the coins and ensure the correct change was put in. When prices changed, he did not have enough 20p sized discs, you can guess the rest. The culmination of Brian's tale was that member Bob Connor had extended his versatility to making an electronic bat detector to detect and give the frequency of the bat calls which can then be identified to the type of bat. Details of any other unusual requests made to model engineers will be welcome.

World News

Australia

Adelaide Miniature Steam Railway Society *"celebrated its thirtieth birthday in some style"* with a run which included other clubs and some old friends. The occasion was also marked by the renewal of the lease for the railway park which has secured the future for the next ten years at reduced rental.

7	**York City & DSME.** *John Dickinson: Building a K1 locomotive from scratch.* Contact Pat Martindale: 01262-676291.
8	**Bristol SMEE.** *Public Running.* Contact Trevor Chambers: 0145-441-5085.
8	**Cambridge MES. Fulbrooke Road.** *Public Running.* Contact Rex Mountfield: 01284-386128.
8	**Canvey R&MEC.** *Last Public Running.* Contact Brian Baker: 01702-512752.
8	**Edinburgh SME.** *Track Running Day Steam & Diesel.* Contact Robert McLucke: 01506-655270.
8	**Guildford MES.** *Driver Training.* Contact Dave Longhurst: 01428-605424.
8	**Harlington LS.** *Public Running.* Contact Peter Tarrant: 01895-851168.
8	**High Wycombe MEC.** *Club Running afternoon.* Contact Eric Stevens: 01494-438761.
8	**Leeds SMEE.** *Running Day.* Contact Colin Abrey: 01132-649630.
8	**Leyland SME.** *Diesel Day.* Contact A. P. Bibby: 01254-812049.
8	**Nottingham SMEE.** *Model Traction Engine Rally & Public Running.* Contact Gerry Chester: 0115-9259096.
8	**Sutton MEC.** *Track Day.* Contact Bob Wood: 0208-641-6258.
8	**Guild of Model Wheelwrights.** *Apple Day, Mary Arden's House, Wilmcote, N. of Stratford on Avon.* Contact Biddy Hepper: 01492-623274.
8	**Worthing DSME.** *Public Running.* Contact Bob Phillips: 01903-243018.
9	**Bedford MES.** *Richard Shepherd: Commercial Modelling.* Contact Ted Jolliffe: 01234-327791.
9	**Saffron Walden DSME.** *Club Night.* Contact Jack Setterfield: 01843-596822.
10	**Basingstoke DMES.** *Bits & Pieces.* Contact Guy Harding: 01256-844861.
10	**Dockland & E. London MES.** *AGM.* Contact P. M. Jonas: 01708-228510.
10	**Romney Marsh MES.** *Track Meeting.* Contact John Wimble: 01797-362295.
11	**Brighton & Hove SMLE.** *Wrinklies Running Day.* Contact Mick Funnell: 01323-892042.
11	**Chingford DMEC.** *Chris Macdonald: The story of London's Speedways.* Contact Ron Manning: 020-8360-6144.
11	**High Wycombe MEC.** *An evening with Steve Dean.* Contact Eric Stevens: 01494-438761.
11	**Hull DSME.** *Tony Finn: New Zealand Scene.* Contact Tony Finn: 01482-898434.
11	**St. Albans DMES.** *Peter Trotman: History of Meccano.* Contact Roy Verden: 01923-220590.
11	**Stockholes Farm MR.** *Members' Evening Running.* Contact Ivan Smith: 01427-872723.
12	**Cardiff MES.** *AGM.* Contact Don Norman: 01656-784530.
12	**Leyland SME.** *Guest Speaker: Doug Hewson.* Contact A. P. Bibby: 01254-812049.
