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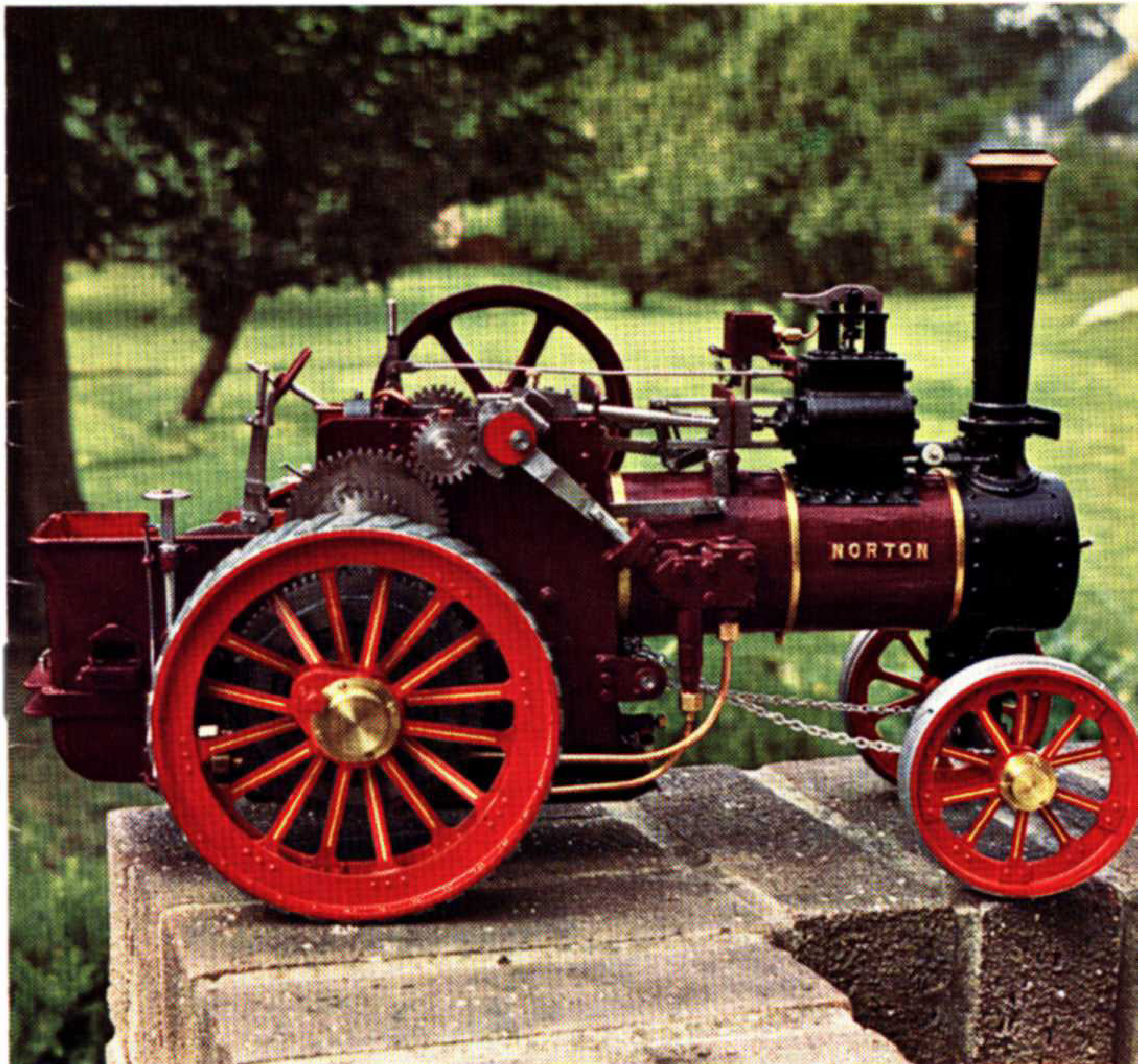

Model Engineer

Founded 1898

Incorporating Mechanics and English Mechanics and Ships and Ship Models

Volume 139 **Number 3458**

February 2nd, 1973

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COVER PICTURE

A one-inch scale model traction engine built and photographed by Professor L. J. Davis.

NEXT ISSUE

Building the boiler for "Torquay Manor": more about model locomotive boiler fittings.

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Flying Dutchman

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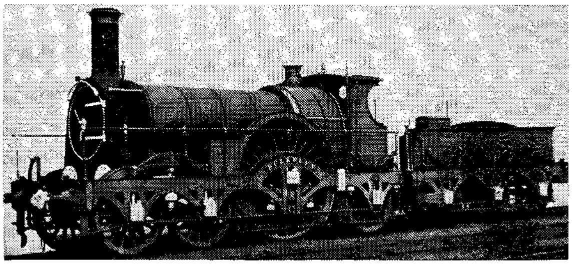

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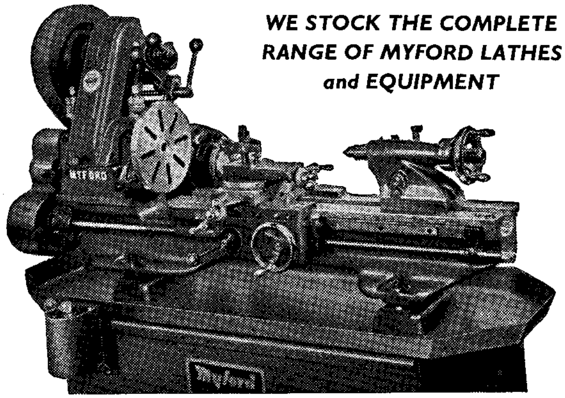

