

MODEL ENGINEER

Vol. 201 No. 4338

7–20 November 2008

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CODE PRICE
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CENTRE HEIGHT 110mm

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SET OF T NUTS, STUDS ETC		
CODE	PRICE	
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ON THE COVER...

This stunning locomotive, built by René Etter of South Africa, was displayed at the Model Engineer Exhibition at Ascot. It is a 5in. gauge model of an American-style 4-4-0 built by Baldwin in the 1860s for the New York City and Hudson River Railroad (NYC & HRR). (Photograph by Roger Bunce)

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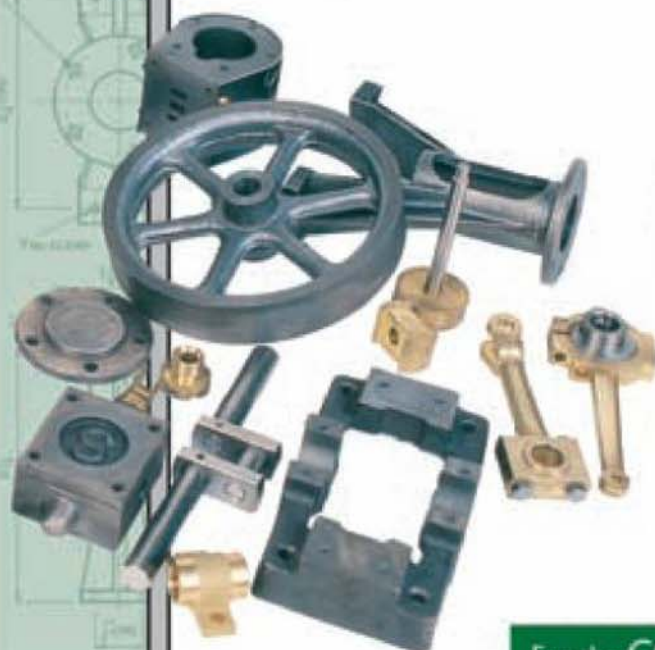
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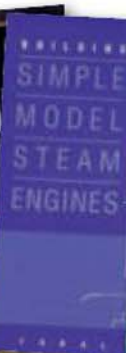
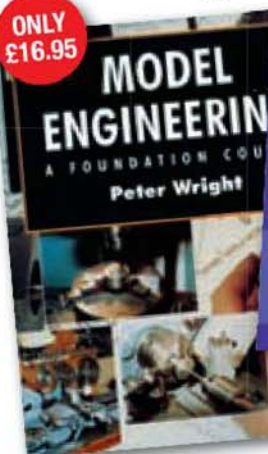
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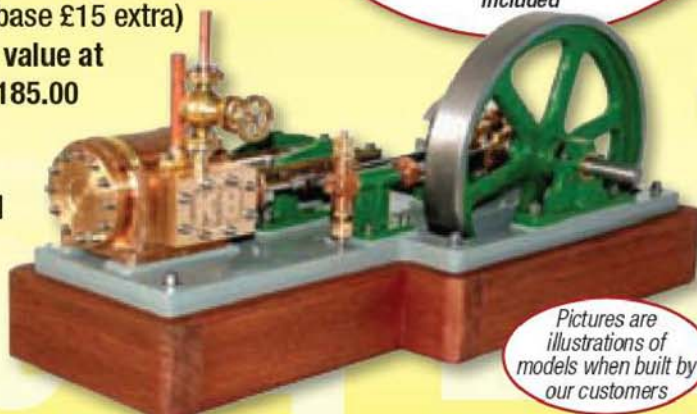
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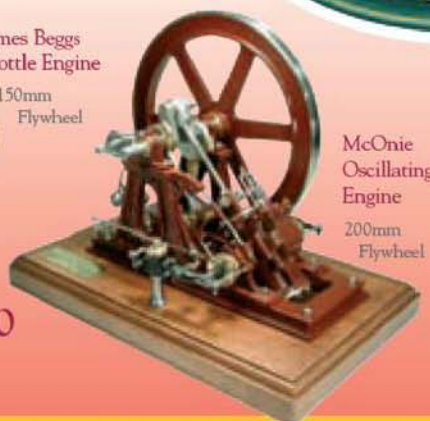
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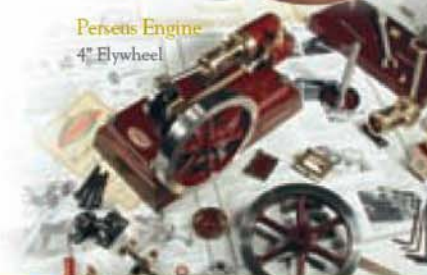
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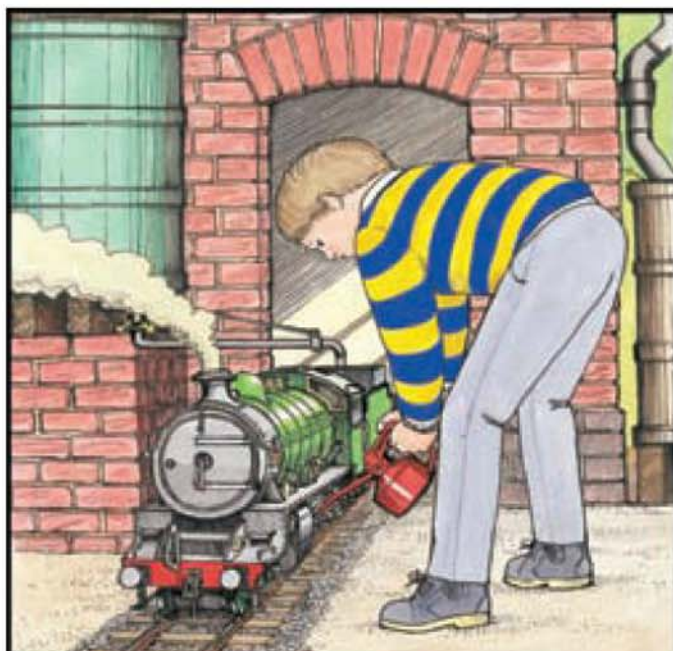
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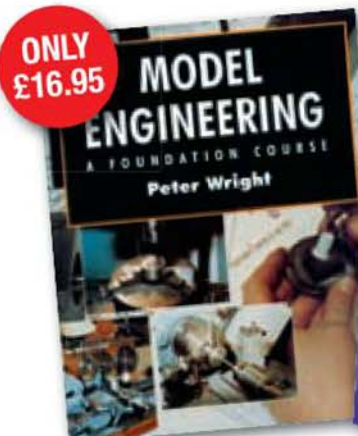
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Sinsheim time approaches

It may be November, but now is the time to start thinking about a trip to Sinsheim in

January. The 13th Echtdampf-Hallentreffen (live steam meeting) is taking place over the weekend of 9-11 January 2009. For railway enthusiasts the indoor live steam event features five kilometres of ground level 5in. gauge track, about 1.5km of dual 7½ and 5in. track. There is also a large boating pool for steamboats and expansive displays of stationary steam engines, many of them running in steam. In all, over 1000 models will be in steam or on display during the Echtdampf-Hallentreffen. Over the three-day event, five metric tonnes of coal are burned - all of it indoors.

Suppliers to the model engineering trade come from across Europe. Roaming the aisles of the exhibition are numerous traction engines pulling wagons and offering rides.

W. www.echtdampf-hallentreffen-messe.de

If you're interested in full-size steam equipment, the Technik Museum at Sinsheim is next door to Messe Sinsheim. Outside are numerous aircraft mounted in various angles of flight. Inside

are many exhibits from military equipment, locomotives, cars, mechanical instruments (organs in particular) and much else.

The companion museum at Speyer offers 150,000sq. metres of exhibits including a huge Chinese 2-10-2 locomotive, QJ 2655, which was turned on its side to pass under the road bridges leading to the museum. At both museums you'll find much to amuse the mechanically inclined. *Model Engineer* is planning reports on these two museums in 2009. The website leads to information about both museums. W.

www.technik-museum.de

There is an organised tour going to Sinsheim leaving from south-eastern Britain (with pickups along the M-25) which is organised by History in Harmony. Departure is on Thursday 8 January and return on Monday 12 January. Beside accommodations in Heidelberg, the trip includes transfers to Messe Sinsheim and one admission. Visits to other museums are made daily, so you can see some of the other attractions in this interesting part of Germany. Enquire about the 'Model Engineering Tour' with the operators. E. tours@historyinharmony.com
T. 01980 621418.



1&2. Locomotives and much more live steam action will be found at the live steam meeting at Sinsheim in January 2009.



Nevil Shute Norway

Many model engineers might have read at least one of Nevil Shute's books, *Trustee from the Toolroom*. The work is well-loved by mechanically and technically-minded people for its discussions of machinery and model engineering. What may not be as well-known is Neville Shute Norway's career as an aeronautical engineer and his career as a best-selling novelist of the mid-20th century.

Airships to Airspeed, a conference organised around the life and writings of Nevil Shute, is planned for 26-31 July 2009 in York at the Novotel.

Nevil Shute Norway, born in London in 1899, was educated at Shrewsbury School and Balliol College Oxford where he read Engineering. He joined the De Havilland Aircraft Company as an aeronautical engineer, then moved to Vickers to work on the airship R-100 in competition with the Government-built R-101.

In the late 1920s he moved to York to work on the design and production of the giant airship, R-100, at Howden. When the airship project was scrapped in 1930, following the crash of rival airship R-101, he co-founded, in 1931, an aircraft design and manufacturing company called Airspeed based in the old bus garage still standing (barely) on Piccadilly, near the Red Lion pub.

Shute's first novel *Marazan* was published while he was working on the airship. It was then that he shortened his name to Nevil Shute to protect his engineering career.

Nevil Shute, left his place in York's history, before moving to Australia in 1950. Shute's 24 novels are still in print and a growing revival of interest in his life and works has spawned a worldwide appreciation group.

A dedicated conference website has just been launched www.uk2009.info and more information about the author can be found on www.nevilshute.org.





Pulse jets (1)

SIRS, - Reference to Dave Fenner's article on pulse jets (M.E. 4334, 12 September 2008). A friend and I have been experimenting with these engines and have found that as far as ignition is concerned, a spark plug (NGK CM-6) powered by a trembler coil as supplied by The Engineers Emporium will provide enough heat for ignition. The plug is screwed into the side of the combustion chamber. This gives a continuous spark and can be disconnected as soon as the engine warms up.

We use propane as a fuel, supplied through a hole drilled in the valve mounting bolt and into a fitting with six radial holes drilled in it so that the gas mixes with the incoming air.

We found a company, (Repco Technology Ltd), who will laser cut valves from stainless shim steel, at a price - CNC machines have to be programmed - but as valve life is short it is worth ordering a quantity of them. Alternatively, they can be etched by spraying thoroughly cleaned shim steel with a metal bonding paint, scribing the outline through the paint and immersing in a sodium chloride solution and passing a current through using a sheet of stainless steel as a cathode.

The valve mounting plate must not have any sharp edges on its valve side as this will cause a fatigue point in the valve petals leading to early failure, (their life is short enough as it is).

Pulse jets are not a very efficient form of propulsion, using a large amount of fuel for the amount of thrust they produce. They do, however, continue to prove thrust as their forward speed increases, diminishing as they approach Mach 1. Someone in America (where else!) strapped one to his push-bike and on reaching 55mph, decided enough was enough and cut the engine. They are great fun and simple to build, producing a shatteringly appalling noise at full power if you like that sort of thing.

Tony Batten, by e-mail.

Pulse jets (2)

SIRS, - Dave Fenner (M.E. 4334, 12 September 2008) might like to try wiring a small DC electric motor (the brushed type used in child's toys is ideal) in series with the low tension side of his coil. The motor will chop the DC into a series of pulses which yield a continuous spark.

A small disc ceramic capacitor across the motor and keeping the spark inside the (earthed) body of the pulse jet should keep the level of Radio Frequency Interference down but you should check this and screen/suppress as necessary.

Truth be told, I was trying to transmit Morse when I 'invented' it at about age 10, so I had an antenna on mine!

Robert Strunz, Ireland.

Ignition coil circuits

SIRS, - I noted in M.E. 4335, 26 September 2008, the M. J. H. Ellis article about ignition coils. Perhaps Mr. Ellis is unaware but the secondary of the ignition coil is not connected to ground as he describes. The common method is for the ground end of the high voltage secondary to be internally connected to the CB terminal. Measuring with an ohm-meter between the HT terminal and the metal canister shows a complete open circuit.

The basic schematic of an ignition system is shown in **fig 1**. This system is commonly known as the Kettering Ignition System after its invention in 1907 by Charles Franklin

Flywheel energy

SIRS, - In the article by Mr. Ridders (M.E. 4333, 29 August 2008) he discusses the flywheel on the engine he is describing and shows how to calculate its kinetic energy. This reminded me of a book I was reading recently in which the author posed an interesting question to his readers about flywheels.

Supposing there are two flywheels each on its own shaft and both rotating at the same speed, measured in revolutions per minute. They are both the same shape but one is twice the size of the other in every dimension. The large one will have more kinetic energy than the small one but how many times more?

As the large one is twice the size of the small one it will be $2 \times 2 \times 2 = 8$ times the volume and eight times the weight but as the speed is unchanged, a first guess might be eight times the kinetic energy. The answer given by the author is 32 times! I couldn't believe this, the guy must have got it wrong somehow, and who was he anyway? A quick look at the back of the Penguin book gave the information that he was a graduate of Cambridge University and had been a mathematics lecturer at various colleges, so perhaps I should think more deeply about this.

With the help of *Machinery's Handbook* I worked it out for myself and unlikely as it seemed to my common sense, 32 times is correct. The author goes on to say that if the ratio of the sizes of the two flywheels is n , then the ratio of the kinetic energies of the flywheels is $n^5 : 1$. In the above example $n = 2$, so that $2 \times 2 \times 2 \times 2 \times 2 = 32$. If a flywheel were to be replaced by a larger one having a 50% increase in kinetic energy when running at the same speed, then $1.5^{(1/5)}$ (i.e. $\sqrt[5]{1.5}$), the number of times the larger flywheel is bigger, works out to 1.084. Multiplying the dimensions of the old flywheel by this number gives the dimensions for the new one.

Some engines are fitted with a plain disc for a flywheel and when replacing such a disc with a larger one, it might be convenient to use the same thickness of disc. In this case the figure of 32 times given above becomes 16 times and the ratio of kinetic energies becomes $n^4 : 1$. Replacing such a flywheel by one having an increase in kinetic energy of 50% would make $n = 1.5^{(1/4)}$ which equals 1.106 and only the diameter needs to be multiplied by this number to give the size of the new flywheel.

H. D. Turner, Wakefield.

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Kettering of DELCO in the USA. The terminal on the coil that connects to the 12V supply used to have the *plus* symbol, today it is denoted by the number 15. The terminal that used to be marked either CB or *minus* is today marked with number 1. The condenser name was discontinued many years ago and replaced with the modern version of 'capacitor', although in the automotive industry things move slowly and condenser is still in common use. Also in fig 1 is shown the method used to provide an adequate spark during starting when the battery voltage may drop. SW1 is the normal ignition switch and normally feeds the primary of the ignition coil via a dropper resistor, R. The value of R is the same as the primary resistance, so for a 12V vehicle system the ignition coil is really a 6-Volt coil. When the key is turned to crank the engine a separate supply directly from the battery provided by SW2 shorts out the resistor causing the coil to be run at higher spark energy, which ensures rapid starting. When the engine starts and the driver releases the key SW2 is opened. This method is known as a 'ballasted coil' and requires the correct value dropper resistor to prevent damage to the coil.

Today contact breaker ignition systems are considered old fashioned and unreliable and electronics have replaced them, reducing the maintenance required and giving much longer life. With an Engine Control Unit (ECU) computer to control the ignition (and often fuel injection) the contact breaker and distributor are largely a thing of the past. The switch shown in fig 2 within the ECU

A final reply

SIRS, - I have read Neville Evans letter about me (M.E. 4332, 15 August 2008). He seems to think I am offended and that I have inferred that he has pirated a Fred Cottam design, that I know nothing about model practice, insult reader's intelligence, my trials with varying size lubricator sight glasses are of no account, and I am of the "Anorak Fraternity". Ernie Nutty's book is the definitive book about Great Western 2-cylinder locomotives, atomising valves are 'on/off switches' called 'Jockey' valves, that I make banal statements, and have an attitude of divine omnipotence. He states that he and his friends believe that I have a patronising and pontificating attitude and I use stock phrases which are generally offensive to them. After all this he then proceeds to give me his best advice as to how to write my articles.

I had no idea that I possessed all of these dubious characteristics but I see, now that it has been pointed out to me, that 50 years of research, study, designing, overhauling (including regulator 'jockey valves') repairing and working on both full-size and model Great Western steam locomotives have been of no avail to me whatsoever and I have learned very little.

I hesitate to query such a knowledgeable and celebrated model engineer but I thought that the size of blobs of oil could be controlled, at least that is what I thought my trials showed up when I was conducting them 40 years ago while working on hydrostatic lubricator systems. However, I see from what he says my results are impossible and that a blob of oil is matchstick head size irrespective of what I found in my trials.

I'm going to frame his letter and hang it alongside all of my other medals and awards for all to see. Referring to fellow model engineers as "fat heads" and of the "Anorak Fraternity" in a cleverly written letter is not how model engineers conduct themselves and I hope I never again see such a letter published in *Model Engineer*, whether it is about me or anyone else.

This correspondence is now closed as far as I am concerned because I don't intend to become involved in an 'insults' competition, model engineering is my hobby and I want to enjoy it and I suggest Neville Evans does the same.

Pete Rich, Monmouthshire.

We also consider this topic now closed.

block is normally a high voltage and high current transistor. Today multiple coils using a technique known as 'wasted spark' is the norm. Here two spark plugs are connected in series across the ignition coil secondary and neither side of the coil is connected to ground. When the spark occurs both plugs spark, but one of the plugs is connected to a cylinder

that is on the ignition stroke and the other is on its exhaust stroke. The schematic in fig 2 shows the basic arrangement. For a 4-cylinder engine there would be two coils, often assembled into a single block with 4 HT posts and fed with a common 12V and two triggering terminals, one for each coil. A 6-cylinder engine would have three coils etc.

The other subtle difference between the original Kettering contact breaker system and the modern electronic controlled system is the coil primary resistance and inductance. In the old system the primary resistance had to be fairly high to limit the current flowing, hence about 4A was the maximum drawn from a 12V battery. With electronic control we can control the current to any value desired and so the coil primary resistance and inductance can be much lower, allowing higher rpm. In an old fashioned coil the primary was typically about 3ohms for a 12V coil, a modern ignition coil for electronic control is about 0.7ohm, so they are not interchangeable. If a modern coil was fitted to an older contact breaker system it would overheat and be damaged in a short time.

John Fielding, South Africa.

Electric cars

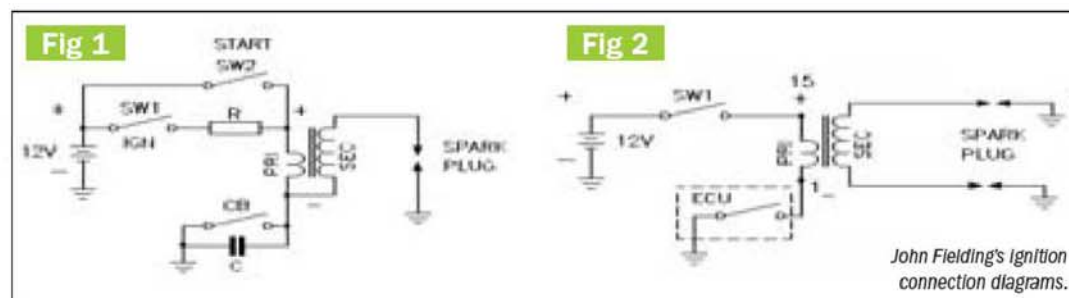
SIRS, - Three cheers for Glynne Hughes for his enlightening letter (M.E. 4333, 29 August 2008) about the facts on electric cars and their 50% increased influence on CO₂ emissions. I hope all who read his letter will think twice on the whole matter about 'green' issues, which surely barks up the wrong tree in condemning vehicles which emit not CO₂ but CO.