12	**Sutton MEC.** *Guest Speaker.* Contact Bob Wood: 0208-641-6258.
13-16	**Guild of Model Wheelwrights.** *Midlands Model Engineering Exhibition, Radford Semele, Warwickshire.* Contact Biddy Hepper: 01492-623274.
14	**Glasgow & S.W. Rly Ass'n.** *Arnold Tortorella: Traders Wagons and the G&SWR.* Contact Bruce Steven: 0141-810-3871.
14/15	**Papplewick Pumping Station.** *Steaming Days.* Enquiries: 0115-963-2938.
14	**SM&EE.** *Training Seminar.* Contact David Boote: 01202-745862.
15	**Bedford MES.** *Public Running.* Contact Ted Jolliffe: 01234-327791.
15	**Bristol SMEE.** *Public Running.* Contact Trevor Chambers: 0145-441-5085.
15	**Cardiff MES.** *Open Day.* Contact Don Norman: 01656-784530.
15	**Frimley & Ascot LC.** *Club Running.* Contact Bob Dowman: 01252-835042.
15	**Northampton SME.** *Sunday Steam-Up.* Contact P. Jarman: 01234-708501 (eve).
15	**Plymouth MSLS.** *Public Running.* Contact John Brooker: 01752-671722.
15	**Rugby MES.** *Public Running.* Contact David Eadon: 01788-576956.
15	**Saffron Walden DSME.** *Running Day (public running after 2pm).* Contact Jack Setterfield: 01843-596822.
15	**St. Albans DMES.** *Puffing Field Morning.* Contact Roy Verden: 01923-220590.
15	**York City & DSME.** *Running Day.* Contact Pat Martindale: 01262-676291.
16	**Model Steam Road Vehicle Soc.** *AGM.* Contact Geoff Miles: 01869-247602.
16	**Peterborough SME.** *AGM & Surplus Goods Sale.* Contact Ted Smith: 01775-640719.
17	**Chesterfield MES.** *Ed Hollis: Indian & Himalayan Railways.* Contact Mike Rhodes: 01623-648676.
17	**Nottingham SMEE.** *Bob Jackson: Lancaster & Morecambe Railway Visited.* Contact Graham Davenport: 0115-8496703.
17	**Romney Marsh MES.** *Colin Cox: Memories of Steam in South Wales & Rhodesia.* Contact John Wimble: 01797-362295.
17	**Taunton ME.** *Skittles Night.* Contact Don Martin: 01460-63162.
18	**Bournemouth DSME.** *Keith Shepard: The Foundry and its Technology.* Contact Dave Fynn: 01202-474599.
18	**Bristol SMEE.** *Cheddar Valley Steam.* Contact Trevor Chambers: 0145-441-5085.
18	**Chingford DMEC.** *A visit from GLR Supplies, Hoddesdon.* Contact Ron Manning: 020-8360-6144.
18	**Guildford MES.** *Bits & Pieces.* Contact Dave Longhurst: 01428-605424.
18	**Leeds SMEE.** *AGM.* Contact Colin Abrey: 01132-649630.
18	**Maidstone MES (UK).** *Members' Playtime Run.* Contact Martin Parham: 01622-630298.
18	**MELSA.** *Meeting.* Contact Graham Chadbone: 07-4121-4341.
19	**Cardiff MES.** *Chris Tuthill: Victory to Vanguard 3.* Contact Don Norman: 01656-784530.
19	**Isle of Wight MES.** *Gil Hughes: Electronic Measurement.* Contact Malcolm Hollyman: 01983-564568.
20	**Rochdale SMEE.** *AGM.* Contact Mike Foster: 01706-360849.
20	**Romford MEC.** *Mike Margerison: Preserved Locos.* Contact Colin Hunt: 01708-709302.
21	**Canvey R&MEC.** *Members' Running Day.* Contact Brian Baker: 01702-512752.
21	**Cardiff MES.** *Steam-Up and Family Day.* Contact Don Norman: 01656-784530.
21	**Chesterfield MES.** *Public Running Day plus Pie & Pea Supper.* Contact Mike Rhodes: 01623-648676.
21/22	**Claymills Pumping Engines.** *Open Days.* Contact B. Eastough: 01283-812501.