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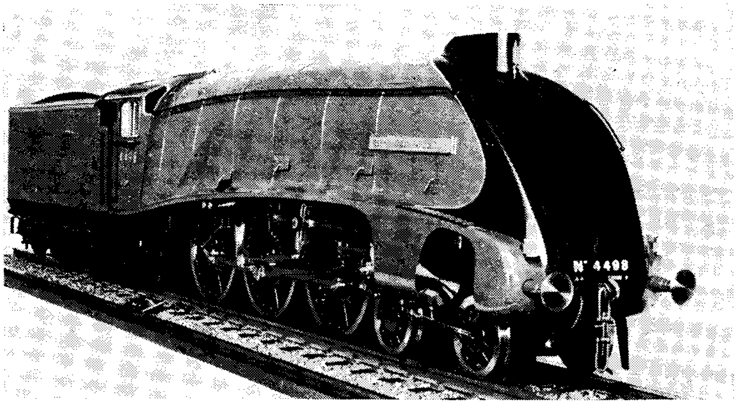
SMOKE RINGS

A Commentary by the Editor



Alfred Nash's 5 in. gauge L.N.E.R. "A.4", winner of the Championship Cup and the J. N. Maskelyne Memorial Trophy.

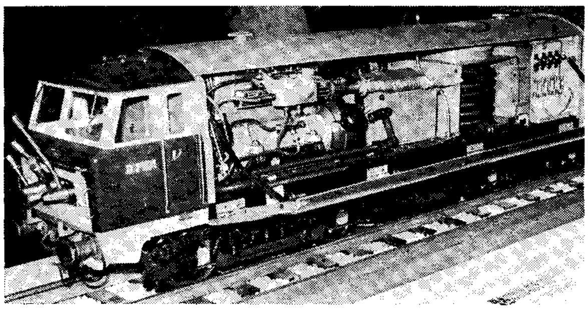
M.E. Exhibition

As I write these notes, the results from the Competition sections are just coming in. The Duke of Edinburgh Trophy was awarded to Peter Dupen, for his 5 in. gauge Midland "999" 4-4-0. Very close in second place came Mr Heyden's Great Western "Single", victor at I.M.L.E.C. Southampton in 1971, and this was followed by Mr T. Smith's Mill Engine and Mr H. Worthington's Allchin traction engine.

Although not having quite the finish of the "Single", due perhaps to several season's hard work on the track, the "999" scored mainly through originality, having the unique Deeley cross-drive valve gear, the only occasion, as far as I know, that this gear has been reproduced in a model locomotive.

Among the large scale steam locomotives, the A.4 *Sir Nigel Gresley* built by Mr A. Nash would surely have delighted the eye of its famous designer. Both finish and accuracy to prototype were impeccable, and gained this engine the Championship Cup and the Maskelyne Memorial Trophy. Two examples of the popular Great Western *City of Truro* 4-4-0 both gained Silver Medals, that built by Albert Peacock also receiving the Crebbin Memorial Cup. These engines were closely followed by two "Terriers", one in Great Western livery, the other in the original Stroudley livery.

L. P. Purple's "diesel" was awarded the Edgar Westbury Memorial Challenge Trophy.



The new Edgar Westbury Memorial Challenge Trophy, presented by the Society of Model & Experimental Engineers, went to Mr L. P. Purple for a "Diesel-electric", actually driven by a Westbury four-cylinder o.h.c. petrol engine and gearbox with friction drive, a very fine effort for 3½ in. gauge, which would have pleased Edgar, had he still been with us.

LBSC Memorial

I am sorry to have to report that we received no entries for the LBSC Memorial Trophy Competition. I cannot understand why this should be so. When the Competition was inaugurated, we only received five entries, which considering the offer of the very fine solid silver bowl which is held for twelve months, plus a nice "replica" bowl for permanent retention, was surprising to say the least. Last year we only had two entries, one of which failed on the track.

When it is realised that there are hundreds, perhaps thousands, of locomotives built to LBSC designs that would be eligible for this competition, the lack of interest is remarkable. Perhaps readers can offer some explanation?

The late H. D. Bond

I was sorry to hear of the death of Mr H. D. Bond, of Toddington, Beds., recently. Mr Bond was a regular reader of *Model Engineer*, President of the Luton & District Society of Model Engineers, and one of the original "Aylesbury Gang".

DONCASTER "PLANT"

Some more recollections of the famous Great Northern Locomotive works

Part II

by Don Young

Continued from page 64

THE CRIMPSALL TOUR began in No. 4 bay, the old resuscitating ground of the L.N.E.R. "Pacifics". The best way to explain the vast improvement in conditions is to relate that I had been fretting all day because of the overcast sky, and wondering whether suitable photographs could be taken with a hand held camera. For I well remembered the atmosphere of old, thick with smoke from welding and cutting torches working on grease covered main frames. Well, all the Crimpsall photographs were taken at 1/60 second exposure, with aperture opening around f5.6. This gives some idea of the lighting improvement! Just compare with the photographs that illustrated my 'steam-age' series.

No. 4 bay has now been relegated to "casual" repairs only. These are the non-routine repairs, such things as minor collision damage and train heating boiler defects. The early range of Midland Region 25kv a.c. electric locomotives were also being modernised, one by one, to bring them up to the performance of the 86 Class. Doncaster has achieved much in the field of electric traction.

Whilst in this bay, I could not resist asking a few unanswered questions from my experiences there, such as the outcome of the saga of the B.1 Class *Mayflower* that I mentioned in the series. I recalled that Mr. Huetson was bay foreman at the time, and spent long hours with the fitters in detailed examination of valves, pistons and the grimy smokebox interior. Well, in desperation, he finally went to Immingham shed and went out on the footplate of No. 61379. She was working a crack express from Grimsby to King's Cross. The first day was terrible. The engine was hardly notched up at all right through to Peterborough; time was lost and it was noted that the brick arch had been tampered with. At this juncture, Mr. Huetson left the footplate in disgust, asking for the brick arch to be rebuilt. The next day *Mayflower* was driven properly, time was gained all the way to King's Cross and steaming was exemplary. A complete transformation.