In any event, to my simple mind and those of millions of others (especially in the Second World) we are unable to accept a single suggestion from this 'greener than grass' brigade.

If anyone can offer proper scientific proof that we humans are to be responsible for any changes in our weather at some indeterminate time in the future, I would be prepared to change my mind. In any case who has decided that any such changes might not bring colder or wetter weather? Where is any proof?

In the meantime, I will continue to look upon these ludicrous pseudo-scientific ideas as just another example of the 'Emperor's New Clothes' fable and its public brainwashing effect.

Patrick O'Keeffe, Kent.





The Duke of Edinburgh



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EXHIBITION

Ivan Law reports on the entries for this premier award. Also covered in this report are the major award winners.

It was with mixed feelings that the judges viewed the array of models entered in this year's Duke of Edinburgh Challenge Trophy. The main emotion was one of pleasure, for not only the judges, but more importantly the general public would be given the opportunity of examining for a second time models that had won major awards in previous exhibitions. However, the judges also had a feeling of trepidation as only one model can be adjudged to be the winner of the event. I am not sure who formulated the rules (it happened a long time ago; I think the SMEE were responsible!) but surely they must have been aware of the almost impossible task of differentiating between models encompassing such a large variety of disciplines, that, or they had mischievous minds and wished to see the judges pondering over an almost impossible task!

I may have given the impression that I do not approve or enjoy this, the most highly acclaimed event in the exhibition calendar; this is not the case. Not only I, but the other judges involved feel highly privileged to have the opportunity to examine the models at close quarters and also the chance of meeting the builders and discussing not only the construction of the models, but also how the problems that arose were met and solved.

The entrants

There were nine entries this year, which is a record number, five of them being boats. It was nice to see these in the competition, over the years the general standard of marine exhibits in all classes is usually very good, but unfortunately only a small number reappear in the D.O.E. The smallest boat entered this year was a model of the White Star Lines' SS *Baltic*. This was only 10in. long, built to a scale of 1:1200 by Mr. Roy Chapman (**photo 1**). I am amazed how much detail he managed to put into such a small model, I find that 10BA is small enough for me, but a nut that size at a scale of 1:1200 would be 11ft. 6in. across the flats in full-size! Mr. Chapman is no newcomer to

the exhibition, he has exhibited no fewer than 36 times over a period of 50 years. This must be a record in itself.

At the opposite end of the scale spectrum was Mr. Barlow's 1:10 scale model of the Mersey Class lifeboat *Andy Pearce* (**photo 2**). Lifeboats are a popular prototype among the model boat fraternity. This is not surprising; they can be built to a scale that facilitates fine details to be achieved. Mr. Barlow's model was an example of this art; there even was a scale size chart on the chart table in the well-detailed cabin. The hull construction was interesting being made of wood but sheathed both inside and out with epoxy resin which gave an authentic appearance to the finished hull.

One aspect of serious model making is that historical prototypes can be chosen thus giving the public an opportunity to see how the modern world has developed. One such model was of a warship from the 18th century built by Mr. Charles Freeman. It was of a 1:48 scale replica of HMS *Agamemnon* a 64-gun ship reported to be Nelson's favourite. This model was constructed on similar lines to the full-size vessel being mainly wood, using the plank-on-frame method. A

1. White Star Lines' SS *Baltic* built in 1:1200 by Mr. Roy Chapman.

2. Mr. A. Barlow's 1:10 scale model of the Mersey Class lifeboat *Andy Pearce*.

3. HMS *Roebuck* of 1774 by Mr. B. Baldwin to the scale of 1/16in. to the foot.

4. HMS *Cornwall* built to a scale of 1:96 by Mr. David Brown.

5. Mr. Peter Law's steam engine model was of Bodmer's sliding cylinder engine.



Challenge Trophy 2008

remarkable model, last seen in competition in 1993, it was awarded a Gold Medal and the Maze Trophy.

Another historical model, and also the winner of last year's Maze Trophy was entered by Mr. B. Baldwin, this was a fully-rigged dockyard model of HMS Roebuck of 1774 (**photo 3**), built to a scale of $\frac{1}{2}$ in. to the foot. This resulted in a beautiful model only 17 in. long. The model was mounted on two African Blackwood cradles and displayed in a Canadian maple and glass case.

The final marine model in the competition was a superb replica of the frigate HMS Cornwall built to 1:96 scale by Mr. David Brown (**photo 4**). Mr. Brown is no newcomer to the exhibition; examples of his superb craftsmanship have been seen quite a few times in the past. This, his latest masterpiece, was awarded a Gold Medal at the Centenary Exhibition last year and it was a privilege to see it on show again. This model was a serious contender for the award.

Last year was a record year for the number of stationary steam engines on show, however, only one of them was entered in this year's D.O.E. It was Mr. Peter Law's Gold Medal-winning Bodmer's

sliding cylinder engine (**photo 5**). This is an unusual engine, in which the piston remains still whilst the cylinder moves up-and-down. There does not appear to be any advantage in this arrangement over the conventional configuration, other than where height is a limiting factor, such as a paddle steamer. I don't know if any engines of this type were used, or even if any were successfully built and put into useful service. Maybe Anthony Mount, who was responsible for introducing the design into his excellent range of stationary engines, has this information? During the development of the steam engine many peculiar designs were patented some were built and found wanting, many got no further than the outline drawing that accompanied the patent. Making models of these engines involves much research work, but the result is to bring to the notice of the general public artefacts that otherwise would be completely forgotten. Mr. Law (no relation) is to be congratulated for exhibiting an unusual model and for his fine craftsmanship.

Another unusual prototype to model, and also one from the past, was a John Fowler Single Frame Self-Lifting Mole



6. A model of a John Fowler Single Frame Self-Lifting Mole Drainer In 1:10 scale by Mr. Rodger Thurston.

7. Mr. Brian Perkins' 1:4 scale model of a Bristol Hydra aircraft engine.

8. The winner of the Duke of Edinburgh Challenge Trophy, a Ruston-Bucyrus 1260-W Walking Dragline model In 1:76 scale by Mr. Roddy Turner.



Drainer (photo 6). This was built to a scale of 1:10 by Mr. Rodger Thurston. Although this type of equipment was invented in 1829, versions of it are still used today. When in use the mole drainer is dragged across fields with a cutting tool or mole as it is called, about 2 or 3ft. below the surface thus producing a bore through which excess water can drain away. Mr. Thurston's model was one dating from 1921. It was beautifully made and well-displayed depicting the mole below the surface. It gained the Bill Hughes Cup and a Gold

Medal at the last exhibition and justifiably deserved its place in the competition.

One noticeable development that has been apparent over the last decade or so has been the increased interest in scale model I/C engines. For many years this type of engine has been designed and made as power units for model boats and aircraft. The current trend is to produce replicas of full-size engines, and some astonishing models have

been made. Brian Perkins's 16-cylinder, double overhead camshaft, poppet valve radial aero engine is a remarkable example of this specialised development (photo 7). Brian's engine is a 1:4 scale model of a Bristol Hydra. This incredible piece of work has been fully described in the pages of the *Model Engineer* during the last year, so no further description here is needed to do justice to it. No castings were used in its construction, all major

components being made from solid blocks of aluminium, truly a major contender for the award.

The final entry in this class was entirely different from anything entered previously, being a 1:76 scale working replica of a Ruston-Bucyrus 1260-W Walking Dragline. This model was displayed in simulated scale surroundings and was shown working throughout the exhibition moving quantities of scale rocks and earth. It was



Chief Judge Ivan Law presented the awards.

The Major Award Winners...



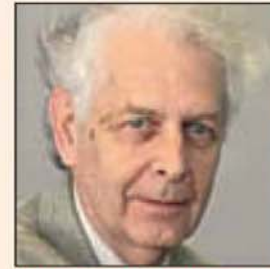
DUKE OF EDINBURGH CHALLENGE TROPHY
Roddy Turner
Ruston Bucyrus 1260-W Walking Dragline 1:76 scale.



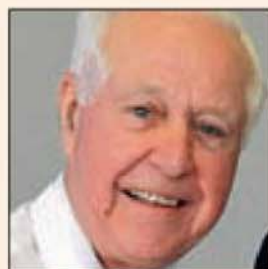
BILL HUGHES CUP
Paul Boscott
5-cylinder steam/air engine.



TOM NEVINS MEMORIAL TROPHY
Lothar Matrian
'Novelty' stationary steam engine.



BRADBURY WINTER MEMORIAL CHALLENGE CUP
Barry Hares
Rolls-Royce Eagle 22 aero engine 1:5 scale.



JOHN PROTHERO-THOMAS CUP
Bernard Baldwin
Miniature Marine SS Ben Loyal.



RNLI MODEL LIFEBOAT TROPHY
Ronald Paddison
George and Mary Webb lifeboat (Whitby) 1:8 scale.



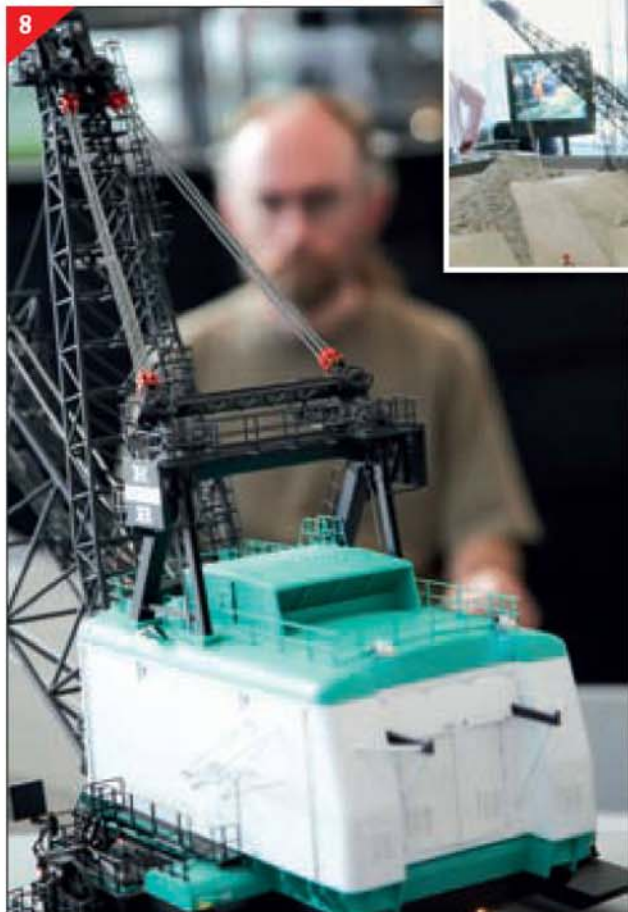
H. V. EVANS TROPHY
Graham Castle
Carron Company Steam Lighter No. 10 1:32 scale.



EARL MOUNBATTEN OF BURMA TROPHY
David Brown
HMS Upholder.



MAZE CHALLENGE CUP
Charles Freeman
HMS Grasshopper.



operated by its builder, Mr. Roddy Turner (photo 8). There was much more to this exhibit than appeared at first glance. It encompassed many

disciplines of the model engineer's craft, including the fitting of an onboard camera showing pictures of the work being undertaken. The operating seat and control panel was modelled from the full-size machine all the controls working as per full-size. I believe that this remarkable model will be more fully described in future editions of *Model Engineer*.

As is often the case with the Duke of Edinburgh, the judging panel had long and detailed discussions, they went on long after the show closed and continued through the evening meal, and well into the following day, before a decision was made to award the trophy to Mr. Turner for his walking dragline

I would like to thank all those who entered into the competition, the judges know full well that practically all the entrants' models deserve the award, but one has to be selected, leaving this year eight justifiably disappointed contestants. **ME**

Other major award winners:

AVELING-BARFORD TROPHY

Nicholas Hooper
Burrell Showman's Engine 2in. scale.

BOWYER-LOWE TROPHY

Alan Jackson
"Stepper head" multi purpose CNC machine.

CHARLES KENNION MEMORIAL TROPHY

Richard Castle
5in. gauge BR Class '2' 2-6-2T locomotive.

NEW ZEALAND CUP

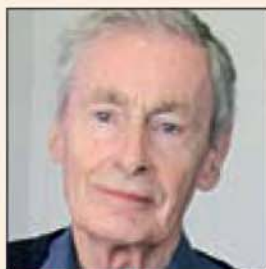
John Lewis
3.5in. gauge Large Boilered Ivatt Atlantic locomotive.

WILLIS TROPHY

Brian Finch
Freelance Steam Turbine Launch 1:12 scale.

CREBBIN MEMORIAL CUP

Herbert Stumm
Le France Fire Engine.



EDGAR WESTBURY MEMORIAL TROPHY

Bill Connor
1956 Manx Norton short stroke engine 1:2 scale.



J. N. MASKELYNE MEMORIAL TROPHY

Alan Crossfield
5in. gauge GWR Bulldog locomotive Empire of India.



JOHN THOMPSON TROPHY

Brian Young
GWR Delivery Van.



UNDER 18 TROPHY

Eric Henry
HMS Caroline 1914 1:72 scale.



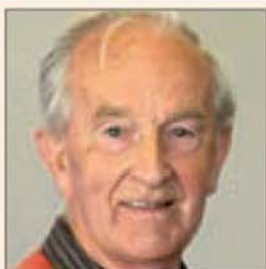
BEST CLUB STAND

National 2½" Gauge Association
Collected by Des Adeley.

Gold Medal Winners...



CLASS A7
Mike Sayer



CLASS A7
Alan Parsons



CLASS A3
Tom Pascoe



CLASS B12
Ashley Best

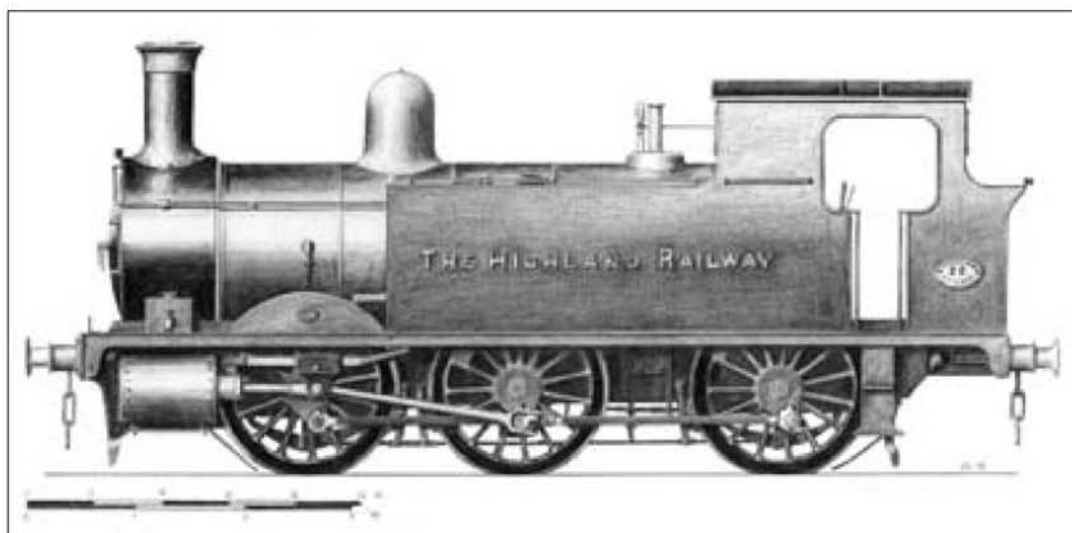


CLASS KA
Stephen Atkinson

EDWARDIAN ELEGANCE: THE HIGHLAND RAILWAY AND PETER DRUMMOND'S 'SCRAP' TANK ENGINES

Ron Isted concludes his description of three Scottish Highland Railway shunters that were thriftily built from scrap parts!

*Continued from page 449
(M.E. 4336, 10 October 2008)*



The Lochgorm works plate, **fig 3**, fixed to the splashers over the leading coupled wheels, measured approximately 8in. by 4in. and was cast in brass, engraved and filled with black wax. None of the 42 locomotives built at Lochgorm between 1869 and 1906 was given a works number, although they did carry the year of construction. The number plate (**fig 4**) measured 18in. by 11in., and was also cast in brass, engraved and filled with black. Although my principal drawing shown above (see *M.E.* 4336, 10 October 2008 for large colour version), depicts No. 22, the first of the 'Scrap Tanks', because it has been scaled mainly from photographs of that engine, **fig 4** on the other hand, shows the

number plate from No. 23, since it constitutes a further example of Highland Railway eccentricity. You will have already observed, I hope, that the figure '3' has a square top, the only instance on the railway, all other plates having a rounded top to this figure, in other words a mirror image of the lower half. I have absolutely no idea why No. 23 should have been honoured with this unique style. A further graphic peculiarity is that the letter 'G' in the word Highland was a different shape on the number plates compared to the same letter on the works plates. As a matter of interest, **Figure 5** shows the Highland Railway crest, although it was never applied to the Scrap Tanks, and in fact did not appear on any locomotive, as far as I know, until the advent of the two elegant 4-4-0s, Nos. 73 and 74, in 1916. It had, however, been used on new corridor coaches since 1912, two representations on each side.

Unusual headlamps

Yet another quirky item, which the Highland Railway shared with the mighty London and North Western, was a peculiar

and very impractical species of locomotive headlamp, not unlike that shown on page 760 of *M.E.* 4289, 20 December 2006. Like those of the Premier Line, (and certain members of the human race on the Saturday before Glasgow Fortnight - none of them model engineers, of course) these Highland locomotive lamps were incapable of remaining in an upright position without some form of support. To solve this self-inflicted difficulty, the Scottish company produced a kind of miniature four-legged stool with a hole in the middle, into which the foot of the lamp was inserted. The lamp occasionally jammed in the four-legged stool, with the result that the complete assemblage was then somehow mounted on the engine. Just how this was physically possible, I cannot tell you, but photographs of this bizarre arrangement have been published. So, if you see a picture of a Highland Railway locomotive with four mysterious excrescences protruding beneath the headlamp above the smokebox door, you will now know what they are.



Fig 3

However, unlike the LNWR, the Highland also employed more normal lamps with the slot on the back for use with the conventional type of lamp iron - having said that, the positioning of the said lamp irons above the front buffer beam on locomotives of the Highland Railway was anything but conventional, because the right iron (looking forward) was set at right angles to the normal position, while the centre one was missing altogether. The reason for this particular oddity was that lamp codes on the system were also unusual and with one exception, gave no indication of either the type of train or its route. Taking the exception first, any locomotive on shunting duty, including our three Scrap Tanks, of course, had to carry a 'normal' lamp on a lamp iron either side on the cab roof, the right-hand one being officially referred to as a Red Head Light, displaying a red light (the opposite to nautical practice) to the front and a white one to the rear. On the other hand, its partner on the port (sorry, left) side was officially known as a Red Tail Light, and showed a white light to the front and a red one to the rear. All other trains, including light engines, at least after dark or in inclement weather, carried one lamp of what I shall call the drunk and incapable variety above the smokebox, displaying a white light, and one normal lamp mounted each side of the cab roof, similar to those described above for shunting duties,

except that both displayed a white light to the front and a red one to the rear.

So what, you may ask, was the purpose of the pair of lamp irons either side of the front buffer beam? The iron on the left-hand side (the one in the normal position) was apparently used for indicating that a light engine, duplicate train or a special working was following, while its offset partner on the right-hand side was merely a storage position for a spare lamp. The bodies of both the normal and drunk and incapable type of lamp were painted red. Incidentally, the Highland never used the white discs so popular with other companies, although these foreign devices must presumably have infiltrated the area after the 1923 Grouping. Having said that, I have never seen a photo of a Highland Railway locomotive carrying discs, even in LMS or BR days. Further information on the subject can be found in the book *Highland Railway Liveries*, details in the references at the end of the article.