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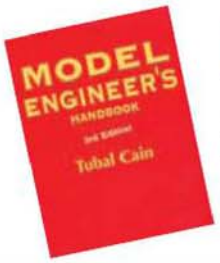

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Workshop Equipment:

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Tel 01452 849051 chris@practical-ideas.co.uk

Myford ML7 Single phase. Cabinet. 3&4 jaw chucks. F/Plate.Imperial change wheel set. £400 Phone. 01237 476454 North Devon

WARCO BV-20 LATHE, AS PER WARCO ADVERT. USED TWICE. BUYER COLLECTS. £375
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Wanted

Cheap but complete used copy of Model Engineering a Foundation Course contact
andrewpaultaylor@hotmail.com

Myford ml7 lathe on stand 3/4jaw chucks tools safety switch and light £600 ono. 01908371765 bucks.

ALLCHIN ROYAL CHESTER 1¼"Part built professional standard, boiler by Alec Farmer certificate. All castings drawings. £3250.
London 0208 368 8085 Mob: 0790082 4030.

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Distance Between Centres	325mm	Speed Range (Low)	0-1100rpm
Motor	400W	Weight	38Kg

Conquest Lathe £365

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Heavy Duty Cast Iron Construction, Imperial & Metric Thread Cutting.

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Model B Super 3-in-1 £725

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Specifications

Centre Height	150mm	Spindle Bore	38mm
Max. Swing	300mm	Spindle Taper	MT5
Swing Over Cross Slide	178mm	Speed Range	75-1400rpm
Distance Between Centres	810mm	Saddle Travel	600mm
Motor	1.5Kw	Weight	450Kg

Crusader Lathe £2095

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1-13mm Drill Chuck & Arbor, Variable Speed, Milling Drawbar.

Features
Dovetail Column, Adjustable Depth Stop, Fine Feed Head Control, Geared Drive, Slideway Covers, Zero Setting Dials.

Specifications

Drilling Capacity	12mm
End Mill Capacity	12mm
Face Mill Capacity	16mm
Table Surface Size	90x404mm
Longitudinal Travel	240mm
Cross Travel	110mm
Max. Distance Spindle To Table	270mm
Number of Spindle Speeds	Variable
Spindle Speed (Low Range)	0-1100rpm
Spindle Speed (High Range)	0-2500rpm
Spindle Taper	MT3
Angle of Column Tilt	45deg Left or Right
Dimensions	460x445x860mm
Table T-Slot Size	12mm
Motor	350W
Power Supply	240v
Weight	55Kgs

Conquest Mill £450

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Features
Heavy Duty Tapered Roller Bearing Spindle, Head Tilts 45 deg Left or Right, Head Rotates 360 Degrees, Easy Clutch Type Mechanism for Engaging Fine Down Feed.

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Drilling Capacity	32mm
End Mill Capacity	28mm
Face Mill Capacity	80mm
Table Size	210x730mm
Longitudinal Travel	540mm
Cross Travel	180mm
Max. Distance Spindle To Table	460mm
Head Rotation on Column	360deg
'T' Slot Size	14mm
Number of Spindle Speeds	6
Head Tilt	45deg Left or Right
Dimensions	460x445x860mm
Spindle Speed	95-1600rpm
Spindle Stroke	130mm
Spindle Taper	MT3
Motor	0.75Kw
Power Supply	240v
Weight	280Kgs

Lux Round Column Mill £975

Standard Accessories
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Features
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Blade Size	1/2"x64 1/2"
Speed Range	65/95/165fpm
Motor	1/3Hp
Dimensions	805x457x985mm
Weight	62Kgs

HV128 Bandsaw £225

Specifications

Capacity	2"
Spindle	1/2"
Angle Adjustment	0-45
Weight	3.5Kgs
Size	300x170x110mm

Tube Notcher £70.50

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