The famous "Pacific", A.2 Class No. 65532 *Blue Peter,* now in private hands, was the last steam locomotive repaired at Doncaster. For the re-naming ceremony, it was estimated that 25,000 people might attend. In the event 60,000 turned up, and swamped The Plant. The last eight enthusiasts, very youthful ones, were suitably scrubbed and escorted from the Works at 20.00 hours on that Sunday evening. *Flying Scotsman* had also received treatment here, before her ill-fated tour of the U.S.A. Let us hope this historic locomotive can still escape the burner's torch. It must be admitted that the Crimpsall Shop had undergone an amazing face lift, but the number of personnel employed has fallen dramatically.

Into the Wheel Shop, the scene was quite familiar, with one very noticeable difference. All the rows and rows of wheels were virtually of the same diameter. No more 6 ft 8 in. diameter driving wheels gracing the skyline. The machines I knew were mostly still hard at work, even the *in situ* crankpin turning machine. This is used for the many shunting locomotive coupled wheels. Incidentally, these latter are the only locomotives remaining that are built on what I call conventional lines. That is with main frames and outside coupling rods. To the present day apprentice they seem antiquated.

One thing that has changed really dramatically is the surface finish obtained on the tyres. This has to be seen to be believed. Yours truly has several times used the excuse for poor finish on miniature locomotive tyres as being consistent with full size. Not any more!

We next moved on to the diesel engine repair area in No. 1 bay. This is one field where I had previous experience, though admittedly this was a long time ago. We had several 350 h.p. diesel-electric shunting locomotives at Eastleigh, and an occasional visit from the prototype main line locomotives of the early 1950s. Partly because of this experience, I helped with the maintenance of four diesel engines during my short sojourn in the R.N. Two were of English Electric manufacture, and one apiece by Paxman and Lister. I regarded the English Electric products as solid "plodders", with no really distinctive qualities. The Paxman engine was much more exciting; but it did have a mind of its own, developing obscure defects at the most awkward times. From these early in-line engines, Paxmans have developed a sophisticated range of "V" type engines, culminating in the famous "Ventura". Well, performance of Paxman engines in traction duty has been closely akin to my own experience. They have been phased out of the present fold of main line diesel locomotives, to be replaced by those English Electric "plodders", admittedly of "V" form. But the basic construction remains largely that of 20 years ago. The mercurial Paxman engine is making a comeback in the traction field, the "Valenta" providing power for the prototype High Speed Diesel Train (125 m.p.h.). Each engine, after overhaul by competent B.R. diesel mechanics, is run for a total of 17 hours before installation in a locomotive. The performance is monitored, even to fuel and lubricating oil consumption.

So far in this story there has been one glaring omission; mention of the famous "Deltics". These fantastic machines sealed the premature fate of many of my favourite "Pacifics". There existed a ready-made excuse for heartily disliking them. Actually the record is such that one can only admire their achievements. These 22 locomotives, introduced in 1961 and 1962, have transformed the East Coast main line. Their story has been well told in *The Deltics, a symposium* published by Ian Allan. This concise book, expertly compiled, gives an account of the Deltics from several aspects. It can be recommended to readers if only to excuse myself not writing too fully on the subject of the diesel locomotive!

It is a fact that the usual noises emanating from the diesel engine are either much reduced, or totally absent, from the Napier Deltic type, due to their unique construction. Instead, there is a fantastic "racket" set up by the trains of gears necessary to couple the three separate crankshafts, located at the corners of the triangle; together with other drives to the auxiliaries, such as fuel boost, injection, and water circulating pumps. The overall noise level is much higher than on any other diesel engine. In the early years, Napiers, a subsidiary of the great English Electric Company, had the contract to maintain the Deltic engines. From 1968, however, overhaul of these engines was undertaken at Doncaster, to the initial chagrin of part of the local population. For that 17 hour running-in period meant working on into the night, and the distinctive Deltic sound, bouncing off various buildings, transmitted itself many miles, to cause much annoyance. One of the "loud spots" was in Sprotborough, where Mr Huetson lives. So he suffered both ways, from the noise and irate neighbours! The simple solution was a sound baffle erected outside the test bay, restoring peace to the locality. Yours truly suffered the same fate during an intensive gas turbine testing programme some years back. It is barely credible just how an innocent wall will reflect sound.

Our Crimpsall tour concluded in No. 2 bay, where all diesel locomotive routine maintenance is carried out. I asked what mileage a "Deltic" achieved between overhauls; the usual foolish question. The answer was that mileage was no longer the key factor. What happens in fact is that every seven months or so, each locomotive is returned to "The Plant" for bogie renovation. The achieved mileages were so high that tyre wear was the criterion. The bogies were exchanged, after which the locomotive returned to service, time taken being 8 hours. Engine changes occurred at intervals of approximately 6,000 hours of running.

I inspected No. 9012 *Crepello*, which was undergoing a bogie change. At the same time, both engines were being changed, as they were not performing correctly. Readers may know that the "Deltics" were introduced for a nominal 10-year period, during which time the East Coast line was to be electrified. Now they are the victims of their success, for the 10 years have elapsed and no decision has been taken on electrification. Due to their phenomenal mileages, some have accumulated more than 2½ million in less than 11 years, and engine problems are beginning to multiply. So a decision will soon have to be taken as to what is to replace the "Deltics". Yours truly was so spellbound, inspecting No. 9012, and watching the Deltic engines being installed into their very cramped quarters, that the opportunity to take an "action" photograph was missed; apologies to readers.