In model form

I would suggest that a miniature version of a Highland Scrap Tank has a lot going for it, especially in 7½in. gauge, which would produce quite a powerful engine, but physically small enough for two people to lift into the (reasonably spacious) boot of a car without inducing too many hernias. The length over buffers of the full-size machine was 30ft. 8½in., equal to 3ft. 10½in. in



Fig 4

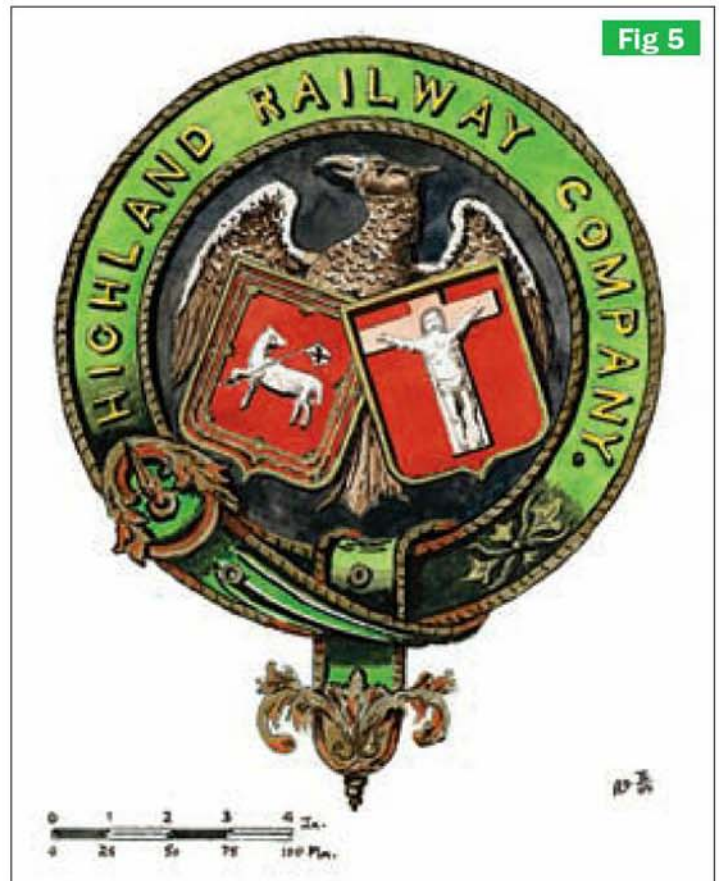


Fig 5

this scale. On the prototype, the larger than normal wheels may have been a disadvantage, but for us they are very much the opposite, as the chances are that small sister will spend most of her life belting round a continuous track on express passenger duties rather than shunting. The wheels were 5ft. 2½in. diameter, with 15 spokes and a crankpin throw of 12in., and in 3½in. gauge, Martin Evans' driving and coupled wheels for his freelance 2-6-2T William are the right size and have the correct number of spokes, although the crank pin throw is intended for the equivalent of 14 inches. I am delighted to report that in 5in. gauge, the wheels for Neville Evans' Highland Railway Jones Goods are almost ideal, except for the balance weights, which may require a certain amount of doctoring. The cylinder castings for this design and also those for the same designer's H. R. Loch 4-4-0 should be suitable for a 5in. gauge Scrap Tank, while in 3½in. gauge, LBSC's ever popular *Juliet* has cylinders one inch by one and a half, the equivalent of 16in. x 24in.,

perhaps a better idea than strict scale size for what is after all not an overlarge engine. In 7½in. gauge, the wheels for Martin Evans' GWR 14xx 0-4-2T Dart could possibly be utilised, although they have 16 spokes instead of the 15 required, in conjunction with the cylinders for Martin's 0-6-ST *Holmside*.

The maximum external diameter of the boiler is officially quoted in all publications as 4ft., but this must surely exclude cladding, as according to my calculations from photographs, the overall diameter is several inches larger. The barrel length was 10ft. 4in. to which must be added a further 5½ft. for the round top firebox, producing a rather meagre grate area of just 16.2 sq. ft. This figure was no doubt adequate for the intermittent demands for steam in a shunting yard, but on a continuous track, even a 7½in. gauge version would probably soon find itself short of breath. Fortunately, the enclosed cab is a generous 7ft. 4in. long, so the length of the firebox can be surreptitiously increased to the rear, which

not only increases the grate area, but will also facilitate driving. In 3½in. gauge, Martin Evans' *Rob Roy* boiler is equal to 4ft. 4in. diameter, but both barrel and firebox could be usefully extended by small amounts without upsetting the various recommended ratios of tube sizes to barrel length and so on. In 5in. gauge, the same designer's Simplex could probably form the basis, although a quarter inch reduction in outside diameter to 4½in. would be desirable in order to leave room for cladding. Alternatively, the boiler for Martin's Midland single *Princess of Wales* uses 4½in. O/D tube, but the firebox length would have to be reduced. For builders of a 7½in. gauge version, the design for Martin Evans' GNR 2-2-2 Stirling would need little modification. One unusual detail easily overlooked, though common to most of David Jones' designs, is that the twin safety valves were mounted transversely rather than one in front of the other. The whistle was forward of the safety valves, instead of the more normal position immediately in front of the cab.

As mentioned earlier, I feel these three engines are certainly among the best proportioned shunting engines ever built, the overall effect having a certain resemblance to Martin Evans' highly successful freelance 5in. gauge Simplex. The most obvious differences are below the footplate: the Highland engine is, of course, equipped with inside valve gear, while its wheelbase is slightly longer and unequally divided, 6ft. 4in. + 7ft. 10in, compared to the equivalent of 6ft. 8½in. + 6ft. 8½in. for Simplex. This seemingly small detail, together with the larger wheels and more spacious cab combine to give the Scrap Tank a generally more imposing appearance, at least in my opinion. The prototypes certainly earned their keep over more than a quarter of a century as 0-6-0Ts, and were only taken out of service when the boilers wore out in the early 1930s. By that time, the LMS possessed large numbers

of the standard Midland type Fowler tanks (known to some as Jinties), and the retention of a trio of completely non-standard shunters could not be justified on economic grounds.

References

1. *A History of Highland Locomotives* by M. C. V. Allchin, pub. Railway Hobbies Ltd., 1947. An excellent little book, years ahead of its time, with several photographs of the Scrap Tanks, some of which are unique to this book. Also contains side elevation drawing by Kenneth Leech of No. 23, which contains minor errors, e.g. boiler bands incorrect, while dome appears too fat compared with photographs.
2. *A History of Highland Locomotives* by Peter Tatlow ("based on the original book by M. C. V. Allchin"), pub.

Oxford Publishing Co., 1979.

A super-deluxe version of ref.

1, printed on excellent quality paper containing much more information and additional photographs, but also the same K. Leech drawing, uncorrected.

3. *Highland Railway Locomotives Book 2* by J. R. H. Cornack and J. L. Stevenson, pub. RCTS, 1990. Includes broadside photograph of No. 23, obviously the basis for the K. Leech drawing, together with three more photographs, reproduction not quite up to the standard in other RCTS publications.

4. *Highland Railway Liveries* by Howard Geddes and Eddie Bellass, pub. Pendragon in association with the Historical Model Railway Society, 1995. This well-researched and superbly produced volume is a model of what a book of

this sort should be, my only criticism(?) is that it covers far more aspects of the Highland Railway than the title implies. Photographic reproduction is as good as it gets, aided by a large number of excellent drawings and diagrams, including a front elevation of a Scrap Tank. Essential reading for anyone modelling the Highland Railway.

5. *The Highland Railway* by H. A. Vallance, 1972 edition pub. Pan Books. Originally published in 1938 with revised versions in 1960s by David & Charles. A good general history of the Highland Railway, but minimal reference to the Scrap Tanks.

6. Postcard of unknown origin of No. 22, shortly after construction. Photographer unknown. This was the main reference for Efty drawing, fig 1.

ME

Highland Railway 'Scrap Tanks': Main Dimensions

Note: these are intended specifically for building a miniature version of this locomotive, so internal dimensions, such as grate area and I/D of boiler are omitted. Figures prefixed by = have been scaled off photographs and may not be precise, while some others may also be suspect, since no official drawings survive. Figures for 3½in. gauge and 5in. gauge are to the nearest 1/64in. and have been calculated at 3/4in. and 1/16in. to the foot respectively. For gauge one, halve the 3½in. gauge figures, for 2½in. gauge, halve the 5in. gauge figures, and for 7¼in. gauge, double the 3½in. gauge figures.

Description	Full size	¾in. scale (3½in. gauge)	1/16in. scale (5in. gauge)
Length over buffers	30ft. 8½in.	23⅜in.	32⅝in.
Length of main frame	27ft. 8in	20⅜in.	29⅝in.
Height to top of chimney	13ft.	9¾in.	13⅜in.
Overall width, width of cab, tanks etc.	Unknown	-	-
Height to top of footplate	= 4ft. 3½in.	3⅞in.	4⅞in.
Height of sidetanks/bunker above footplate	= 4ft. 4½in.	3⅞in.	4⅞in.
Height of cab roof above rail level	= 11ft. 10in.	8⅞in.	12⅞in.
Length of cab	= 7ft. 4in.	5½in.	7⅝in.
Total wheelbase	14ft. 2in.	10⅝in.	15⅜in.
Divided into: leading coupled to driving wheels	6ft. 4in.	4⅜in.	6⅞in.
driving to trailing coupled wheels	7ft. 10in.	5⅞in.	8⅝in.
Diameter of coupled wheels (15 spokes)	5ft. 2½in.	3⅞in.	5⅞in.
Throw of crankpins	1ft.	¾in.	1⅞in.
Pitch of boiler above rail level	6ft. 11in.	5⅞in.	7⅞in.
External diameter of smokebox	= 5ft. 2in.	3⅞in.	5⅞in.
External diameter of boiler over cladding	= 4ft. 8in.	3⅞in.	4⅞in.
Length of smokebox	= 2ft. 9in.	2⅞in.	2⅞in.
Diameter of smokebox door	= 4ft. 2in.	3⅞in.	4⅞in.
Height of chimney above smokebox	= 3ft. 6in.	2⅞in.	3⅞in.
Cylinder bore	1ft. 6in.	1⅞in.	1⅞in.
Piston Stroke	2ft.	1⅞in.	2⅞in.
Length of connecting rod	= 6ft. 6in.	4⅞in.	6⅞in.
C/L cylinders to driving axle	= 10ft. 5½in.	7⅞in.	11⅞in.

John Wilding MBE FBHI begins work converting the pigeon racing timing machine into a domestic timekeeper.

A Toulet Imperator

The first step is to apply layout blue to the square

With this lid removed you will see a blued steel plate about an inch down and the actual clock movement is fitted to the





7. Ornamental brass tubing
8. Drilling the letter 'J' holes
9. Making the saw cut in the Myford lathe.
10. Large washers at the base can be formed from off cut pieces of 1/8in. brass.
11. Completed pillars mounted on the finished base taken at a later stage of the construction.

sections and mark out the positions for the letter 'J' holes and the 5BA clamping holes. The forming of these holes is carried out in the drilling machine (photo 8), and then the work is transferred to the lathe where it is held in the lathe toolpost for machining the straight saw cuts (photo 9). Here we see the Myford slitting saw between centres and the



work is fed into the blade for a distance of some 7/8in. (back gear is recommended). A side cut can be carried out to release one half of the square stock and I did this by hand with a hack saw. It can be seen from the drawing that the lower part of the square stock is 5/8in. long on the left side and 23/32in. on the right side. The holes in the clamping strips can be opened up with a No. 30 drill to provide clearance for the 5BA screws. If the pillars are being fabricated, then the top sections are held in the 4-jaw chuck for drilling the 1/4in. axial holes. At this stage these pillars can be checked for fit on the movement pillars. It will be noticed from the drawing that the pillar on the left requires a light relief filed on the upper inside in order to clear the barrel in the movement.

The lower end of the round stock has extensions machined 1/4in. dia. and 7/32in. length.

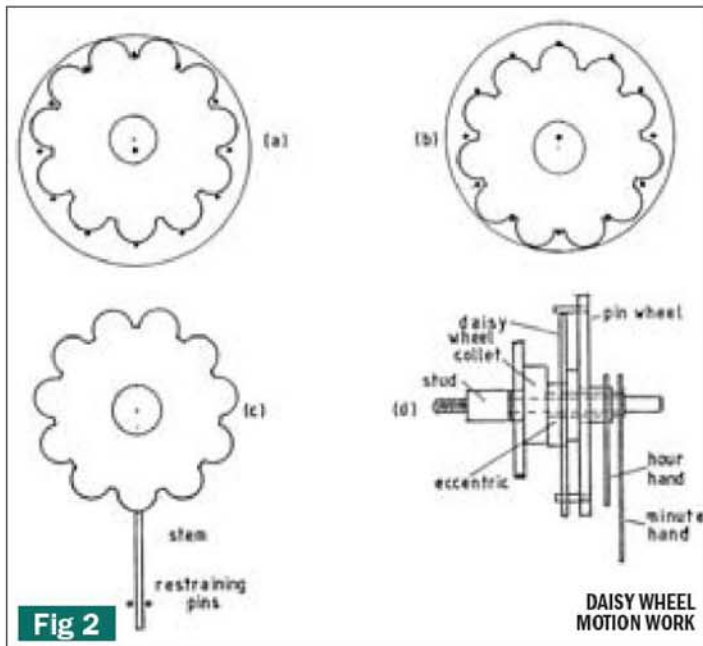
When the base washers are fitted, the whole assembly will pull up tight to the base with the 4BA screws. These washers can either be parted off from round stock or cut out from scrap pieces of 1/8in. brass sheet. They are drilled 1/4in. and then mounted on a 1/4in. mandrel for machining the outer diameters and forming the concave decoration (photo 10).

Before drilling the 4BA clearance holes in the wooden base, a careful measurement should be taken on the actual pillars in the movement as I found these varied in some cases. The pillars on the finished base, taken at a later stage of the construction, is shown in photo 11.

The motion work

I decided to use the 'daisy wheel' motion work. Firstly it doesn't involve any gears and secondly because it is such





a fascinating mechanism. I am giving a description of this device, which I wrote for Dr. Woodward's gearless clock book:

The 'daisy wheel' motion work

Motion work is the term given to the 12:1 reduction between the minute and hour hand. The normal way of obtaining this reduction is to use two pairs of gears, one pair being mounted on a stud fitted to the front plate. The ratios are chosen to provide the 12:1 reduction and also so that the two pairs of gears can share common centres. An example of this is to be found in the normal longcase clock where the reduction is obtained with one pair of gears using 6 and 72 teeth and the other pair of 39 each. When these tooth counts are added together we have a total of 78 in each pair so not only can these gears share a common centre but they can be the same module. Another advantage of this system is that the hands are mounted concentrically and of course the hour hand will rotate clockwise.

Along comes Aaron Dodd Crane who designs a motion work arrangement using only two gears (neither of which is a gear in the accepted sense of the word) and still the hands are mounted concentrically and both rotate clockwise!

Aaron Dodd Crane lived and worked in the USA in the first half of the 19th century. He had

an inventive mind and rather like John Harrison came into clockmaking almost by accident. He certainly did not learn the business by being an apprentice, in fact he didn't think much of the way clocks were designed in those days and straightaway looked for improvements.

The American society NAWCC have produced a bulletin, No. 16 devoted to the life and work of Aaron Crane written by Frederick Shelley, it makes fascinating reading. However, I first read of the daisy wheel motion work in Dr. Philip Woodward's book *My Own Right Time* where he describes the device in the chapter on his gearless clock. He did not in fact use it in this clock because he was unaware of its existence at that time. As Dr. Woodward rightly says the action is not easy to grasp, indeed I read the explanation several times and although I 'thought' I knew how it was supposed to work, I couldn't really visualise how it 'would' work until I started to construct it. I actually cut the daisy wheel out of cardboard with scissors initially before I finally grasped the action.

Description

There are three components in this motion work. Firstly the daisy wheel itself which I show in **photo 12**. This has 11 petals and mounted at its back is a stem which hangs down and is loosely embraced

by two horizontal pins let in the front plate. The wheel has a largish hole that rides on a cam fitted to the centre arbor. As the cam rotates the daisy wheel describes an eccentric motion equivalent to the throw of the cam, its stem riding up and down between the two restraining pins. The third component is a pin wheel; this has 12 pins at right angles to the face of the wheel. The relationship in the diameters of these two items is such that when the daisy wheel is located inside the pin wheel it will only fit when two diametrically opposite pins are located; one in the trough between two petals and the other at the apex of a petal.

The action can be followed on the drawing **fig 2**. At (a) we can see the daisy wheel is supported underneath on the apex of the lower petal while the opposite pin is in a trough. If the daisy wheel is imagined to be fitted on the cam then as the latter turns, the wheel, because it can't rotate, will oblige the pin

wheel to rotate, until after half a turn of the cam the situation will appear as in (b) where the pin at the bottom is now in a trough between two petals. After the next half revolution of the centre arbor the situation will revert to (a) again and the pin wheel will have advanced one twelfth of a revolution. I think this motion work is quite delightful and I don't think I shall ever make the conventional design again.

Photograph 13 illustrates a stage in the construction and, if you hold the pin wheel in one hand and put your finger in the daisy wheel hole, then move it in a circular motion, the daisy wheel rolls around inside the pin wheel.

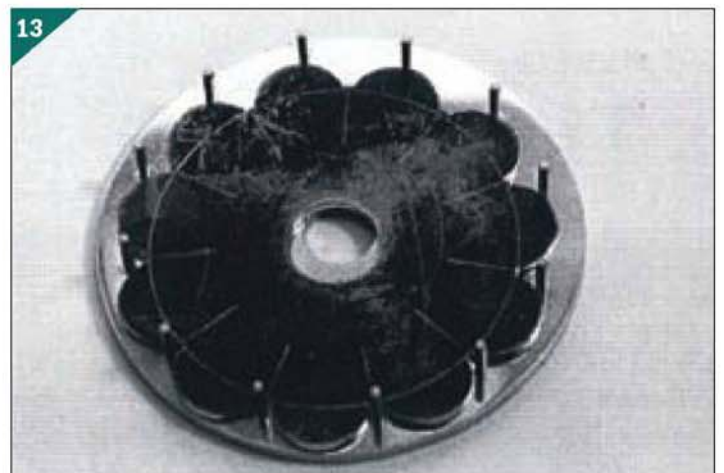
An extraordinary feature is, as Dr. Woodward points out, you do not need 12 pins in the pin wheel. The system will work with as few as four pins and Aaron Crane uses only three, mounted on a three-legged spider and this can be seen in a photo of one of his turret clocks in the bulletin already mentioned. As Frederick Shelley rightly states, Crane's inventions have to be seen to be believed. His inventive mind produced all sorts of interesting devices such as a walking escapement. His clocks were usually month or year going and he was an advocate of the torsion pendulum. The bulletin makes fascinating reading.

● *To be continued.*



12. Daisy wheel (aptly named!).

13. Daisy wheel located inside the pin wheel.



McONIE'S OSCILLATING ENGINE

Anthony Mount tackles various steamchest and cylinder parts.

*Continued from page 455
(M.E. 4336, 10 October 2008)*

We now come to a part not found on many engines: the steamchest top cover (**part 17**). I would imagine that on the full size engine, the steamchest top cover was a separate item bolted on, but with this size of model there is very little metal in the cylinder for bolts. I decided to machine a slot in the cylinder valve face to locate the steamchest top cover, and to silver solder or Loctite it in place. If you are only going to run the engine on compressed air, the cover can be a close fit in the groove and held in by Loctite. However, if you intend to steam the engine, the cover should be silver soldered to the cylinder as mentioned in *M.E.* 4334, 12 September 2008.

The cover and boss are shown on the drawing as one piece. However, most people will find it easier to make it from two pieces. Start by machining a piece of brass bar or plate to the overall dimensions. The nearest stock bar size will be 3mm thick so machine this down to 2mm. If using plate, engraving brass is much nicer

to machine than ordinary brass. I used wider material (25mm), which was held in the vice on the milling machine by the long edges to reduce the thickness, taking care to avoid the vice jaws! The thicker edges were removed when the width of the material was reduced.

Drill all the holes using co-ordinates. The holes for the gland studs can be countersunk on the underside for long screws, these pass right through the plate and also hold the boss to the plate. The boss can be made from a block of brass and the holes again drilled using co-ordinates. A bit of judicious filing completes the shape. For the 12BA threads I did not tap full depth but counterbored to clearance size leaving only 2mm to be tapped. The counterbored hole also acts as a tapping guide. The two parts can be silver-soldered together if you wish.