It was also explained that "hot boxes" were a thing of the past, thanks to the Timken roller bearings. Many latterday steam locomotives were fitted with this type of bearing, among them four Class A.1 "Pacifics" of A. H. Peppercorn design. Ironically, these bearings caused a lot of friction at "The Plant". Overhaul of these bearings and their refitting to each locomotive, was undertaken in the early 1950s by Timken personnel. Before these gentlemen arrived, clad in immaculate white overalls, a labourer would have spent several hours religiously cleaning all grease and dirt from the main frames, cannon axleboxes and all other areas where those overalls might make contact. Why could not this treatment be universally employed? Today, B.R. fitters attend to all the axleboxes, clad in immaculate blue overalls. How times have changed.

Moving out of the Crimpsall, we came across a bunch of workmen, debating what to do with a temporarily forlorn No. 9016 *Gordon Highlander*. She had caught fire the day before, said fire had been extinguished by the local fire brigade playing hoses into the exhaust ducts! It was time to bid farewell to Mr Huetson and thank him for his kindness. The schedule had gone completely awry, timewise.

I asked Roger if we could make a slight detour, to visit the Weigh House and Paint Shop. First we inspected a newly repaired Type 47 diesel locomotive in resplendent blue and yellow livery, outside the Weigh House. Inside were the same scales used for checking each axle loading, but fewer in number. A "Pacific" required 20 scales to "weigh off", twelve for the engine and eight for the tender. After the visits of *Flying Scotsman* and *Blue Peter,* the extra scales were removed, as a Co-Co diesel locomotive only requires a total of twelve. The Paint Shop looked forlorn, with only two locomotives in evidence. Modern times decree that the painter must come to the engine and not the reverse. Due to the workload, these two engines had completed overhaul before painting; now they were receiving the same careful treatment as the steam locomotives of yesteryear. Only the beautiful lining was missing.

Time was running short; in fact the set time limit had expired as we crossed the yard to the old carriage repair shop. When I really knew this shop, it housed some of the beautiful two-tone blue coaches from the "Coronation" train of pre-1939 days. Now it has been transformed into the Diesel Multiple Unit Repair Shop. So the work is largely as before, with the addition of the underfloor diesel engine and transmission units. I suppose the D.M.U.s could be termed the Rail Motors of the 1970s. Though a highly successful mode of transport, they leave me cold, save in one aspect. Yours truly is an avid supporter of automatic transmission for the automobile. The D.M.U.s also rely on a very good self-changing gearbox for their versatility.

Roger was engaged in this particular shop and explained that working conditions here were difficult due to the inherent dirtiness of the underfloor power units. It sounded like a good case for steam cleaning the underbodies before the units entered the shop for repairs.

As an ex-apprentice, I was particularly anxious to discover the method of training the lads who were entering "The Plant" at the present time. So I asked Roger if we could visit the Apprentice Training School. Once more I entered B.1 Shop, almost as timidly as on the first occasion! Here the "wind of change" had really blown at gale force. Roger introduced me to Mr McCollin, the Chief Instructor, and I was whisked away on a guided tour.

All craft apprentices entering "The Plant" now spend their first year at the school. Here they are segregated into their chosen crafts, such as fitter, electrician or joiner. Projects are undertaken during the year, to teach the rudimentary skills. For instance, sheet metal worker apprentices each make a cantilever tool box; whilst woodworkers produce a magnificent tray, among other useful items. The electrical craft apprentice has a very varied training, including the manufacture of a small electric motor and a transformer. Also in the curriculum is a course on domestic wiring. Meanwhile, the trainee fitter may be stripping down and rebuilding a withdrawn diesel engine, to gain valuable experience. Or maybe getting to grips with a self-changing gearbox. The budding machinist is still acquiring his skill under the watchful eye of Bill Woolner, just as yours truly did; but not mass producing items to be used on the locomotives. Bill has given many lads the right start in life and it was pleasing to learn he is still dispensing his particular brand of magic.

The school is complete with lecture room, where training films are regularly shown, also slides can be projected as further illustration. A totally different concept to that of former times, when many employers were criticised for using apprentices as cheap labour.

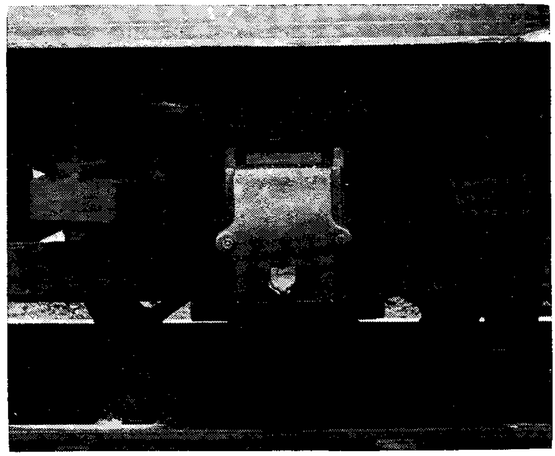
One craft was almost absent; that of old-style fitting. In the modern era of complete interchangeability, these skills are no longer quite so necessary. The older steam locomotive fitters were scared stiff, in the 1950s, that the dawning age of the diesel, with its tolerances expressed in tenths of thous, instead of whole thous, would be beyond their skills. They need not have worried, for even the most complex diesel engine, like the Deltic, is simply repaired by fitting spare parts. So it was actually a case of de-skilling the job. My thanks to Mr McCollin for showing me around the school. In those few short minutes I learnt a great deal about the new role of the apprentice.