The steamchest top cover can now be fitted to the cylinder using either silver solder or Loctite. To silver solder: flux the groove, place the cover in position, apply more flux and place a length of 1.6mm silver

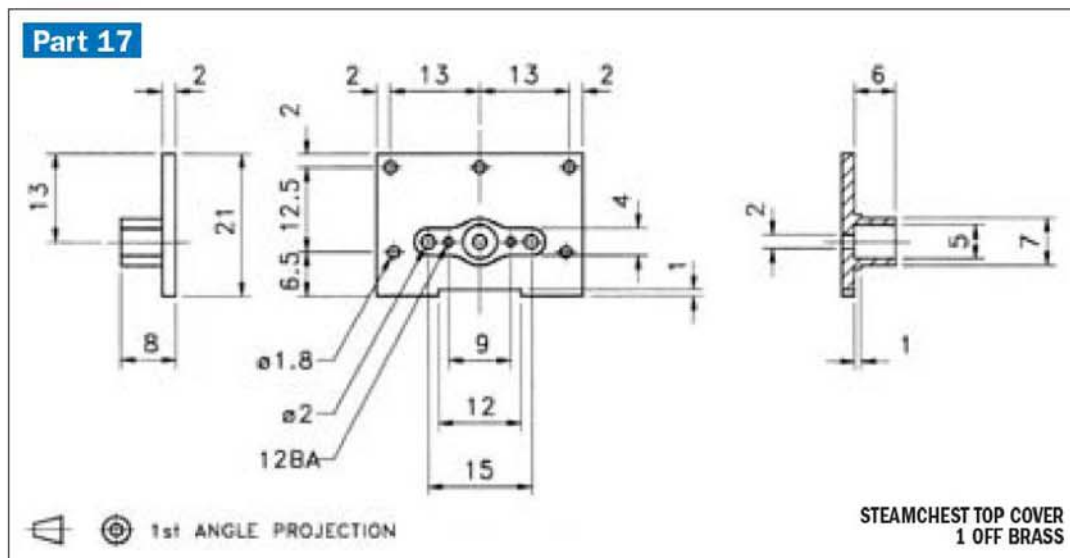
solder against the joints either side. Heat up with your gas torch and watch the flux bubble up and go stiff; this may well displace the solder strips, so push them back into position with a push rod. Reapply the heat until the flux goes watery, shortly after that the solder will run freely around the joint. Allow to cool and then clean up the cylinder. Use a fine flat file to square up the joint where the steamchest will fit. Finish off with fine abrasive paper, wrapped around a flat file, to leave a smooth flat surface on the valve face.

Slide valve (Part 18)

Slide valves are tricky things to make, not helped in this case by being so small. Either bronze or brass can be used. Start by machining up a block to the finished overall dimensions. Hold in the vice of the vertical mill and, with a 3mm slot drill, machine out the bottom cavity. It is probably safest not to machine the full depth in one go, but rather in a series of steps. If your milling machine has XY stops it is best to set these, to restrict the movement of the table, which helps to prevent mistakes. Turn the slide over in the vice and machine the two slots for the nut and valve rod. The nut should be an easy sliding fit so that the valve is free to contact the valve face. It also needs to be able to lift to clear condensate if that occurs.

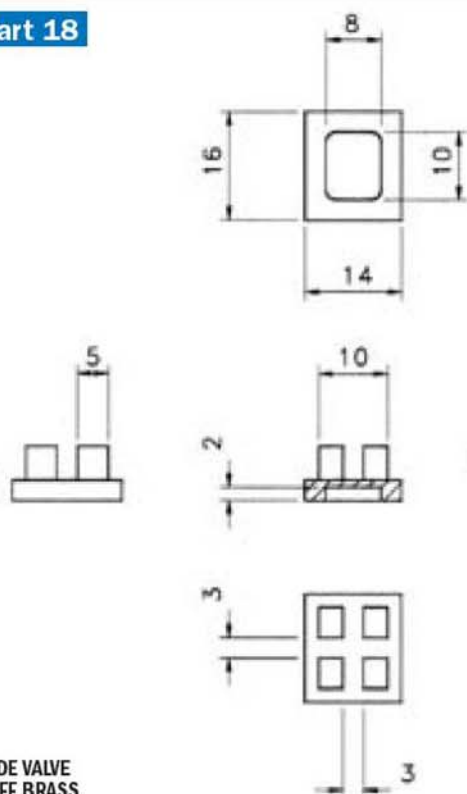
Rocker shaft bearings (Part 19)

The bearings for the rocker shaft are simple flanged sleeves. Free cutting phosphor bronze is the ideal material, second choice gunmetal or, failing that, brass. Drill and ream the bearing hole and then, with a short parting tool, form the seating to fit in



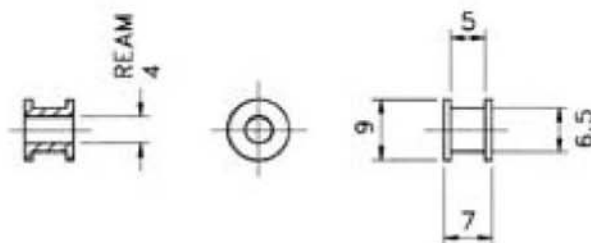
Part 18

SLIDE VALVE
1 OFF BRASS



Part 19

ROCKER SHAFT BEARINGS
2 OFF BRASS



and a very light touch. On the last hole I broke the tap. I had already broken a drill, so for a while I was not a happy chappy!

The tap was carbon steel so the whole block was heated up to bright orange and left to cool slowly. Then, very gingerly, the clearance drill was used to drill down the 6 millimetres. Fortunately the tap had broken off somewhere down, so there was a hole to guide the drill. Then I changed to the tapping drill and, with trepidation, drilled through the tap, then finally re-tapped.

Sometimes a broken drill can be persuaded to come out with a little probing with tweezers - but not this time. The drill was HSS which retains its hardness at red heat but, as the block was quite small, I thought I would try to soften it. The maximum temperature I could get the block up to was the same as for the tap, a very bright orange. After slowly cooling I was relieved to find that it was soft enough for the new drill to cut through it.

the pedestal. The diameter needs to be accurate so that the bearing is clamped tight. The width can be a little oversize to allow for the thickness of paint. Part off, and the job is almost complete. The oil hole can be drilled through the cap during trial assembly.

Bearing caps and rocker pedestals (Parts 20 and 21)

The bearing caps and pedestals are best described together. Cut off two slices from a 25 x 5mm section mild steel bar and machine to 15mm wide. Cut

each slice into two. Machine the bigger pieces 14mm long and the smaller pieces 5mm long. Using a 6mm cutter, machine an 8mm wide tongue on the smaller pieces and a slot in the bigger pieces to take the tongue - the fit needs to be close. Three flute FC3 type throwaway cutters are ideal for both milling and slotting.

Reposition in the vice and, after locating the faces with an edge finder, use co-ordinates to position the holes. Most milling machines are too slow for drilling small holes, so spot with a centre drill and transfer

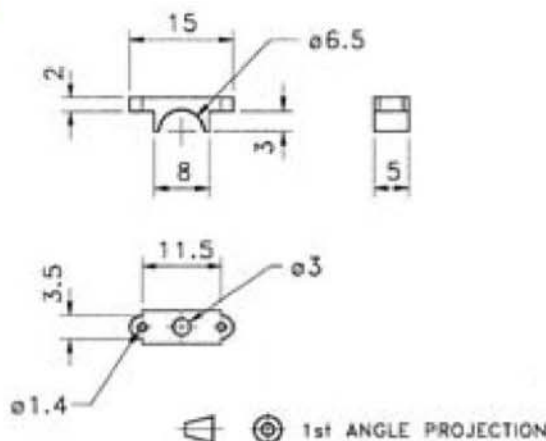
the job to the high speed drill. I have a small 10mm capacity drilling machine that I use for about 90% of my drilling.

For the body of the pedestal, spot both ends and drill 12BA clearance 6mm deep from both sides, then change to the tapping size for the remaining 2 millimetres. Take great care with these tiny drills by continually withdrawing the drill. Watch the depth dial - as drills break through, they are prone to snatch and break.

The clearance hole will act as a guide for the tap and at 12BA use lots of cutting compound

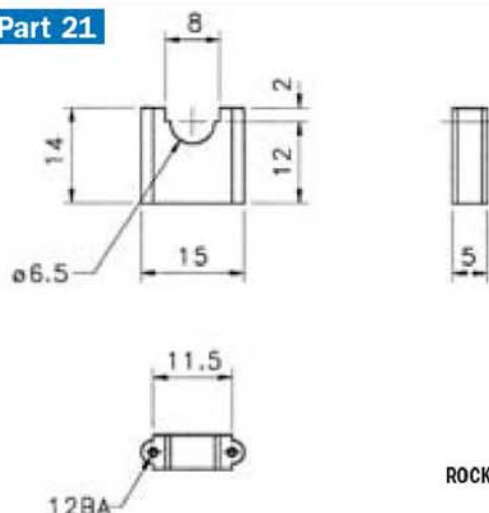
Part 20

BEARING CAPS
2 OFF MILD STEEL



Part 21

ROCKER BEARING PEDESTALS
2 OFF MILD STEEL



OSCILLATING ENGINE

So the pedestal was saved, but if you consider the time it took and the wear and tear on the nerves it would probably have been just as quick to make a new one. So, be warned, go steady with small drills and taps and use plenty of cutting oil or compound.

Soldering the rocker pedestals

As I said in M.E. 4336, 10 October 2008, there is a choice of cylinder end cover and method of fitting the rocker pedestals. If you chose to solder the pedestals to the end cover this is how to do it:

Use 12BA bolts to fix the rocker bearings in place. As there is only one bolt per bearing, use a short length of rod to bridge between the two bearing pedestals; this will need to be necked in the middle to clear the gland flange. The rod can lie in the bearing seating and is used to align the two pedestals.

Note also that a special flux is needed for stainless steel. If the bearing is pulled down tightly, there is nowhere for the solder to go. To allow the silver solder to flow underneath, I filed a few shallow grooves in the bottom of the bearing block, and made a few small centre punch marks to raise the bearing slightly. Turn the cover over so that the underside is at the top. The little ledge formed by the overhang of the bearing will form a location for a short length of silver solder rod. After soldering, I am afraid there is no short cut to the chore of cleaning up the cover. Use fine abrasive paper and just

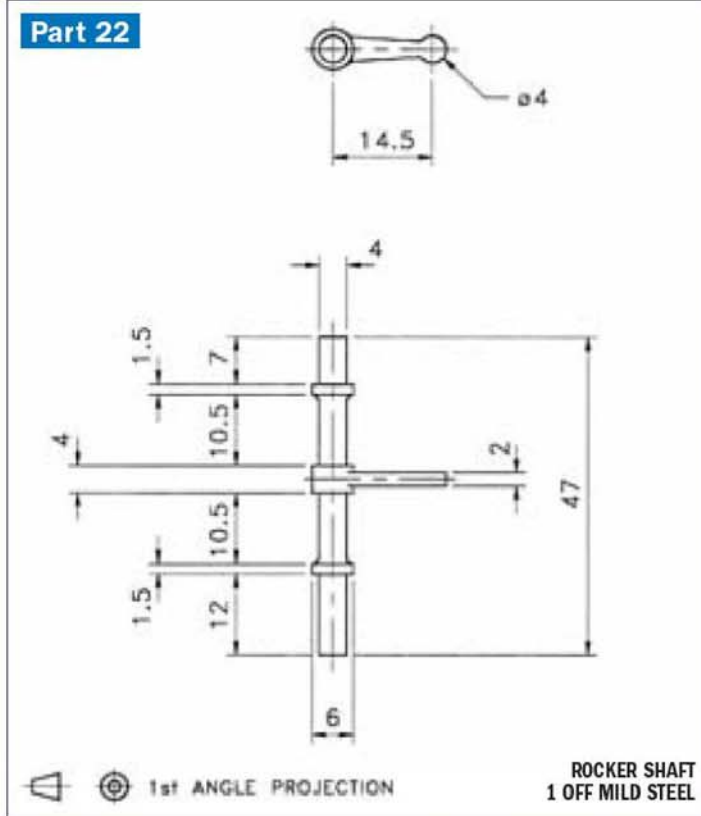
stick at it. If there are any solder runs, be very careful when removing them not to score the face of the cover.

After the rocker pedestals have been silver-soldered in position, the new stud holes can be drilled and tapped from the underside. To locate these two holes, I made up a cup washer, the same diameter as the cylinder cover, and bored it out to fit over the cover spigot. I drilled eight holes at the same setting as the stud holes in the cover. It was then just a case of positioning the cup washer on the cylinder cover, clamping it in place, and drilling and tapping the two additional holes 6BA. These can only be drilled the depth of the cover as they come partly inline with the bearing pedestals.

Rocker shaft (Part 22)

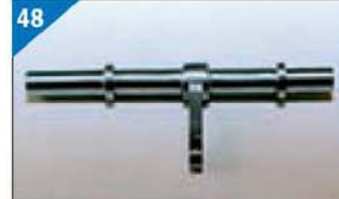
Mounted over the cylinder cover is the rocker shaft that transfers the motion from the cylinder and eccentric to the slide valve. It could be fabricated, but it is an interesting exercise to machine it from the solid. Start with a piece of mild steel bar 19 x 7mm section. This will need to be machined down from a standard section. The bar needs to be about 30mm longer than finished size for holding in the lathe chuck. Mark out the outline and then saw and mill roughly to shape (photo 46).

Mount the blank in the four jaw independent chuck and lightly centre the end for tailstock support. Turn down the shaft sections to 6mm dia.



leaving a 2mm web for the arm. Reduce the shaft between the flanges to 4mm dia. and the same at the ends (photo 47).

Begin with a R-H cranked knife tool and turn the 6mm shaft dia. at the front end and also face the arm. Change to a parting tool, with enough overhang to clear the arm, and turn the other 6mm dia. section. Change to a L-H knife tool to face off the other side of the arm to 2mm thick. Change back to the parting tool to form the 4mm dia. either side of the arm. The R-H knife tool can be used for the 4mm dia. region that fits in the bearing, but the parting

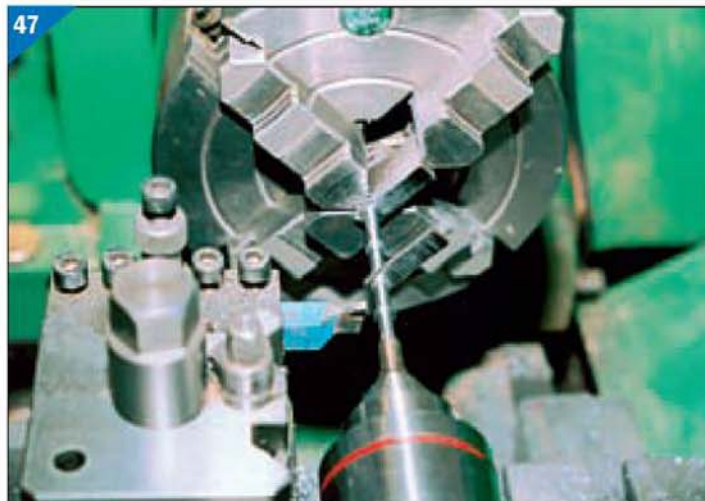


tool must be used for the 4mm section at the other end.

Use sharp tools and neat cutting oil to get a good finish. Do not be tempted to use a file or abrasive paper for the final finish as the arm is going around like a scythe and can easily slash a finger!

Remove the shaft from the chuck and saw off from the parent metal. The shape of the arm can be formed using a square pillar file and the edge finished by draw filing with a smooth cut, half round, Swiss file. Mount the shaft in the 3-jaw chuck and, taking light cuts, face off the ends to the finished length. The finished rocker shaft is shown in photo 48.

● To be continued.



46. Rocker shaft blank.

47. Careful use of the parting tool!

48. Finished rocker shaft.

The British Railways 82000 class 2-6-2Ts (Swindon-built, of course!)

Peter Rich describes a Swindon-built class of BR standard locomotives which had a hint of GWR influence.

I was out on the foreshore again with the pipes the other day practicing the *Pìobhaireachd of Donald Dhu* when my mind drifted off into our model engineering world with the thought that there are engines of which we never see models of and for which there appears to be no commercial design. Yet, the

engine was quite a prominent type within the range of full-size locomotives. It occurred to me that the British Railways 82000 class of 2-6-2 tank engines fall into this category. Not a great deal has been written about them in the railway enthusiast press and I don't think I have ever seen them mentioned in *Model Engineer*. So I thought to myself "let's have a bit of a look at them and see if we can come up with something of model engineering interest."

When completed, they totalled 45 locomotives numbered from 82000 to 82044 and were all built at Swindon together with their tender counterparts, the 77000 class of 2-6-2s. Both types were designated Class 3. I have a feeling that in these two examples, Swindon was trying to sneak one past the mainly LMS management which had largely taken over the top jobs when British Railways were formed. Mr. R. A. Riddles became the overall Chief Mechanical Engineer for British Railways and all of the B.R. steam engine designs were attributed to him, hence my reference to the 'Riddles' 82000 class in the text. Having said that he did not actually produce a design himself, he was more in the position whereby he told his design engineers what he wanted and they produced it for him, a situation which held sway on most of the pre-BR railways. When the new designs were shown to him he could reject or modify them or even change the type completely.

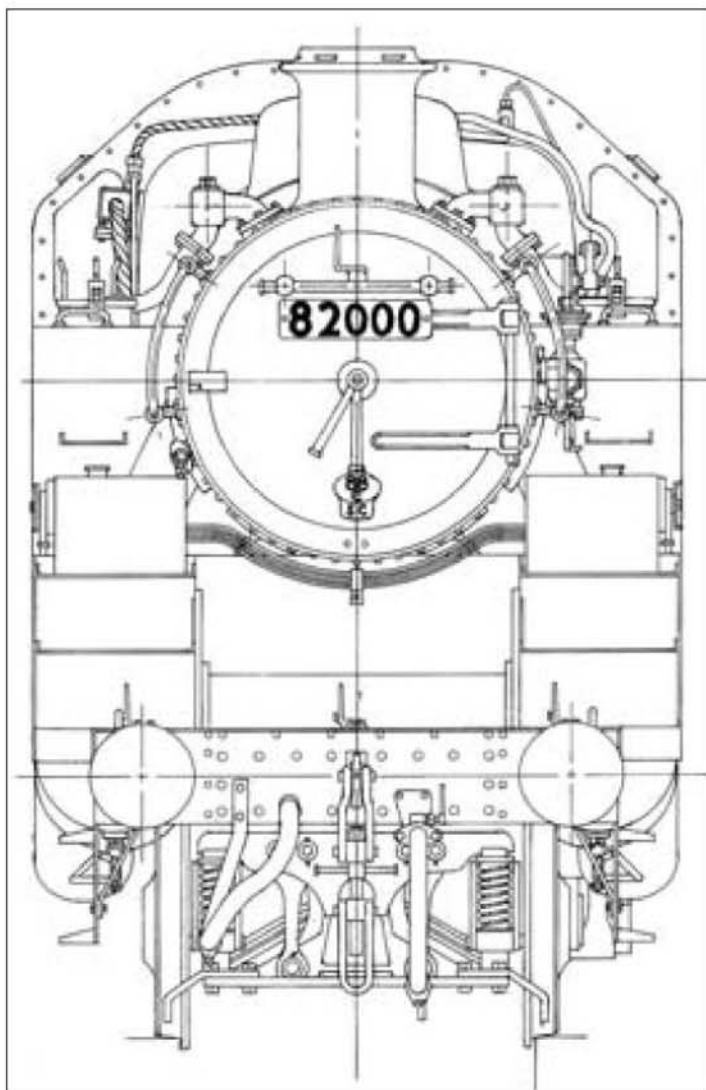
Under Riddles superintendency, responsibility for individual designs was farmed out to the various regional design offices, whereby Crewe was responsible for the overall design of the 'Britannias', Brighton for the 92xxs, and Swindon became responsible for the 82000 and 77000 classes.

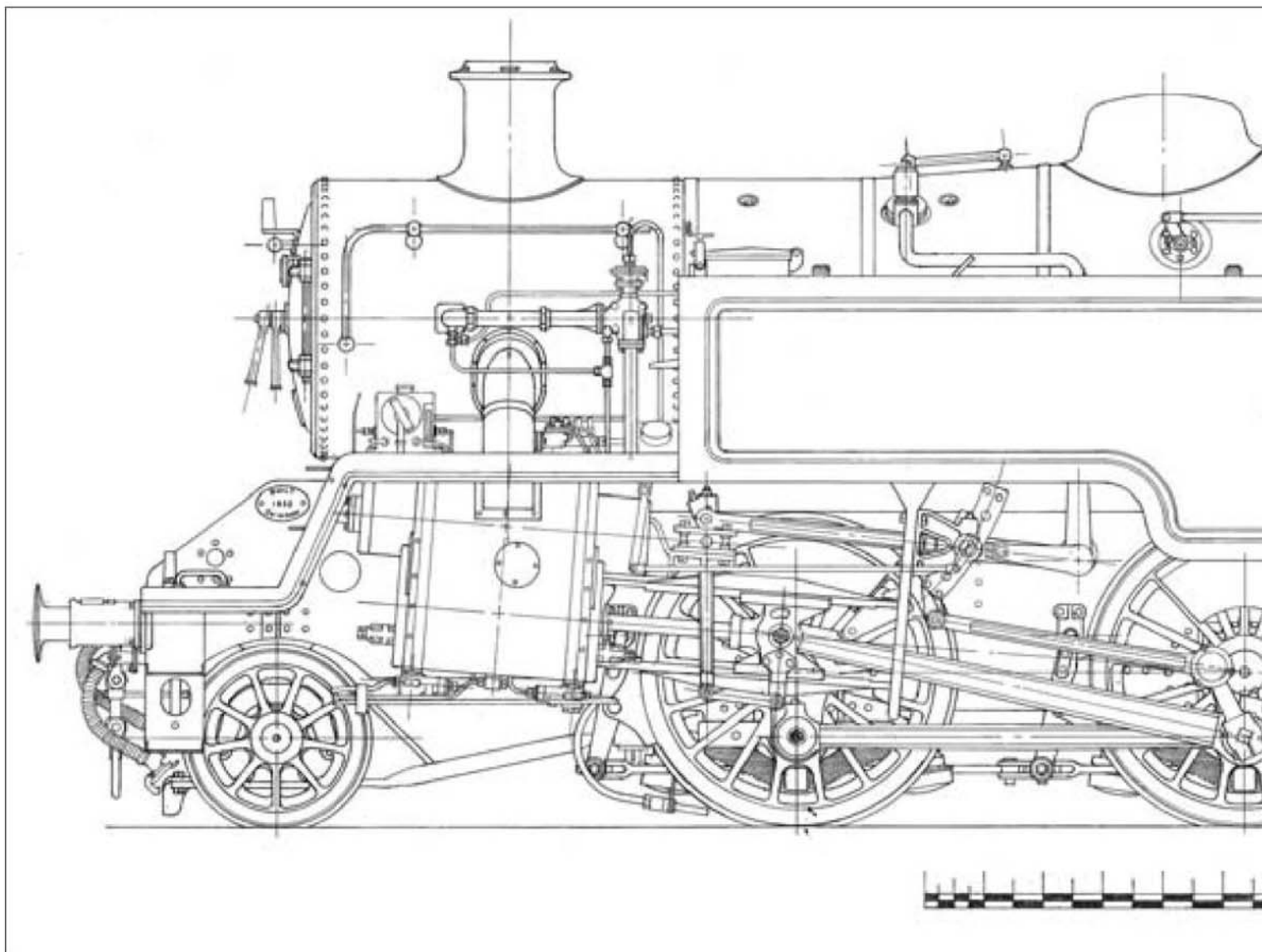
Bearing in mind Riddles' LMS background it is reasonable to assume that there would be a lot of LMS influence in the general design of the standard engine classes. However, when it came to individual components and fitments, the best from each region was chosen to be incorporated in the new designs. Hence, the ex-GWR influence was seen in the design of some of the boiler mountings such as the water gauges and the injectors.

GWR influences

With the 82000 class, I feel Swindon got their ideas in through the back door before anyone noticed that such things as the cylinder relief valves and steam pipe cladding were pure Great Western. The boiler was the GW standard No. 2 boiler modified to have a dome where the safety valves had been, and the safety valves separated and re-located to the top of the firebox.

The cylinder relief valves on later engines had the modified BR, design, but the early batches very definitely had the original Great Western type. The pet cock situated on the lower right hand side at the front of the smokebox was pure Great Western as were the snifting





valves located on the rear of the steam pipes as per late-GW practice. All BR standard locomotives allocated to the Western Region also had Great Western lamp irons fitted.

The original coupling rods were fish-bellied, fluted types but those locomotives which were eventually overhauled at Swindon had them changed for the GW-style rectangular rods.

Wheels

Prospective modellers should note that the wheels contained odd numbers of spokes and that the wheel rims were of very pronounced 'V' section between the spokes as was typical of LMS practice. As an aside here from the main subject, most designers pay very little regard to the wheels on our models. This is a pity because

I have found over the years that design of wheels can be of very interesting shapes particularly those of crank bosses. At the turn of the last century when Churchward was developing his designs at Swindon, some very artistic work was put into the design of his wheel bosses. These were modified over the years and when I was drawing my plans for a 5in. gauge 'Saint', I found that no less than seven visibly different boss shapes had been employed on this class and frequently different shaped bosses could be found on the same locomotive. When I did the pattern making for them I found that by sticking to the full-size design shape, the pattern was easy to make and withdrew from the mould very easily.

Tanks

A further modification was a grab handle fitted on top of the boiler (as shown) which was standard Great Western practice on taper boilered tank engines. Another departure from the standard BR practice was noticeable in the filler caps for the side tanks. The original type fitted appeared to be based on the GW screw handle type but later engines may have had the later GW snap-over locking type. If not fitted when built, they were certainly fitted at Swindon when the engines were overhauled there.

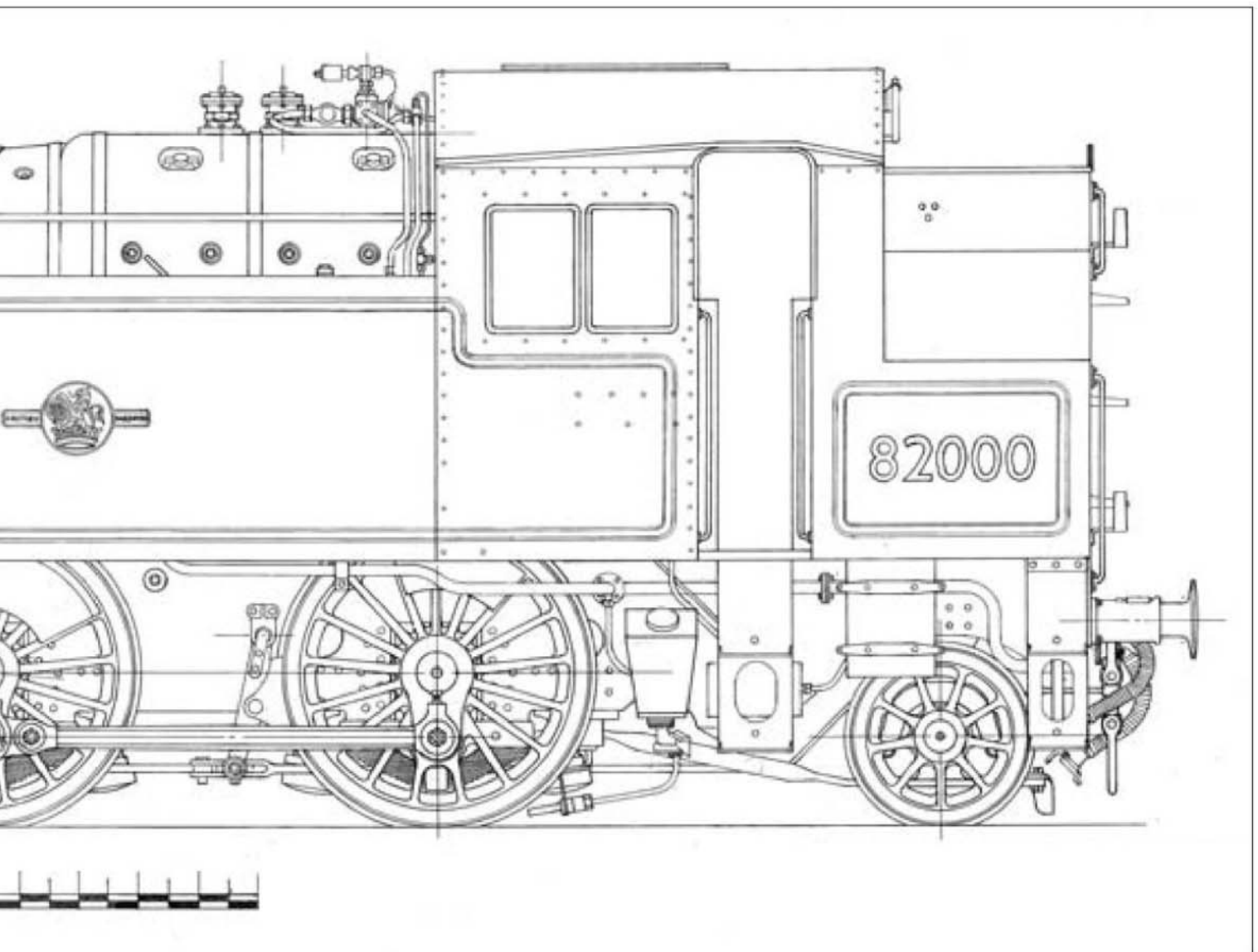
Another point which may have been a departure from the 'standard' was that the front outside corners of the side tanks were turned inwards with a radius (as was Swindon practice) whereas the other two

tank engine classes had these corners squared off.

Liveries

When built, all locomotives in the class displayed the LNWR 'Blackberry Black' livery and lining out on tank and bunker sides with the number on the bunker side. When the Middle Chrome Green livery was re-introduced for most GW engines in the mid-1950s, Swindon also turned out the 82s in this lined-out Middle Chrome Green livery, thus further extending the Great Western influence on this design. By the 1960s austerity had started to creep in again and some of the 82s were turned out in plain green livery.

Andrew Wilson wrote an excellent article about this class, published in the January 1996 issue of *Steam Days* and



which I have referred to greatly for this article. He provided a list of the final liveries carried by each engine and I include it here for authenticity's sake and to provide the prospective model engineer with correct information. In lined black were numbers 82000/10-19/23-29, unlined green 82007/20/21/30/31/37/39/40/43 and in lined green 82001/08/09/22/32-36/41/42/44.

It should also be noted that at least one engine carried its number on the cab side instead of the bunker, the livery being the black lined-out type with the lining also omitted from the bunker, 82044 was one example.

Smokebox number plates were standard throughout

the range of the BR standard classes and were 2ft. long by 6in. wide with the numerals being 5in. high. The numerals for the bunker/cab sides varied in height, most works using eight inch high numerals, but Swindon used nine inch numerals while Darlington and Cowlairs used ten inch numerals. Doncaster differed from the others works in that they used 8in. for the Class 4 2-6-0s and 10in. for Class 5 2-6-4 tanks and the 9Fs. This is the reason why on some photographs the engine numbers appear to be larger than others.

The depot code plate fitted at the bottom of the smokebox door was standard size for all British Railways steam locomotives - 7½in. wide by 4½in. deep. All of the standard

Basic dimensions

Boiler	Barrel 4ft. 5in. dia. increasing to 5ft. 0½in. dia. Firebox 7ft. 0in. long by 4ft. 0in. wide Pressure 200psi. Pitch 8ft. 7½in.
Cylinders	17½in. dia x 26in. stroke.
Total length	40ft. 10½in. over buffers.
Front overhang	2ft. 2¼in.
Rear overhang	2ft. 6¾in.
Wheel base	8ft. 9in. + 7ft. 7in. + 7ft. 9in. + 8ft. 6in. Total 32ft. 7in
Tank capacity	1,500 gallons.
Bunker capacity	Coal 3-tons.

82000 CLASS LOCOMOTIVE

engines carried self cleaning smokeboxes which is denoted by the 'SC' plate combined with the depot codes plate as shown. Except for the three large Pacifics and some of the 73000 class 4-6-0s, all of the standard classes were fitted with a Great Western whistle.

Driving

The driver's position was on the left side of the locomotive and he was provided with a good seat with all controls conveniently at hand. Everything could be operated from his sitting position. I found this to be all very well if you were driving the engine forward but it was a different matter when driving them in reverse. I never drove one of the 82s but I did drive many of the Standard tender engines about the shed at Ebbw Junction. These included the 73xxxs, 75xxxs and the 9Fs and I found that to drive backwards you either had to turn 90deg. and face inside the cab while looking to your right through the tender window and try to operate the controls with your left hand by reaching back behind you, or you had to stand up and lean out of the cab window while also operating the controls which were now behind you. The back and fore regulator handle was most awkward to manipulate in these circumstances. Prospective builders should note that the sides of the bunker tapered inwards toward the buffer beam from waist level.

Tanks

In his article, Andrew Wilson referred to the tank capacity of 1,500 gallons and said this was possibly an Achilles heel of the design as they had to frequently stop at platform ends for a top up. I have to say that I agree with him that 1,500 gallons seems to be a small capacity for such a large tank engine. Indeed some of the much smaller Great Western pannier tanks of the time carried 1,300 gallons while the engines of the 5600 class, a similar size to the 82s, carried 1,900 gallons and the Taff Vale 'A' class carried 1,700 gallons.

In light of this, it is interesting to note that when they were sent to South Wales, it was intended that the 82000s were to replace the 'Taffy' and the 56XX classes on the valley passenger services. I find this small water capacity all the more puzzling because the inside of the coal bunker was hopper-shaped to allow the coal to self-feed down to the shovelling plate and there was plenty of room underneath this to have carried at least a further 500 gallons. A bunker tank was a standard practice on Swindon's GW engines.

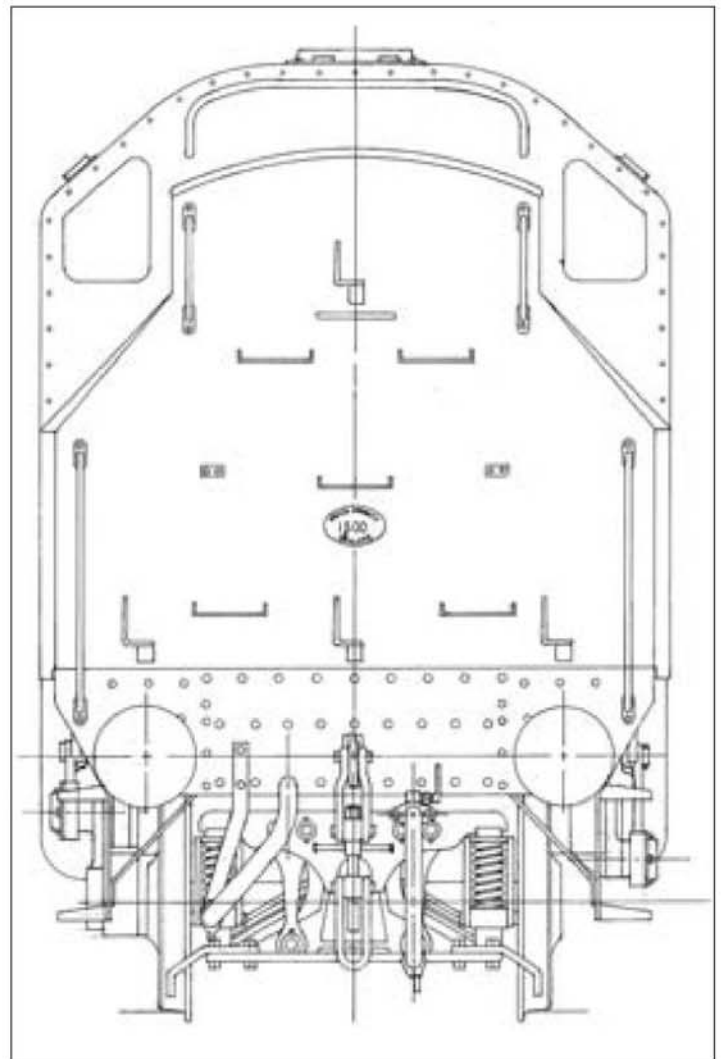
Injectors and ATC

Two GW type live steam injectors were fitted both to the R-H side under the cab and alongside each other with the inboard one slightly higher than the other for easy access. I don't know whether No. 82000 carried the ATC battery box and vacuum reservoir tank behind and to the rear of the left hand cab footstep as shown, but some locomotives did have it here and I have included it for the very purpose of showing its size and position for prospective modellers.

Performance

Despite these engines being designed and built at Swindon, the Western Region crews did not take kindly to them. Colin Jacks, a Tyseley fireman where they were first allocated, has stated that they weren't up to the standard of the GW types they were meant to replace. Indeed, the Tyseley allocation was very soon transferred to South Wales where they took up residence at Barry and worked the trains on the South Glamorgan line and on the passenger trains up to Treherbert.

Having witnessed these engines working through Cardiff, I can only say that they seemed to be entirely on top of their tasks when I saw them, so perhaps the Welsh crews got more out of them than elsewhere on the Western Region. Enginemen in South Wales were quite used to working on other than



GW types because they had to contend with a lot of the absorbed companies' engines right up until the mid-1950s, probably more so than in other areas, so this may have been a reason why they got more out of the standard classes than elsewhere on the system. Older readers will recall that the entire allocation of the Western Region BR standard Pacifics of the 'Britannia' class were eventually concentrated at Cardiff Canton Depot because crews elsewhere were not happy with them and yet the Welsh crews worked well with them.

My old friend, driver Bob Gale, told me that the fastest engine he had ever driven was one of this class when he was required to work one of them 'light engine' very late in the days of steam on the Western Region.

Unfortunately for the class they were destined to be the

last built for the work they were assigned. Their became available just at a time when the sort of work they were built for was being withdrawn, given to the new diesels or was rapidly transferring on to the road system of this country. They were, after all, classified as Class 3 which covered a sphere of work which the management was no longer interested in. Indeed, it was the policy of the British Railways management at the time that they were only interested if you had 500 tons to transport. Pick-up freights and single wagon loads were not for the future and all of the smaller firms and businesses which had railway lines laid into them very soon had them torn out and therefore couldn't put their products on the railway in any case.

But, ours is not to reason why, but to build our models and enjoy the hobby.

ME

Peter Spenlove- Spenlove has some screwcutting tips to make this useful procedure easier.

1. View of the indicator from above. For convenience I have replaced the $\frac{1}{4}$ in. hex nut with a wing nut. On large lathes this dial is set into the actual carriage casting and a permanent part of the lathe.

2. The Myford screwcutting dial indicator. Dial on top with eight lines, four of which are numbered, the others unmarked. An oiling nipple is to be used occasionally. The body is a zinc die-casting with a mounting boss for a $\frac{1}{4}$ in. BSF stud. A bronze 16-tooth gear is shrouded to engage with the leadscrew.

3. A red wax crayon is stored in the gutter of the milling machine table.

4. The numbered marks have been filled with red wax crayon for easy visibility.



A few decades ago it was usual for machinists in jobbing shops to keep a piece of chalk by their machine. It was used for marking positions, numbers and gear teeth. Before lathes were fitted with screwcutting (Norton) gearboxes, to connect the mandrels and leadscrew, one had to 'do a sum' - to work out which gears, from a set, were to be fitted in order to cut a chosen pitch (tpi) of screw thread.

As a first year apprentice in the lathe shop, you would have been shown how to use the chalk to mark a gear tooth, faceplate or chuck after closing the clasp nut. Note the chalk positions relative to more chalk marks on fixed points of the headstock. Each time you started another traverse, engage the clasp nut at the same chalk alignments. With luck, the new cut should follow the previous one.