It was time to say goodbye to my old and new friends. For "The Plant" still exudes the same friendly atmosphere as ever. To Mr Burkill, my thanks for arranging such an interesting tour at such short notice. Roger deserves a special mention for his excellent company and for remaining after hours in order that the tour could be completed. Unlike B.R., yours truly ran late!

I think readers will second the vote of thanks to Mr A. E. Robson, Managing Director of British Rail Engineering Limited, both for granting permission for the tour and for having this article and the photographs checked for accuracy.

Perhaps yours truly can draw a couple of conclusions, after penning these notes. The first is that there is still romance in the locomotives of today, sufficient for a young lad to carve an exciting career with British Rail Engineering. But for a lad raised on a diet of Gresley "Pacifics", there are too many ghosts. Not only of the steam locomotives themselves, but of the craftsmen that built and maintained them. For together with those famous, and not so famous, engines, many of my old friends have passed on. I shall remember them; the 20-year gap was very painful to span.

Just one final interesting point that has arisen as a result of my visit. As soon as the film was developed, it was shown to some fellow enthusiasts. "What engine is that under the bench in the Training School" they chorused. "Engine?" says yours truly, dumbfounded! There it was, tantalisingly in the bottom left-hand corner of the photograph. Then I recalled that Stan Parker, an ex-foreman at "The Plant", had told me of the find, under a table in the Tool Room. It must have been the 7¼ in. gauge "Single", which Stan told me is nothing like anything built at "The Plant", or anywhere else for that matter. Its origin, and the reason for its existence, I believe remains a mystery. Perhaps I can glean some information on this model in the not-too-distant future. Mention of a locomotive model in the Training School reminds me that at Horwich, a 5 in. gauge "Isle of Wight" locomotive should be taking shape. Dare I suggest that Doncaster follows suit?

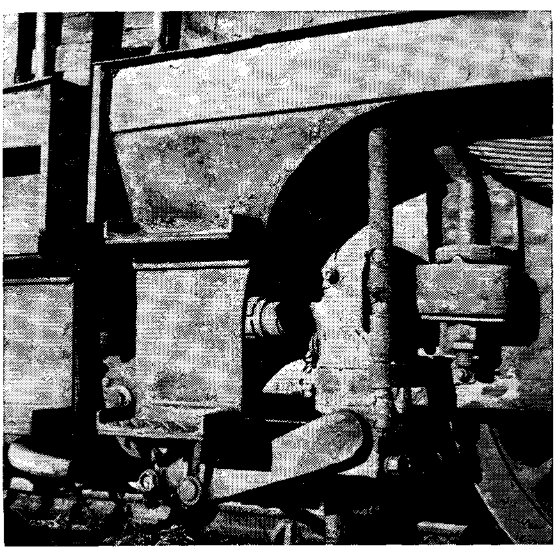


Intermediate tender axlebox and spring. Note the length of the spring.

Below left: The front tender step and hand brake arm.

JERSEY LILY

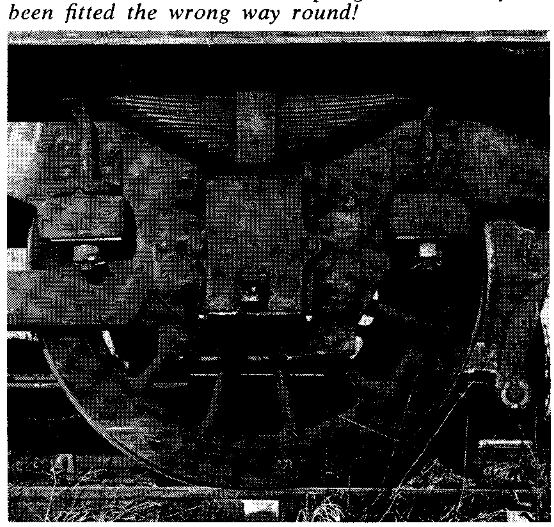
As our worthy Editor was unable to find the space for the drawing of *Jersey Lily's* tender frames he has allowed me extra space in this issue, so *Lily* builders can enjoy some further description of her tender. The tender springing is similar to that employed on the engine trailing axle, thanks to Mr Robinson's standardisation. The table of leaves on my drawing shows enough to make one spring.