Later, lathes were fitted with a gearbox and screwcutting dial indicator set into the carriage casting close to the operator for easy viewing (photo 1). Around the dial's edge were radial lines some of which were numbered. On a shaft running down from the dial was a gear in engagement with the leadscrew (photo 2). With work in the chuck, the leadscrew and the gearbox running, and the clasp nut open (not engaged), the carriage will not be synchronised to the headstock or leadscrew. However, the leadscrew will still be driving the threading dial; its



unmarked and numbered lines rotating past an index mark.

First pass

The first cut is started by engaging the clasp nut when a line (say number one) passes the fixed mark. Start all future cuts when this number passes the same spot. Do not disconnect any change gears, etc. Sometimes it is possible to close the clasp nuts at two or four lines instead of waiting for your chosen line to come around. Whether this is successful depends on the thread pitch being cut and the dial gear and leadscrew threading.

On the Series 7 Myfords, ($3\frac{1}{2}$ in. centre height) the leadscrew is 8tpi. The indicator dial gear has 16 teeth and it has eight marks on top with four of them numbered. The lines on my Myford dial (circa the 1960s) are cut deeply - enough to hold the red wax from a pencil (photo 3). I had noticed that the red had gone and as, I filled in the four numbered lines (photo 4) while cleaning down after an oily job.

Myford's threading kit

Some Myfords were sold minus the threading dial indicator, but it was easy to buy and fit one. The fixing place on the carriage was already machined. The dial kit - if I remember correctly from the 1960s - consisted of a mild steel stud screwed $\frac{1}{4}$ in. BSF, two or three red, vulcanised washers plus one steel one, a $\frac{1}{4}$ in. BSF hex nut and the threading dial/gear assembly.

Because hobby lathes are liable to become choked with swarf, especially behind the apron and leadscrew, the dial gear can be swung out of engagement with the leadscrew.



Alignment of the indicator

The fibre in the vulcanised washers allows the dial casting to be moved in or out quickly, but they have another more important purpose: adjustment of the threading indicator so that it reads correctly relative to the clasp nut engagement.

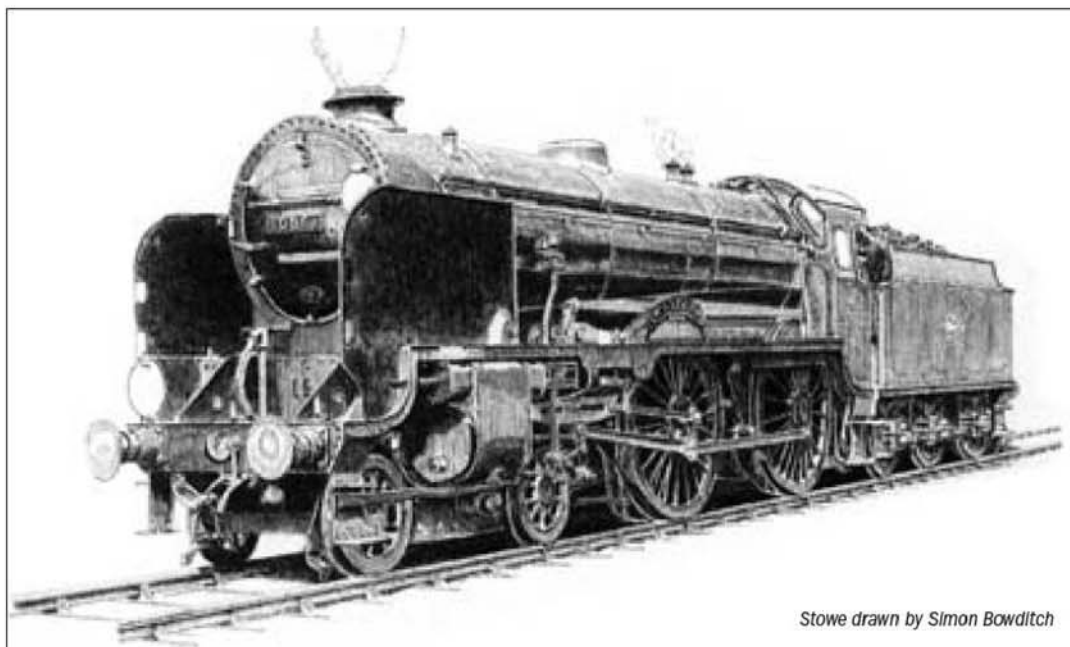
First, clean the leadscrew so that the clasp nut closes firmly. Try the rack traverse to make sure. Screw the stud in firmly to the right hand corner of the carriage and facing right. Slip on a couple of fibre washers, the dial assembly, another fibre washer, then the steel washer. Add the nut and tighten gently with the gear engaged with the leadscrew. Look at the dial. Its lines may not line up with a fixed one. With the handwheel at the tailstock, turn the leadscrew as you watch the dial. The relative positions of the lines should not change. If this is so, then everything is correct except one. That is, the number of washers on the left of the dial casting.

Don't alter anything else, but remove or add washers until the lines are in perfect alignment with the dial gear fully engaged and the clasp nut tight.

Now, if you open the clasp nut and rack the carriage along and perhaps turn the leadscrew, the clasp nut will again close easily when the same line aligns. But also, other lines may line up. In this case, if a screw thread was being cut, the next pass won't follow the last one! Lathe guides and books often mention these exceptions in the screwcutting pages.

● To be continued.

STOWE - Southern Railway Schools class locomotive



Stowe drawn by Simon Bowditch

Neville Evans
considers bearing
aspects before
describing the tender
chassis for *Stowe*.

*Continued from page 444
(M.E. 4336, 10 October 2008)*

As I have mentioned many times, I usually find the readers' letters page to be of great interest and this week's offering is no exception (M.E. 4336, 10 October 2008). I must congratulate Norman Barber on his neat solution to the problem of scale appearance in the clack valve. I can honestly say that his idea is quite original and that I've never seen anything like it before, otherwise I should have used it as a standard fitting a long time ago. Nice one Norman, keep them coming. If I may try to gild the lily (slightly), may I suggest a copper/asbestos crushing washer instead of a soft solder behind the olive, purely as a matter of convenience.

Ron Wright (in the same issue) seems to have hit the jackpot with his de-ionising device for providing clean, lime free boiler water. I've never tried it, as one of the benefits of living in South Wales is that we have soft water straight from the tap, but it should be a boon for those of us who are cursed with harder water.

Stephen Atkinson complains, rightly, about the high rate of wear that is endemic in small, poorly lubricated plain bushes. May I suggest that one or all of the following will ameliorate if not cure the problem.

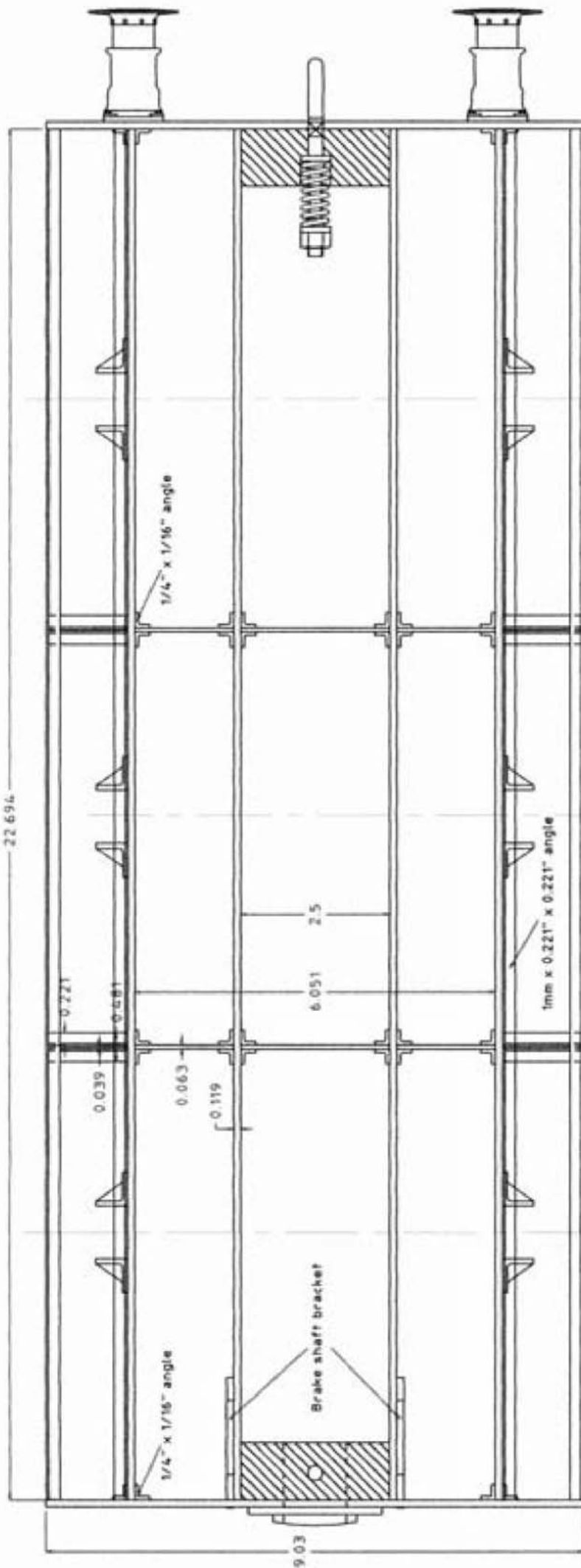
1. Substitute cast iron for brass or phosphor bronze in highly visible outside bearings. Buy it from your friendly neighbourhood metal supplier, preferably in the form of Meehanite, a fine grained centrifugally cast iron which may be obtainable in stick form, but is best cut up from a larger piece, thus ensuring homogeneity.

2. Do as I do and substitute small roller or even ball bearings for plain bushes and pins. These invaluable artefacts are available from most of our advertisers, as well as local bearing suppliers (*Yellow Pages*). In the next gripping instalment, I shall append a drawing of the standard long con-rod GWR Stephenson valve gear expansion and lifting links as fitted to all the standard 4-6-0s. The drawing shows both the plain and the alternative roller

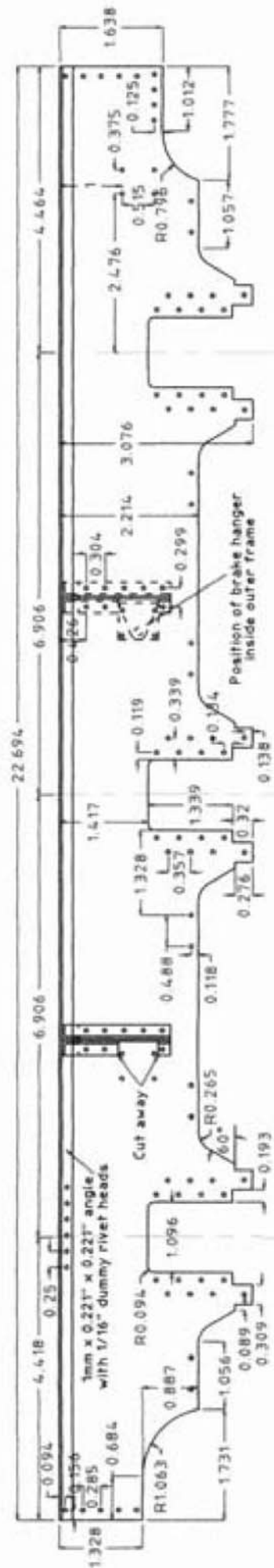
bearings. The expansion links are bored to take INA 2YATN needle roller bearings and the bearing spindles are a press fit in the respective eccentric rods. A great advantage of this layout is that the eccentric rod ends form a shield preventing the ingress of grit to the bearings. Remember that it may be far more economic to use metric bearings than imperial, a 4mm roller clutch for example is less than half the price of an imperial counterpart. Simply adjust pin and bore hole sizes to suit. There are probably smaller needle rollers than the Torrington B24 which is $\frac{3}{8} \times \frac{1}{4} \times \frac{1}{4}$ in. size, but if there are, I can't say that they are readily available. A B24 fits neatly into a $\frac{3}{8}$ in. boss however, which gives one a lot of scope for improvement.

3. In the series on *Penrhos Grange* and also recently in the drawings for *Stowe* valve gear, I mentioned, and drew, ball bearing eccentrics as devised by my friend Ivor (the engine) Roberts. These devices have been running in Ivor's *Torquay Manor* and his 6100 tanker for 15 or so years, and are still totally free from wear. They are lubricated annually from the outside by means of a pressure oil can which forces out any bits of extraneous muck at the same time. Thoroughly recommended.

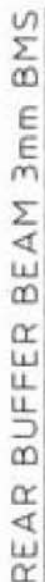
4. Ivor has also tried rolling die blocks made from hardened silver steel with conspicuous success, a hardened steel bush running on a hardened steel shaft makes an excellent bearing (ask any jeweller), and a further refinement is that the oil hole can be placed so that oil is forced into the bearing as it turns in the slot of the expansion link. These aids to long mechanical life are of the tried and trusted variety. Another that springs to mind is the total enclosure of the inside



"STOWE" TENDER CHASSIS



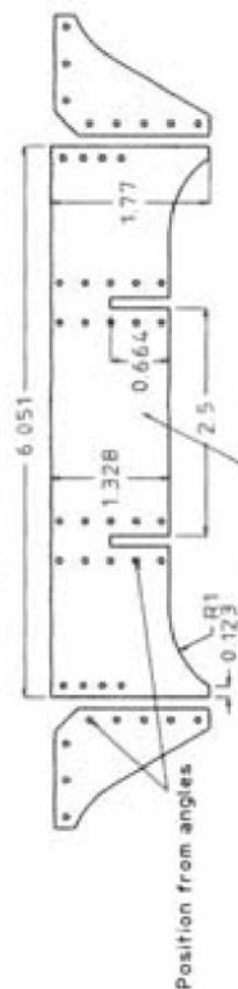
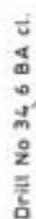
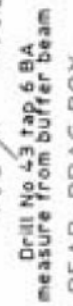
TENDER OUTER FRAME SIDE 2 off 3 mm BMS



I haven't mentioned the various schemes whereby the plain bushes and eccentrics are lubricated by means of a pressure oilcan via holes drilled through the centre of the axle. As can be seen from the above, the limits to what can be done are set only by human ingenuity.

The Maunsell 4,000 gallon tender chassis is quite straightforward, and is very similar to the very popular GWR chassis that I provided for the larger GWR locomotives. The brass or preferably aluminium blocks that find themselves at either end of the inner chassis are used as drag boxes and are milled from 1 x 2.5in. stock which used to be a standard size but which may not still be available. There's no harm in asking though as our local metal stockist has all sorts of odds and ends tucked away in dark corners. I would definitely go for the aluminium option if possible as, apart from the obvious benefit of lighter weight, the present price of brass and bronze seems to have gone through the roof.

● *To be continued.*



Which air compressor?

David Stokes takes a look at what's on the market for this essential piece of workshop equipment.

A workshop is not complete without an air compressor; air tools are more powerful than their electrically-powered brethren so tightening, undoing, cutting, sawing, polishing and drilling can be done with ease. The only two real disadvantages are you have to drag about an air hose and the noise of the compressor, especially on start-up, can be disturbing.

For the steam locomotive builder the most useful thing a compressor can be put to, I would think, is to run and test, without the need for steam, a newly built or repaired locomotive chassis. Although air doesn't expand in the same way as steam, bench testing a locomotive's machinery does give the builder some idea how it will run.

We took a look at compressors around the 24-litre mark and managed to get-together six low cost ones for a check over to see just what the market has to offer. All are for the DIY market but all are suitable for occasional professional use. Users should be able to do minor paint spraying jobs and operate small air tools with these units.

ME



DRAPER 42636

Guide Price	£176.56
Motor output	1.5hp
Input current	5A
Air displacement	6.3cfm
Maximum free air delivery	4.3cfm
Tank capacity	25 litres
Maximum pressure	116psi
Contact	02380 266355

Comes disassembled needing its wheels attached but that's all. Handy for the small workshop, can be wheeled about to where it's wanted. Equipped with a pressure switch, pressure regulator and gauge.



CLARKE AIRMMASTER TIGER 8/44

Guide Price	£117.48
Motor output	2hp
Input current	N/A
Air displacement	7.8cfm
Maximum free air delivery	N/A
Tank capacity	24 litres
Maximum pressure	116psi
Contact	01992 565300

Designed for the semi professional and DIY user, good for tyre inflation, occasional paint spraying and powering air tools. Fitted with a pressure regulator, pressure gauge and pressure off switch so motor only runs when it's needed. Wheels need to be fitted as they come loose in the packing.

METABO CLASSIC 250

Guide Price	£149.99 (Screwfix)
Motor output	1.5hp
Input current	5 Amps
Air displacement	3.88cfm
Maximum free air delivery	3.5cfm
Tank capacity	24 litres
Maximum pressure	116psi
Contact	02380 732000

Blessed with two quick action connection couplings and has a most useful carrying handle at the rear of the tank making for easy lifting into the boot of your car. Designed for the DIY or for occasional professional use. Automatic shutoff when tank is up to pressure, transportable on its own wheels that you have to fit when unpacking.



SCREWFIX DIRECT POWER 74212

Guide Price	£124.99
Motor output	1.5hp
Input current	5 Amps
Air displacement	5.68cfm
Maximum free air delivery	3.0cfm (approx.)
Tank capacity	24 litres
Maximum pressure	120psi
Contact	0500 414141

Low cost high value compressor with twin quick action connector couplings. Great for DIY and limited professional use, fitted with wheels so transportable around the workshop without the need to lift or pipe out the shop. Equipped with an automatic shutoff and pressure gauge.



SEALEY SA952015

Guide Price	£142.97
Motor output	1.5hp
Input current	5 Amps
Air displacement	6.7cfm
Maximum free air delivery	5.9cfm
Tank capacity	25 litres
Maximum pressure	116psi
Contact	01284 757500

Basic starter compressor, good for DIY and occasional use by a Professional. Fitted with the usual automatic switch off system to save on power and noise. Will operate a small spray gun and other air tools. Wheels need to be fitted, as they are loose in the packing box.

TOOLSTATION AIRMATE 33069

Guide Price	£99.48
Motor output	1.5hp
Input current	5 Amps
Air displacement	8cfm
Maximum free air delivery	N/A
Tank capacity	24 litres
Maximum pressure	118psi
Contact	0808 100 7211

Very low cost compressor for the DIYer, hobbyist and for limited professional use. Equipped with an auto cut off, reducing valve and two quick action couplings. Can be used for minor spraying jobs.



A practical approach to injector making

Terence Holland concludes his description of a simplified way of making injectors.

*Continued from page 452
(M.E. 4336, 10 October 2008)*

With the all the parts made from the previous instalment (M.E. 4336, 10 October 2008), the next step is to assemble them into an injector body by silver-soldering. Begin by pressing all fittings in place using silver solder flux powder mixed up with water as a paste. After soldering, clean up in an acid pickle and check that all joints look good with complete fillets.

From the underside extend the overflow hole up into the NRV overflow with a $\frac{1}{4}$ in. dia. drill.

Drill through the tapped hole in the top overflow chamber into the valve box using a 5mm drill at a slight upward angle (to miss the valve seat - see fig 5, M.E. 4336, 10 October 2008).

Set the exit end of the body in a $\frac{3}{16}$ in. x 32tpi tapped bush, chuck true in the 4-jaw chuck and ream through with a $\frac{1}{4}$ in. reamer.

Clean up all accessible parts and remove burrs.

Nine-degree reamer and mandrel

Only one type of reamer is required with an angle of 9 degrees. It is worthwhile making several, along with a couple of brass mandrels, once the top-slide is set over. One of the mandrels will be used as a tool for inserting the combining cones. The taper required can be obtained from tangent tables (4.5deg.) and for a 1in. long reamer (which is long enough to produce all the cones) the change in radius will be equivalent to 0.0787 inches. The best way to set the angle accurately is that used by Laurie Lawrence in his mighty 1985 tome on injector making (see 'Sensitivity to Other Parameters', M.E. 4334, 12 September 2008). The method presented by Lawrence is therefore summarised.

Note: In the following procedure, the parallel length of the bar is measured using the lead-screw hand wheel and not, as Laurence did, the length of the taper and hence the use of tangent tables and not sine tables. At these small angles there is little difference; for example, 0.0787 for the tangent and 0.0784 for the sine.