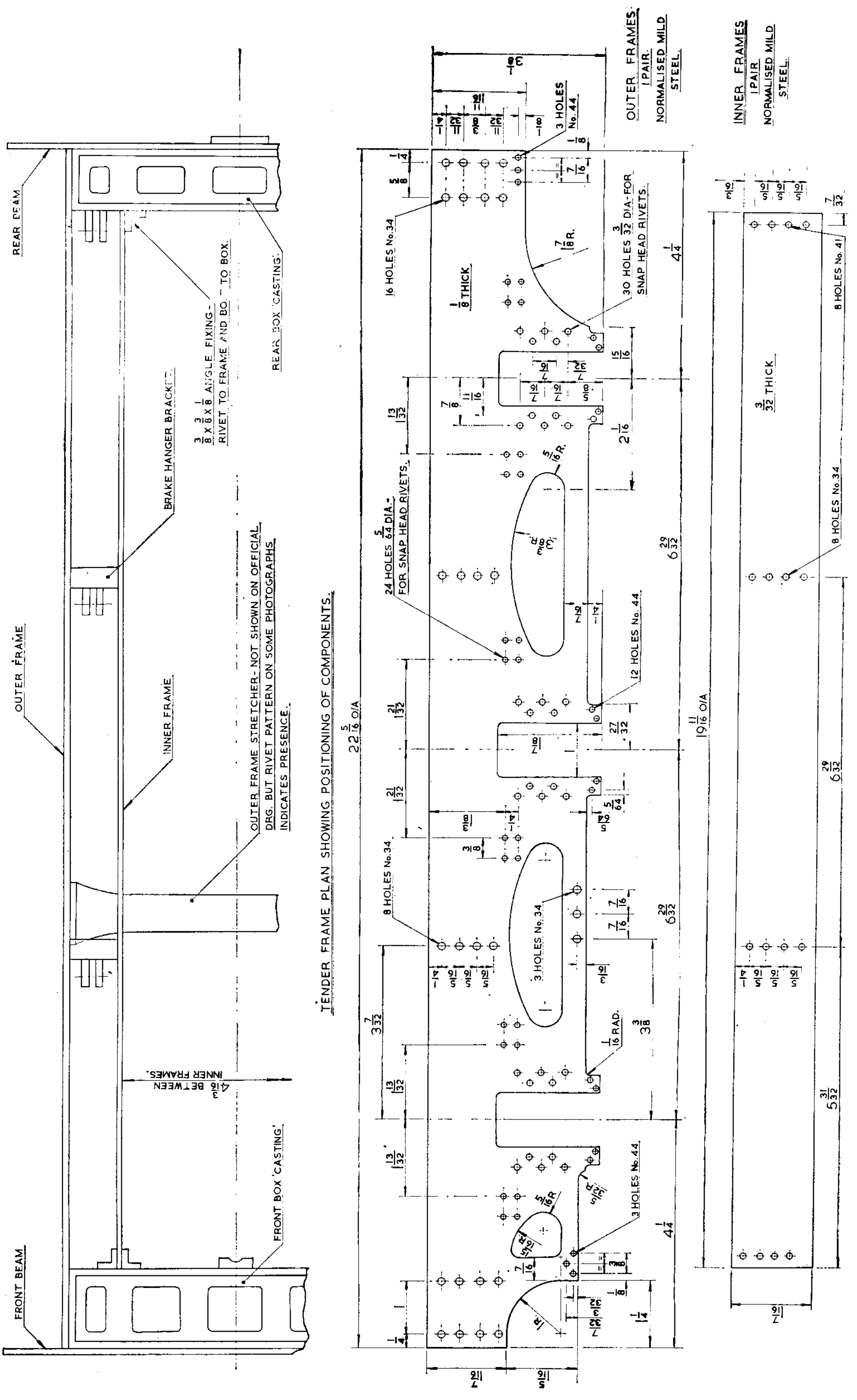


When completed, except for fitting the 6BA socket headed grub screw to lock the leaves in position, assemble the whole. This includes the spring rubbing plate, which I omitted to mention earlier. Add between 60 and 70 lb. of "ballast", fairly evenly distributed, to the chassis. This is to simulate the final "all up" weight. You can now check that the springs are of the correct stiffness, for the axleboxes should now be in their running position.

We must quickly proceed to complete the chassis, beginning with the brake gear. The brake hangers are very similar to those employed on the trailing engine wheels, whilst the brake shoes are identical. Assemble them, using the brake shoe pins made to drawing. Attachment to the brake hanger brackets

The rear tender axlebox and spring. The hornstay has been fitted the wrong way round!





DETAILS OF THE FRAMES FOR JERSEY LILY'S TENDER poses the same problem as I found on the K.1/1; the pins are too long. There are two solutions and it must be admitted that yours truly took the easy way out. This was to release the inner frame and slide in the pin. The alternative, and probably the better bet, is to drill holes in the inner frames, say $\frac{5}{16}$ in. diameter, to clear the head of the pins, when they can easily be pushed home. That last sentence was rather prophetic, for I soon got fed up with releasing some 30-odd screws, just to remove a brake pin!

Brake beams I would like to make from 5/32 in. thick steel, but it seems unobtainable of late, worst luck! Once again time has overtaken that last remark, for 4 mm thick steel strip is now becoming available and will be ideal here. Shape the central portion, from the chosen strip, drilling the brake pin holes as shown. For the beams as illustrated, drill into their ends No. 51 to about $\frac{3}{16}$ in. depth and tap 8BA. Turn up the end rods from 5/32 in. material, screwing to suit the beam. Screw them home, then secure with Easyflo or Loctite retaining compound. For the thicker, 4 mm, material, the end journals can be integral with the rest of the beam. Assemble to the brake hangers, drill the 3/64 in. split pin holes and we can move forward to the brakeshaft.

The brakeshaft is a simple turning job, with the pull arms made up like a valve gear rod. Braze together and clean up. Paint, using the black undercoat previously mentioned, except for the journals for which we must now provide the trunnions. These are made from $\frac{5}{8}$ in. × $\frac{1}{4}$ in. b.m.s. bar. First mill the recess to fit neatly to the frames, $\frac{5}{16}$ in. wide and $\frac{1}{8}$ in. deep. Saw off to about 1 in. overall. Mark on one piece the centre of the 9/32 in. bearing hole. Clamp in the machine vice, as a pair, and drill the aforementioned hole. Clamp one trunnion to its frame, remembering they are handed, spot through the No. 34 holes. Drill the trunnions No. 43 and tap 8BA. Fix temporarily with screws, then assemble the brakeshaft and second trunnion. Make sure that the shaft turns freely, before drilling and tapping the second trunnion. Remove the trunnions and finish profiling to drawing.