Start by setting the top-slide over to half the required taper, i.e. 4.5 degrees. Then, chuck a piece of $\frac{1}{4}$ in. dia. brass rod. Turn a section to approximately $\frac{3}{16}$ in. long by $\frac{1}{16}$ in. dia. using the lead-screw or rack.

Lock the saddle and turn a length, just over $\frac{1}{2}$ in. long, to a taper using the set over top-slide. At exactly 0.50in. from the narrow end, as positioned using the lead screw, turn a short parallel length, by feeding with the rack or lead-screw.

Measure the diameters of these two parallel sections and subtract one from the other - the result should be 0.079in. for the $\frac{1}{2}$ in. length, i.e. 0.158in. for a 1in. long section.

If you get it right first time - well done - if not, read on!

Correcting the error

To correct a taper which is too narrow, i.e. taper less than 0.079in. over $\frac{1}{2}$ in., proceed as follows.

Run the tool into contact with the larger diameter. Gently loosen the top-slide clamp screws and advance the cross-slide by $\frac{1}{4}$ of the error. Lock up and remachine the test piece.

To correct a taper which is too large, i.e. taper greater than 0.079in. over a $\frac{1}{2}$ in., proceed as follows.

Run the tool into contact with the larger diameter. Note the collar reading on the cross-slide, withdraw the tool (taking up slack) by $\frac{1}{4}$ of the error. Gently loosen the

top-slide clamp screws and swing the top-slide until the tool is in contact with the larger diameter. Lock up and remachine the test piece.

For making the reamers and cones it is convenient to have some sort of collet, unless of course you are fortunate in having a 'spot on' self-centering 3-jaw. If you don't have a collet chuck use a 3-jaw with the time-honoured brass chuck inserts. Make these as follows.

1. Chuck a 1in. length of $\frac{3}{16}$ in. brass, face, centre and drill/ream $\frac{1}{4}$ in. for holding reamers and the reduced section of the cones.
2. Repeat with a second 1in. length of $\frac{3}{16}$ in. brass, but ream $\frac{5}{16}$ in. for the stock cone material.
3. Mark the position of jaw No.1 with a centre pop on each before removing from the chuck, so the brass inserts can always be replaced with the same orientation.
4. Remove and saw latterly with a jeweller's saw into the bore. Tidy up and you now have a useful pair of collets to enable repeated accurate chucking in the 3-jaw.

Once the top-slide is correctly set, chuck 3in. lengths of $\frac{1}{4}$ in. dia. silver steel for making the reamers.

1. Using a newly sharpened tool, face and check that the tool is at correct centre height.
2. Extend the stock to just over 1in. from the chuck, turn the taper using the top-slide only, taking light cuts (particularly at the narrow end) with plenty of cutting fluid. Turn until the small end is less than 0.040in. diameter.
3. Polish with fine emery cloth and remove from the collet.

Don't forget to turn a couple of brass mandrels at the same top-slide setting.

The reamers can now be filed or milled to half their diameters. Keith Wilson's method for milling is good, providing that light cuts are taken and that the cutting direction is from the thick end to the thin end with the feed against the rotation of the cutter - no 'climb milling' - especially if you are using a vertical slide on the lathe. Set the stock material in a machine vice parallel to the axis of feed. Take care that the cutter does not snatch when starting each cut at the stock end or you'll find out the hard way what climb milling can do! If part of the stock $\frac{1}{16}$ in. dia. stock material is also milled, this can be measured with a micrometer to determine when the half-way point is reached. Finish on an oil stone before hardening and tempering.

My reamers were hardened by heating to cherry red and quenching in water. I used them like this and did not attempt to temper them. Even like this, they tended to bend and twist on occasion. I think I probably had an indifferent batch of silver steel and, in future, will try using quality material. It is also possible, however, that I did not hold the 'cherry-red' temperature for long enough - it should be about 10 minutes for a $\frac{1}{16}$ in. dia. tool. After heat treatment, the reamers should again be sharpened on an oil stone prior to use.

The various tools required for making injectors are illustrated in **fig 4** (M.E. 4336, 10 October 2008).

Making the cones

The dimensions of the cones are shown in **fig 7**.

Combining cones

1. Chuck a piece of $\frac{1}{16}$ in. or 8mm brass rod in a collet or brass bush and face.
2. Machine a $\frac{3}{16}$ in. length to a tight press fit in the injector body. Finish with 600 grit emery or similar. Part off $\frac{3}{16}$ in. and chuck in a $\frac{1}{16}$ in. collet.
3. Face and drill No. 55 or 1.3 millimetres. Reduce the overall length to exactly 0.645 inch.

If the fit is suspect use a drop of Loctite when assembling, followed by a trace added through the ball aperture on to the visible part of each cone. Once the combining cones are in place, the steam and delivery cones can be made and fitted according to the method devised by Eric Rowbottom.

Steam cone (with plain drilled inlet)

1. Chuck a piece of $\frac{1}{16}$ in. or 8mm brass rod in a collet or brass bush and face.

2. Machine a $\frac{7}{16}$ in. length to a push fit in the injector body. Finish with 600 grit emery or similar.

3. Adjust the length by facing so that 0.047in. of the $\frac{1}{16}$ in. dia. section protrudes from the injector when the unfinished cone is pushed home. At this stage, the end of the cone is touching the combining cone inlet.

4. Carefully reduce a 0.3in. length to a jet until it starts to enter the combining cone, at which point the 0.047in. gap will start to decrease. Take it slowly at this stage because a fine cut off the diameter results in a relatively large movement into the combining cone.

5. Machine until zero protrusion of the $\frac{1}{16}$ in. diameter section into the body is reached. At this point, the steam cone jet is touching the wall of the combining cone at the correct insertion depth of 0.047 inch.

6. Remove the injector body and machine 0.010in. from the steam jet (take two 5 thou. cuts), which will produce the desired 10 thou. annulus.

7. Centre with the smallest centre bit and drill No. 52 for a 1in. depth. Remove the drill frequently and release swarf to prevent problems.

8. Gently ream the end of the steam jet with a 9deg. reamer until a knife-edge is produced. Take care because too much pressure on the reamer at this stage can enlarge the steam jet diameter.

9. Part off the cone with $\frac{1}{16}$ in. of full diameter material to make the flange.

10. Measure the depth of the reamed hole with a No. 50 drill and subtract from the overall length. Subtract a further 0.030in. from this figure to obtain the drill depth for the 5mm steam inlet (this allows for a 30 thou. parallel drilled portion).

11. Reverse in a $\frac{1}{16}$ in. collet, face to produce a $\frac{1}{16}$ in. flange and drill 5mm for the depth calculated in 10 above.

12. Drill through with a No. 50 drill to produce the required 0.070in. dia. jet.

Delivery Cone

1. Chuck a piece of $\frac{1}{16}$ in. or 8mm brass rod in a collet or brass bush and face.
2. Machine a $\frac{1}{16}$ in. length to a push fit in the injector body. Finish with 600 grit emery or similar.
3. Carefully face off the end until the shoulder closes with the barrel exactly. At this point the unfinished cone is touching the outlet jet of the combining cone.
4. Face off the required 0.005in. clearance.

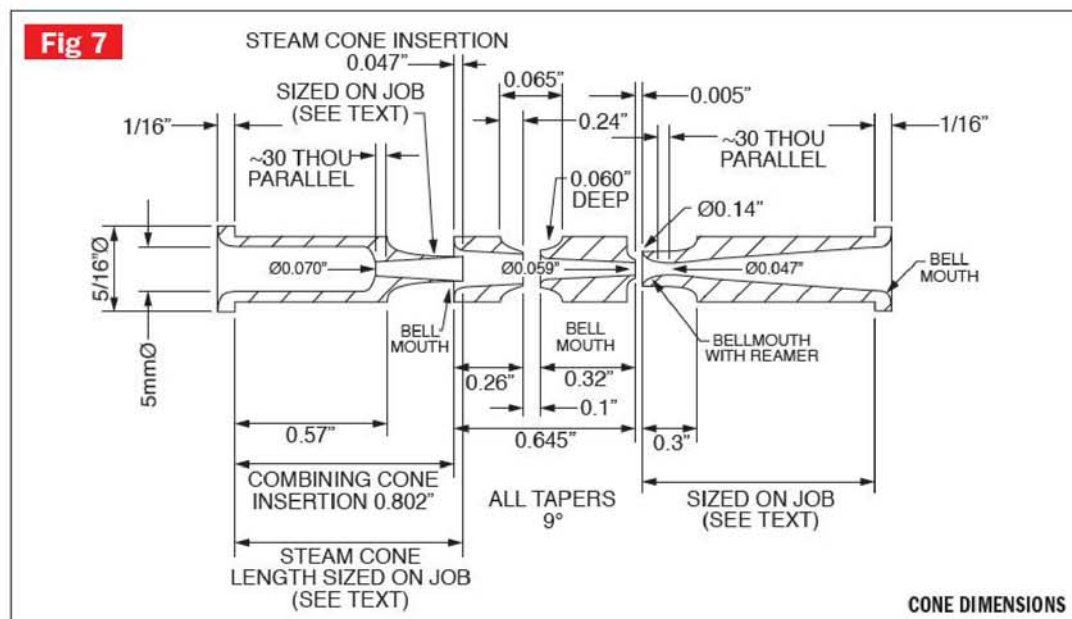


Table 3: Design Faults

Symptom	Problem	Solution
1. Non-priming of injector - steam only, at overflow.	Annular gap is too small.	Fit 5 thou. spacers to steam cone flange or remachine a new steam cone with a smaller jet diameter. Retest.
2. Primes but does not feed - spills water.	Annular gap is too large. Ball valve is blocking exit.	Machine 5 thou. increments from steam cone flange face or remachine a new steam cone with a larger jet diameter. Retest. Fit ball control.
3. Primes and feeds but with heavy overflow.	Annular gap is functional but may be a few thou too large.	Machine 5 thou. increments from steam cone flange face. Retest.
4. Primes and feeds but is unstable. Spits steam and water at overflow.	Poor cone concentricity. Badly seated ball valve.	Check concentricity and remachine as appropriate. Check ball seating and reseal if necessary (see W. A. Carter's procedure for testing injector ball valves).

5. Reduce a 0.3in. length to 0.140in. dia. to make the jet.
6. Lightly centre and carefully drill No. 58 for a depth of 1 inch. Bellmouth the end with a reamer (see drawing for profile).
7. Part off just over 1/16in. of the 1/16in. stock to make the flange.
8. Set a collar on the 9deg. reamer in a 4.4mm hole and ream to depth.

9. Bellmouth with a hand graver and face the flange to 1/16 inch.
10. Drill through with a 1.2mm drill to produce the required 0.047in. dia.

Assembly

This is quite straightforward. The 1/16in. dia. stainless ball is seated in the overflow chamber and the best way to do this (and this also applies to non-return valves in general) is to make up a simple tool as

shown in fig 4 (*M.E.* 4336, 10 October 2008). This is used to apply screw pressure to the ball ensuring concentricity etc. If any doubt exists as to the effectiveness of the seal, an article by Bill Carter in the *M.E.* dated 2 August 1974 detailed a useful procedure for testing injector ball valves.

The cones are pressed in each end, the ball placed in the overflow chamber, the ball cage is screwed in and that's it. However, cone removal for cleaning etc. is not easy if a good fit of the steam and delivery cones has been achieved. A special tool, as shown in fig 4, is well worth making up. No matter how careful you are, pulling them out with pliers is not the answer (unless you are a dentist!) and I have several graunched cones in my scrap box to prove it!

Testing injection feed rate

One injector was tested to determine the feed rate and this was injector No. 7 in Table 1 (*M.E.* 4334, 12 September 2008). The flow rate was measured as 60 ounces per minute which is equivalent to three pints per minute; that is, slightly in excess of the nominal 55 ounce per minute rating.

Fine tuning

An injector made using the above instructions should function reasonably well, however, despite all the care and experimentation, there is still a degree of 'hocus-pocus' associated with injector making - even using the empirical method detailed in this article. Consequently, to achieve the best possible performance, adjustment of the steam cone annulus by altering the depth of insertion may be necessary. See **Table 3** which has been compiled from work by Martin Evans and D. A. G. Brown. This table addresses those problems which are likely to occur during manufacture.

Table 4 identifies problems which may occur during operation. Note that in cases 2 and 3 in Table 4, if problems occur under normal conditions, the water supply should be turned rapidly off and on to start injection and the water feed then throttled until the injector feeds dry.

Laurie's No. 1 injector

For those requiring a smaller unit, I have modified the construction technique to suit manufacture of a 26 ounce per minute injector as detailed by Laurie Lawrence in his series published in 1986. For fuller details, this series should be consulted.

The body

This can be made the original Lawrence way in 1/16in. round brass rod using a silver-soldering jig - or with 1/16in. or 3/16in. square brass bar following the method used by Keith Wilson with spigots on the fittings. The latter way is much easier, however, and you get a physically bigger injector which is better if you are building narrow gauge locos or large scale working engines. The important dimensions for the body identified as 'Laurie's No. 1', measured from the steam inlet end are:

- body length 1.25 inch.
- water inlet 0.356 inch.
- ball valve 0.625 inch
- overflow 0.920 inch

Table 4: Operational Faults

Symptom	Problem
1. Non-priming of injector - steam only, at overflow.	No water in tank. Strainer blocked. Air leak in water supply. Feed water too hot. Water valve closed or obstruction in water supply. Obstruction in cones.
2. Primes but does not feed - spills water.	Boiler check valve may be stuck. Feed water too warm. Boiler pressure too low. Obstruction in cones. Primes and feeds but with heavy overflow. Boiler pressure low.
3. Primes and feeds but is unstable. Spits steam and water at overflow.	Water low in tank. Water level high in boiler. Boiler priming.

The ends of the body and water inlet are threaded $\frac{1}{8}$ in. x 32tpi and, after silver-soldering the fittings in place, the body is reamed $\frac{1}{2}$ inch. The stainless steel ball for the non-return valve is $\frac{3}{16}$ in. diameter.

My 'Laurie No. 1' body was made about 15 years ago when I contemplated another stab at injector making. However, other pressing needs must have arisen at the time and the job didn't get finished. Fortunately I retained the completed body (I knew it would come in handy one day!) and, more importantly, managed to find it when I needed it.

The combining cones

Again, the combining cones are made first and the other cones are fitted to them.

1. Chuck a piece of $\frac{1}{4}$ in. or 6mm brass rod in a collet or brass bush and face and centre.
2. Machine a $\frac{5}{16}$ in. length to a tight press fit in the injector body. Finish with 600 grit emery or similar.
3. Drill $\frac{1}{8}$ in. dia. for $\frac{1}{2}$ in. deep. Part off just over $\frac{1}{2}$ inch.
4. Reverse in a $\frac{1}{32}$ in. collet. Face and drill No. 65 into the $\frac{1}{8}$ in. hole.
5. Set the reamer collar on the 9deg. reamer in a 0.100in. (or 2.5mm) hole, i.e. set the collar to restrict the cut of the reamer to a maximum diameter of 0.100 inch.
6. Ream until the collar touches the stock, bell the end slightly with a hand graver.
7. Drill through with a No. 53 drill.
8. At 0.114in. from the entrance relieve the centre portion 0.14in. wide and 0.040in. deep.
9. At 0.162in. from the entrance part off with a 0.030in. wide narrow parting tool (or file two slots 0.030in. wide to make a Sellers cone).
10. Part off a further 0.220in. to make the second cone.
11. Relieve around the exit jet and slightly bell mouth the entrances to both cones with a hand graver.
12. Tidy up the cones and press into the body at the steam end using a brass taper mandrel with a collar set at exactly 0.434in. from the cone entrance to the start of the collar.

Steam cone

1. Chuck a piece of $\frac{1}{4}$ in. or 8mm brass rod in a collet or brass bush and face.
2. Machine an approximate $\frac{5}{16}$ in. length to a push fit in the injector body. Finish with 600 grit emery or similar.
3. Adjust length by turning/facing so that 0.030in. of the $\frac{1}{32}$ in. dia. section protrudes from the injector when the unfinished cone is pushed home. At this stage, the end of the cone is touching the combining cone inlet.
4. Carefully reduce a 0.15in. length to a jet until it starts to enter the combining cone, at which point the 0.030in. gap will start to decrease. Take it slowly at this stage because a fine cut off the diameter results in a relatively large movement into the combining cone.
5. Machine until zero protrusion of the $\frac{1}{32}$ in. dia. section into the body is reached. At this point, the steam cone jet is touching the wall of the combining cone at the correct insertion length.
6. Remove the injector body and machine 0.007in. from the steam jet diameter to produce the 7 thou. annulus.
7. Centre with the smallest centre bit and drill No. 60 for a depth of approximately $\frac{5}{8}$ inch. Remove the drill frequently and release swarf to prevent problems.
8. Gently ream the end of the steam jet with a 9deg. reamer until a knife-edge is produced. Too much pressure on the reamer at this stage can enlarge the steam jet diameter.
9. Part off the cone with $\frac{1}{4}$ in. of full diameter material for the flange.

10. Measure the depth of the reamed hole with a No. 58 drill and subtract from the overall length. Subtract a further 0.020in. from this figure to obtain the drill depth for the $\frac{1}{8}$ in. steam inlet (this allows for a 20 thou. parallel drilled portion).
11. Reverse in a $\frac{1}{32}$ in. collet, face to produce a $\frac{1}{16}$ in. flange and drill $\frac{1}{8}$ in. for the depth calculated in 10 above.
12. Drill through with a No. 58 drill to produce the required 0.046in. jet.

Delivery cone

1. Chuck a piece of $\frac{1}{4}$ in. or 8mm brass rod in a collet or brass bush and face.
2. Machine an approximate $\frac{5}{16}$ in. length to a push fit in the injector body. Finish with 600 grit emery or similar.
3. Carefully face off the end until the shoulder closes with the barrel exactly. At this point the unfinished cone is touching the outlet jet of the combining cone.
4. Face off the required 0.005in. clearance.
5. Reduce a 0.15in. length to 0.080in. dia. to make the jet.
6. Lightly centre and carefully drill No. 69 for a depth of $\frac{5}{8}$ inch. Bellmouth the end with a reamer.
7. Part off just over $\frac{1}{4}$ in. of the $\frac{1}{8}$ in. stock to make the flange.
8. Set the 9deg. reamer with a collar in a 1.8mm hole and ream to depth.
9. Bell mouth with a hand graver and face the flange to $\frac{1}{16}$ inch.
10. Drill through with a $\frac{1}{32}$ in. drill to produce the required 0.031in. dia.

Batch production

If I were to contemplate making large numbers of identical injectors I would make up a batch of nine deg. reamers and brass or mild steel tapered form tools at the same top-slide setting on the lathe.

With one of the form tools fix a location collar permanently with silver solder for inserting the combining cones at a controlled depth.

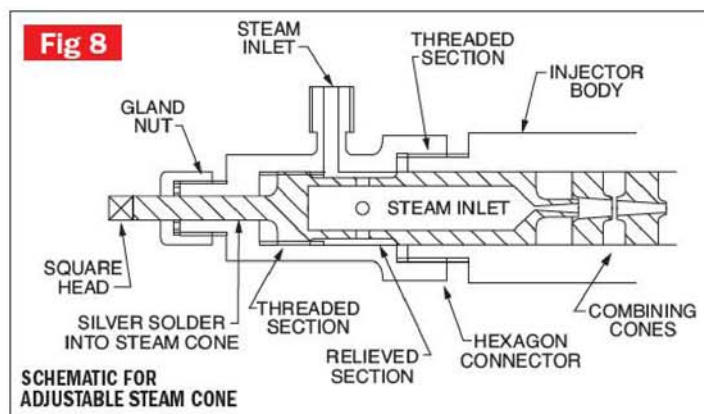
There should be three nine deg. reamers. Fix two with collars specific to the combining and delivery cones. Set the collars in drilled holes.

Also I would make up steam and combining cones using the Rowbottom method for sizing, i.e. a 0.010in. annulus and about 0.050in. insertion and a 0.005in. combining cone-delivery cone gap.

Finally, I would test one unit and fine tune the steam cone dimensions until self-starting is achieved over the desired pressure range, then I would copy the dimensions of this cone for all other units.

'Cert' injectors

For an injector to be capable of lifting and also self-starting, the exit diameter from the combining cone must be greater than the entrance to the steam cone. Clearly this is not the case as the steam cone throat diameter is the largest of all the cones. To overcome this problem the combining cone is split to provide a free release of steam/water via the overflow during the starting phase. Once the steam/combining cone combination is working and lifting water, the jet is established, water enters the boiler via the delivery cone and



INJECTORS

a vacuum is achieved in the front end, which closes the overflow valve.

With good proportions and a positive pressure of water feed, of course, an injector will pick up without producing much of a hot water overflow. Ironically, once these conditions are achieved, the overflow valve closes and the system becomes redundant and I believe this was the case with the old 'Cert' injector which had only three cones - steam, single combining and delivery - and no top overflow system. However, I'm not an expert and as far as I am concerned the workings of the Cert are still a mystery. The important fact is that, once fine-tuned, the conventional design with overflow works so well that pursuit of an overflow-free design seems pointless.

Adjustable steam cone injectors

For anyone who fancies a bit of experimentation, an injector with an adjustable steam cone would be an interesting project. A rough design is presented in **fig 8**, but I have not made and tested such a device. There may be problems using two concentric threads and a flanged joint on to the injector body with a locating spigot may be a better proposition.

Roy Amesbury published a design with an adjustable steam cone for his De Glen compound locomotive in 1984 which would also make a useful starting point for such a device. His design was produced to simulate the original French Giffard injector, but could be adapted to suit the conventional type.

Standardised injector dimensions

The original Keiller dimensions, as used by Martin Evans etc. are presented in **fig 9**. The modified dimensions, resulting from this work, are presented in **fig 10**. The modified data are all expressed as functions of dimension 'A': the delivery cone throat diameter.

Draining and raising water

For moving large quantities of water around, an injector-based device was relatively economical. One useful application of this was their use as bilge pumps in steam ships.

Exhaust steam jet condensers

The use of a custom-designed injectors (or ejectors in this case) for reducing the back pressure on large steam engines was economic and negated the need for an air pump.

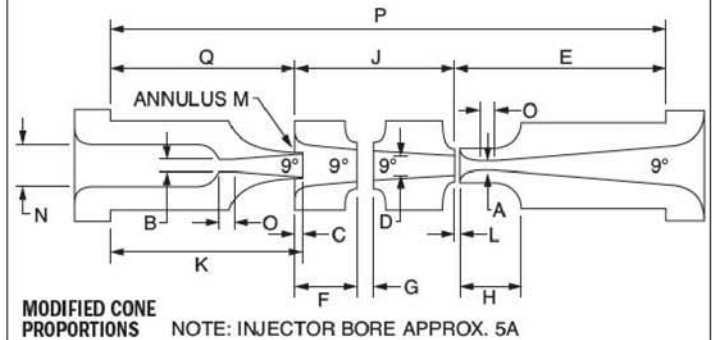
Coal Sprinklers. The coal sprinkler (known as a 'squirt') was used to wet the coal supply of a locomotive or coaling plant; thereby reducing the dust problem.

Conclusion

The method of construction detailed in this article considerably simplifies injector making. Body construction is made relatively easy using Keith Wilson's method, which utilises square brass stock with spigoted attachments. Cone angles are reduced from as many as three in previous articles to a single 9deg. angle in this work and the use of a plain drilled hole in the steam cone inlet further

Fig 10

A = DELIVERY CONE THROAT DIAMETER
B = 1.5A G = 1.4A M = 0.22A
C = A H = 6A N = 4.5A
D = 1.25A J = 13.7A O = 0.7A
E = FIX ON JOB K = FIX ON JOB P = 50A
F = 5.6A L = 0.1A Q = 17A



simplifies cone manufacture. Additionally, the application of the Rowbottom method for fitting the steam and delivery cones to the in situ combining cones eases manufacture by reducing the number of areas where a high degree of precision is essential. Finally, the fine tuning of the manufactured units ensured that the injectors performed so well that they have made a major contribution to the ease of operation of my 5in. narrow gauge 0-4-0 Andrew Barclay locomotive on my garden railway; I wish I had had such injectors 20 years ago!

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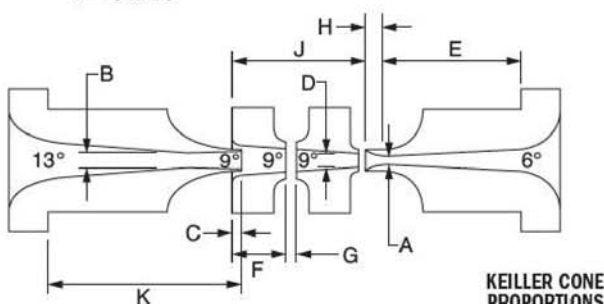
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Fig 9

A = DELIVERY CONE THROAT DIAMETER
B = A x 3/2 G = J x 1/10
C = A H = A x 7/2
D = A x 5/4 J = A x 14
E = A x 15 K = A x 18
F = J x 2/5





Malcolm Stride reports

Notices

Sinsheim 2009

The next Indoor Steam Meeting at Sinsheim will take place on 9 - 11 January 2009. Full details can be obtained from Messe Sinsheim GmbH, Neulandstrasse 30, D-74889 Sinsheim, Germany. T. +49 72 6168 9 0, F. 49 72 6168 9 220. E. echtdampf@messe-sinsheim.de W. www.echtdampf-hallentreffen-messe.de

Model engineering evening class costs

We have had a query regarding the costs of model engineering evening classes run by local colleges. The reader concerned is one of a local group using such facilities and the group has been presented with a cost increase this term of over 130% which is obviously raised some complaints. If any readers can provide information on the cost of their own local courses, we would be please to pass that on to the person concerned for comparison. I know from my own experience that fees vary widely between different local authorities and that there have generally been substantial increases over the past few years.

UK club news

Colchester SMEE members were recently entertained by Brian Bourne from Chelmsford model engineers to a talk on the Cornish tin mining industry and the beam engines used in the 18th/19th century. Colchester Society members travelled to the Gravesend club site for a "steam up" at the track. Seven steam locomotives were run during the day. The next day was

spent "at home" entertaining the Peterborough model engineers on their return visit to the Colchester track site. Six steam locomotives ran during their visit, despite the rain.

A group of members at **Ickenham DSME** spent much effort installing an old style Gilbert Scott designed red telephone box in the corner of the club site recently. The telephone box was purchased for the society by three members at less than the market rate because "it would be going to a good home". Peter Pardington, who supervised the installation efforts, attempted to make the first call from the box with his mobile phone but could not get a signal. I suppose that is some justice, since it is the mobile phone that has led to the demise of telephone boxes. Work on rebuilding the club *Speedy* is continuing with work on the new boiler completed up to the point of silver-soldering which is scheduled for later this year. It is hoped that the locomotive will be back in working order sometime next year.

Members at **Kings Lynn DSME** have a new project in the form of a *Super Simplex* which has been donated to the club by John Illiff. The locomotive is part-built and needs finishing off. Two more projects are also in the pipeline, a traction engine and a 3½in. gauge locomotive. The new loading trolley is now in use and the railway has a new addition for the comfort of members and visitors, a swing garden seat.

Capably led by Dennis Billington and Tony Kendall, work on the ground level track extension (**photo 1**) at **Northampton SME** continues apace. Phases 1a and 1b, which will be the return section around the bottom and along the drain side of the site, are currently being worked on by the Tuesday and Sunday groups. In conjunction with these works, a comprehensive tree and bush planting programme designed to enhance the future railway is under way, but the gardeners have found that they are providing food for the rabbits! To prevent this damage, chicken wire mesh has to be placed



1. The ground level track extension is taking shape at Northampton SME.

around the new plantings. One of the raised track signal posts was recently torn out of the ground, and member Peter Jarman is to be congratulated on re-installing it, with more substantial foundations within a week of the incident. The newsletter Editor comments "Funny how acts of vandalism at Delapre Park seem to coincide with the start of the school holiday; perhaps it is the relief of being allowed out of school combined with the boredom of not being a model engineer."

Members of **Norwich DSME** joined in the 80th anniversary of the opening of Eaton Park in June by starting the running session early resulting in over 800 passengers being carried during the day. The interior of the main building is being reorganised with new benches and shelves already installed. Progress has also been made on the 7¼in. gauge LNER A3 locomotive with the reassembly completed and the majority of the vacuum brake system installed. The installation of the raised track signalling system will commence during the winter because of the need to cut the rails for the track circuits.

The newsletter of the **City of Oxford SME** reports that the summer rallies this year were very well attended with record attendance at the Sweet Pea Rally and the Dreaming Spires event again well attended. Both events drew good weather, which is an achievement this year.

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.

Roy Brooks
Trevor Gill
Les Hammond
Alan Nicholson

Northampton SME
West Riding Small Locomotive Society
Colchester SMEE
West Riding Small Locomotive Society



2. Clive and Alistair Cook's Aveling tractor was enjoying a visit to Saffron Walden SME joined by Ian Couchman with his Ruston Procter tractor.

3. 'Chief Pinkie', John, admiring his handiwork at Saffron Walden SME.

4. Steve Gosling looks pleased with his new Midland Compound at Taunton.

Engineering work at **Pinewood Miniature Railway** has included completion of the new country carriage store which involved building a brick arch for the front. The design of points has been changed to make use of aluminium rail which will enable the detection of trains on the points for the signalling department. A new signal has been made for the head shunt. As part of the clear up of the site, all the scrap metal collected

was taken to a scrapyard and sold for almost £200. This sounds like something worth doing by others.

September is often noted for an 'Indian Summer' and, so far, predictions are coming true at **Saffron Walden SME**. The AER Steam Gala (**photo 2**) has enjoyed favourable weather in recent years and 2008 came up trumps with lots of sunshine and no rain! On the track, the trickle charging circuit problems for the air compressor battery by the station appear to have been resolved and it has stood up to the rigours of intensive use over the running weekends. The Wednesday Gang has been addressing a number of areas where the track has settled or moved. Putting a small paving slab under the expansion joints on the back straight by

the container seems to have been a success, coupled with some more ballasting this section is now much improved. The concrete encased track by the picnic field gate will be removed and a new concrete pad laid for the new track. A wooden inlay will enable vehicles to cross the track. Appropriately nick-named Pinkies Paradise the signal box has been getting a bit of a makeover. Some flashing tape has been fitted just above floor level to try and keep rainwater at bay, the paintwork has been cleaned, windows re-puttied, and repainting is underway. Roof guttering is to be fitted to deflect most of the rainwater thus helping to preserve this most useful building. The picture (**photo 3**) shows Chief Pinkie, John P. admiring his handiwork after fitting the waterproof flashing tape.

There are some new faces in prominent positions at the **Society of Model and Experimental Engineers**, Mike Chrisp has been elected to the position of Chairman and Matt Pulzer has taken over as editor of the journal. We wish them success in their respective roles. The society continues to be active at many of the events during the year and have had a presence at Harrogate, Merstham, Guildford and not least at the Model Engineer Exhibition. The April Gauge 1 meeting included a presentation on weathering

techniques by David Hatherill. David demonstrated many of the techniques used and several members also tried out the processes.

Members of **Stamford MES** planned an evening running session at the track in August, but were caught out by the generally inclement weather. Only one locomotive ran; a Class O8 shunter which gave one of Richard Wright's granddaughters driving experience on the otherwise empty track. The other attraction was the Tiger tank built by Colin Richards. This had realistic sound effects and also fired blank 12-bore cartridges. The latter operations caused the electronics board to "take umbrage" which no doubt resulted in several hours repair work. A Saturday morning session mustered two locomotives, a *Simplex* and a *King Arthur* which both ran well.

Taunton Model Engineers has received permission from the local borough council to extend the raised track (**photo 4**) at Vivary Park by about 400 feet. Off site construction work has already started with on-site work due to start at the end of the running season. At the Creech track site, the grading of the embankment has been completed and the exit point has been installed, levelled and ballasted ready to extend the running line. Some 80ft. of track has been laid on the embankment



towards the level crossing with final levelling and packing to be done. A further 25-30ft. is required before the level crossing section can be laid.

I have some news of a society that has not sent information in for a while. **West Riding Small Locomotive Society** had a very successful visitors rally in mid June with a successful barbecue and eight visiting locomotives on each of the days with the Sunday bolstered by some traction engines. Three awards were made, the Best Finished Locomotive was P. Dalley's 3½in. gauge LMS 8F, the Best Unfinished Locomotive was R. Lumb's 7½in. gauge GWR Dart and the Best Non-locomotive was T. Oughton's universal pillar tool.

The open day at **Wigan DMES** was very successful with plenty of visiting locomotives, plenty of volunteers to man the event and a "tremendous" range of food provided by the catering team. Two locomotives highlighted in the report were John Richardson's new *Merchant Navy* locomotive and a *Lion* from Southport. Norman Mathews steamed his Garratt in mid July after 14 years and 8,000 hours in the making. Since then Norman has had several more outings, ironing out teething troubles as he goes.

World club news

Canada

Another well-populated meeting took place at **Toronto SME** in October. Dave Oulton described how he got into the model engineering hobby - wanting a new challenge. He has found it an interesting learning experience! Dave showed a number of small oscillating engines he has made and demonstrated them running on air at only about 3psi. Some engines are Stuart Turners; others are from castings purchased at NAMES. Dave mentioned that his lathe and mill are both fitted with DROs which he finds makes machining easier and accurate.

Bill Huxhold brought in his latest project, still a work in progress - a Single Corliss Engine that he started in June. The base plate is machined from 1in. plate machined to look like a casting. Bill was asked to give some advice on drilling and tapping small holes - use good quality taps and dies, use lubricant (but not in cast iron) and a tapping machine and do it carefully!

Lloyd Hall bought an old Atlas Shaper and is now renovating it. From the pictures of it before Lloyd started to clean it up, it looked in pretty poor shape,

although he had no trouble dismantling it.

Barry Fletcher showed his completed Halbrook No. 7 Twin-Cylinder Reversing Piston Engine and demonstrated how easily it runs on air, his blowing was sufficient!

Dan O'Connell introduced his guests - Donald Greer and his son. They are members of a worldwide group that is interested in producing full-size versions of the Star Wars robot - R2D2. Don mentioned that standardized parts are available, although he has chosen to make his own R2D2 using aluminium bodysheet parts and an aluminium and steel inside frame. His R2D2 body section he showed is about 18in. diameter and the top half sphere spun in aluminium.

Roy Elliott has started on a 4-cylinder OHC internal combustion engine of his own design, and showed how far he has progressed with the cylinder body and the head. He intends to use a timing belt rather than gears to drive the valves, this arrangement being simpler. Roy is thinking of using aluminium pistons and cylinder sleeves in steel. The bore is 0.680in. which he hopes will allow him to avoid the use of rings.

Phil Regan brought in a Unimat, recently purchased though eBay. These small lathes have not been made since the 1970s and are now considered collectors items.

Bill Salt showed a running stand he has put together so that he can test run his recently acquired 0-6-0 4¼in. gauge locomotive at home before he gets to the track at Richmond Hill Live Steamers.

South Africa

In contrast with the previous boot sale in June, the September sale at **Centurion SME** turned out quite well with at least five vendors with tools and other equipment as well as material on sale. I trust that everyone got the bargain they were looking for. September was a month and John Shaw and the part-timers really put in a lot of hard work in getting a substantial number of trees into the ground. Those who took a walk or a ride along the track would have noticed his hard work - mostly between the second and third bridges, adjacent to the outer track.

A footbridge was built out of scrap iron that was being stored at the clubhouse. With a bit of paint applied, it was installed between the two



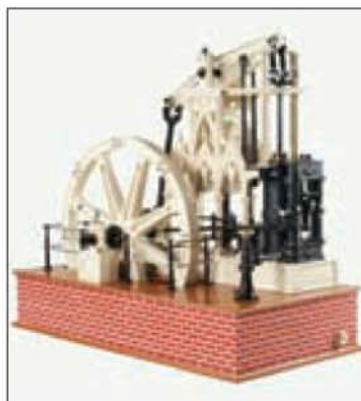
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- Model Engineer Exhibition report
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ON SALE 21 NOVEMBER 2008



Tips and hints from Karl Konrad on machining a 1:20 scale model of the 1895 Gothic-style engine on display at the Henry Ford Museum, Dearborn, US. (photograph by Lothar Matrian)

Seen at the Model Engineer Exhibition at Ascot this year is the upper train of Nicholas Hooper's crystal wheel clock which was awarded a Bronze Medal. (photograph by Roger Bunce)



dams adjoining the steaming bay to facilitate access to the far side of the track. In the meantime research and discussions on the raised track is ongoing and various construction options remain under review. Being a quite large and costly project, it must be wise to ensure that we opt for the ideal solution, rather than to rush things at this stage. As usual, any ideas and suggestions in this regard will (still) be appreciated.

Humour time

More history lessons from the **Miniature Steam Road Vehicle Society**:

The floor was dirty. Only the wealthy had something other than dirt. Hence the saying *Dirt poor*.

The wealthy had slate floors that would get slippery in the winter when wet, so they spread thresh (straw) on floor to help keep their footing. As the winter wore on, they added more thresh until, when you opened the door, it would all start slipping outside.

A piece of wood was placed in the entranceway. Hence the saying a *thresh hold*. (Getting quite an education, aren't you?)

In those old days, they cooked in the kitchen with a big kettle that always hung over the fire. Every day they lit the fire and added things to the pot. They ate mostly vegetables and did not get much meat. They would eat the stew for dinner, leaving leftovers in the pot to get cold overnight and then start over the next day. Sometimes the stew

had food in it that had been there for quite a while. Hence the rhyme, *Peas porridge hot, peas porridge cold, peas porridge in the pot nine days old*.

Sometimes they could obtain pork, which made them feel quite special. When visitors came over, they would hang up their bacon to show off. It was a sign of wealth that a man could bring home the bacon. They would cut off a little to share with guests and would all sit around and *chew the fat*.

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Issue 4337

24 October - 6 November

- The Midlands Federation Rally by Terry Dell
- Engineering's Local Heroes - Lord Armstrong by Roger Backhouse
- Model Engineer Photo Competition 2008 by Malcolm Stride
- Engineering in Wood by Eric Basire and Dave Knight
- The Riddles 9F Enigma No. 92250 by Peter Rich
- Machine Tools - Drummond Flat Bed Lathes by Tony Griffith
- A Freelance Shay Locomotive by Alan Beasley
- Keith's Column by Keith Wilson



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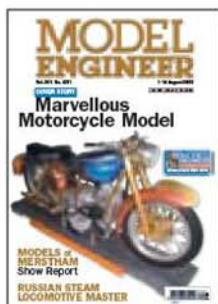
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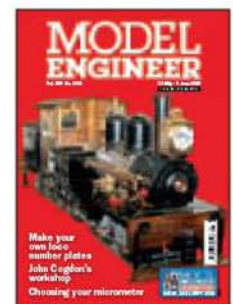
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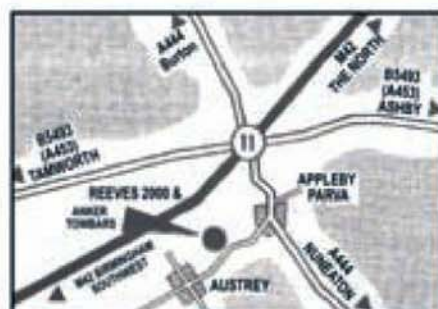


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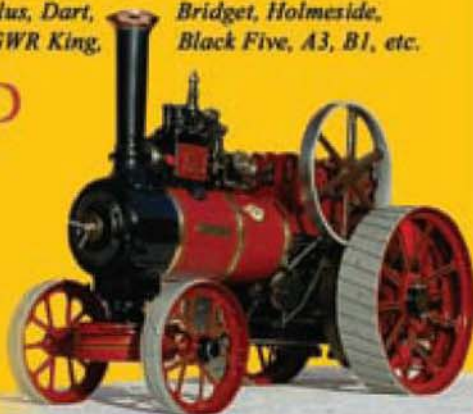
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