Pull rods come next, starting at the trailing end. Cut four $1\frac{1}{2}$ in. lengths from $\frac{3}{8}$ in. × $\frac{1}{16}$ in. steel strip and reduce to $\frac{5}{16}$ in. wide. Bend round a piece of $\frac{1}{8}$ in. rod, to give an embryo fork end. For those builders using thicker beams, remember to make the fork ends to suit! Fit a piece of $\frac{1}{8}$ in. thick packing between the jaws of the fork ends; mark off and drill the No. 22 brake pin holes. Now, at the centre of the fork eye, drill No. 50 and tap 8BA. Fix to the relevant beams with brake gear pins and clamp the brake shoes hard onto the wheels. Measure the distance between fork ends and cut a length of $\frac{1}{8}$ in. steel rod $\frac{3}{16}$ in. longer than the dimension obtained. Reduce and screw both ends to 8BA for $\frac{1}{8}$ in. length. Screw into the fork ends and adjust until the required centre distance is obtained. It will not necessarily be the 6 29/32 in. stated, as there is plenty of room for small tolerancing errors to creep in. Braze up and clean, removing any excess threaded portion protruding into the fork eye. Carefully radius the fork ends over a 5/32 in. mandrel. The operation is identical to that for valve gear rod ends, though the parts are much flimsier. Finally, file the remaining portion of the fork ends to $\frac{1}{4}$ in. width, as shown. The fork end for the intermediate pull rod is identical; at the front end, the collar is made from $\frac{5}{16}$ in. steel rod, reduced to 9/32 in. diameter and drilled No. 22 before parting off an $\frac{1}{8}$ in. thick slice. Before we can finish this rod, the front pull rod fork end is required.

For this fork end we need a $2\frac{1}{2}$ in. length of the $\frac{5}{16}$ in. × $\frac{1}{16}$ in. section. Bend as before, then drill the brake pin holes. Clamp the front pair of brake shoes hard on to the wheels, then assemble the fork end. Fit the $\frac{1}{8}$ in. thick collar to the rear hole of the fork end. Measure for, then make up the $\frac{1}{8}$ in. rod, finishing as before. The front pull rod is a simple matter to complete.

For the brake adjuster, start with a length of $\frac{5}{16}$ in. square bar. Drill the No. 22 holes right through, then produce the $\frac{1}{8}$ in. slot. Radius the ends then drill and tap the back end, centrally, at 5BA. Chuck a length of 4BA hexagon steel rod, centre, drill No. 40 for about $\frac{3}{8}$ in. depth and tap 5BA. Scallop the outer end to suit the piece just made, then part off to 7/32 in. overall. Fit the two pieces together for silver soldering, with a very rusty 5BA screw. Yours truly would use an odd scrap of aluminium, but we have been through all that before! Assemble the brake adjuster, with a locknut on the front pull rod, and couple to the brakeshaft, using the outer holes. That leaves the handbrake outstanding.

This time I have omitted a sectional assembly of the brake, it being very similar to that employed on *County Carlow* and the No. 1 Rail Motor. The column is shown machined from $\frac{7}{16}$ in. square mild steel bar, though on reflection brass would be equally suitable, if not more so. Whichever material you choose, the operations that are required are simple turning ones. Make up and silver solder the base to the column. As the handbrake fixes through the tender sole plate, the positioning details are given on the latter item, yet to be described. So we shall have to leave erection for just a little while.

The handbrake screw is one of those simple turning jobs that come as a bit of light relief. I suppose most builders suffer periods of frustration at some time or other during construction of their locomotives.

To be continued

Locomotive Boiler Fittings

Part II

by C. R. Amsbury

Continued from page 69

THE BLOW-DOWN valve body is turned up to the drawing with a centre drilled inlet end only. Next drill and taper ream the cross hole, and then drill the inlet passage and hole for the outlet fitting. This is then silver soldered in and both holes drilled through to the taper hole. The plug may now be made and drilled *in situ,* half way from each side. The blow down valve is screwed into the gauge with an annealed copper washer between the two—I make mine from .005 in. and .010 in. foil; don't be tempted to use aluminium, it corrodes and makes the point difficult to unscrew.

Top Feeds and Safety Valves

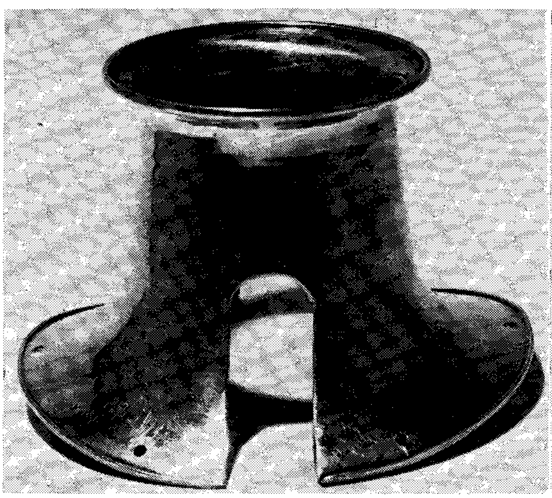
The drawings are self explanatory for these items which are designed to suit a sheet metal casing. This looks much better than a casting particularly from above which is the usual view of a model. The top feed fittings are machined from solid and the flanges fitted at the same time as the rest of the silver soldering. Two 6 BA brass screws are used to hold the top feed bodies to the cover plate whilst silver soldering, these screws are drilled out afterwards to form the feedways.

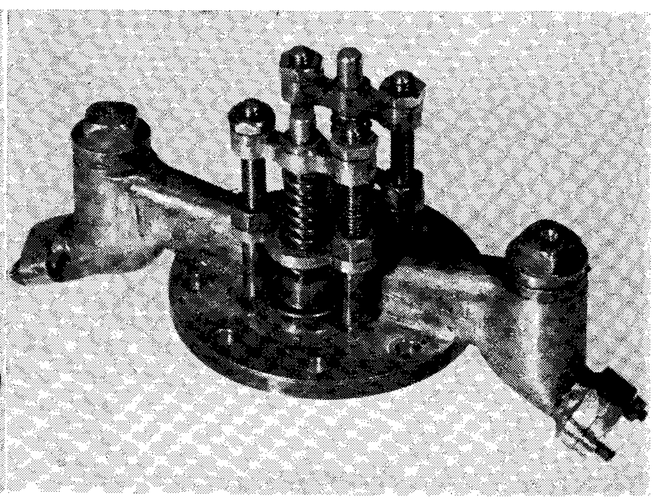
The casing entails some interesting metal spinning, I am no expert at this, but will describe the method I have satisfactorily used. A former should first be turned out of hard wood and is made to suit the shorter conical length at the rear of the casing. A 3 in. disc of 18 or 20 s.w.g. brass is then held against the small end of the former by a flat revolving support from the tailstock, a fairly heavy pressure will be needed.

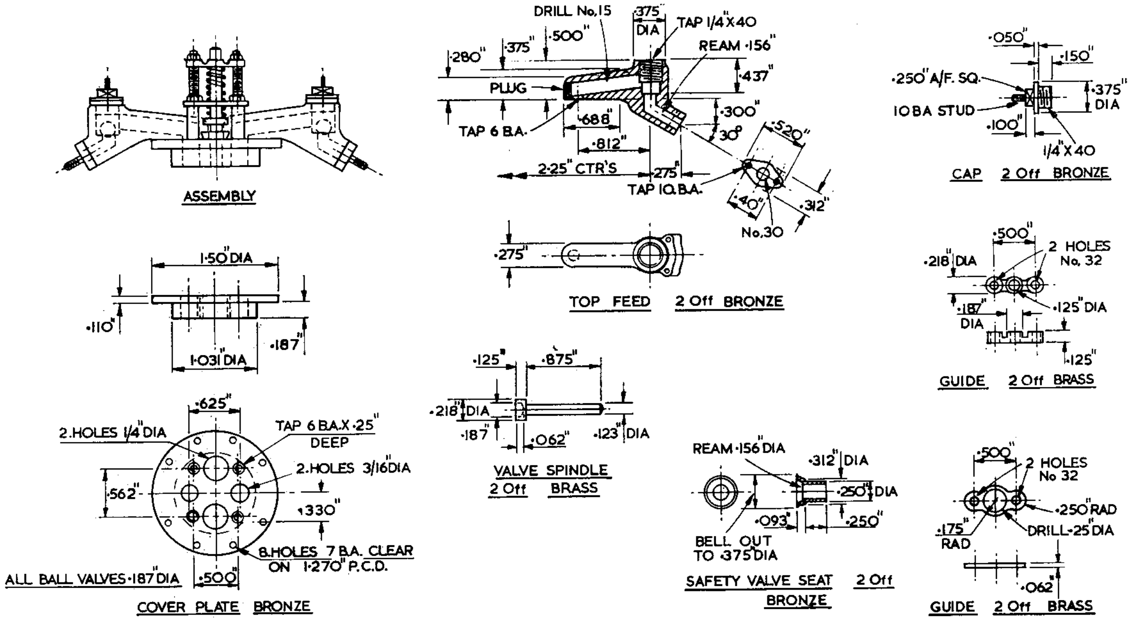
The tools required are simple. A tool rest is needed consisting of a bar about 1 in. by $\frac{3}{4}$ in. with a vertical pin set about 1 in. from one end and one or two hand tools. The ones I use consist of a bar about $\frac{1}{2}$ in. dia. having a $\frac{1}{4}$ in. or $\frac{3}{8}$ in. bore ball race fitted at the end. One of these has the race axis along the bar and the other has the race in a fork at the end of the bar.

Run the lathe at a moderate speed, say about 500 rpm, and with the hand tools work the brass sheet around the former by levering against the pin on the tool rest. Start at the centre and work outwards, but don't concentrate too long on any one area, particularly at the inner end. Very frequent annealing of the brass sheet will be required. Don't be disheartened if one or two split—it took me about six attempts before making the first successful one. When the sheet has been worked down to the former all the way along, the various ridges and rings can be easily worked out. You will now have the embryo bottom half of the casing.

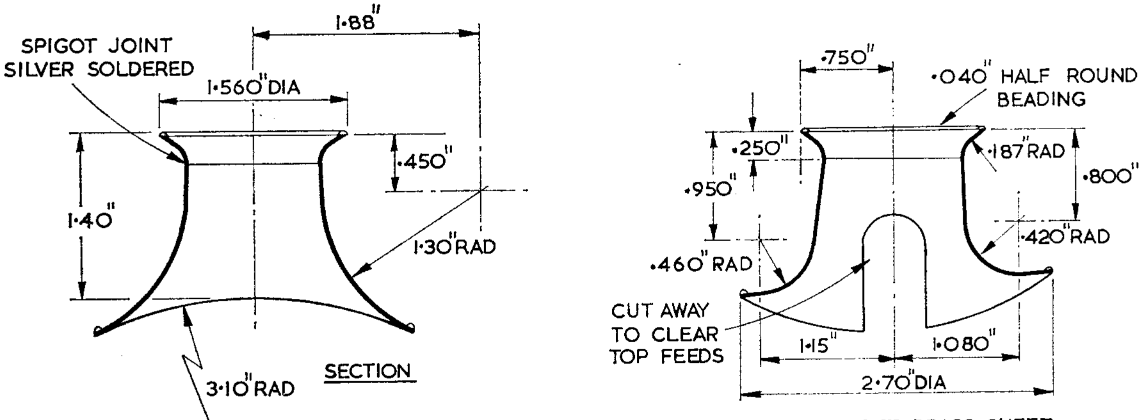
At this point either another former can be made, or the first one mutilated by filing away two opposite sides to form the fairing at the side of the boiler barrel. An area in between these on one side is also filed away to form the longer length of cone which matches the front taper of the barrel, the



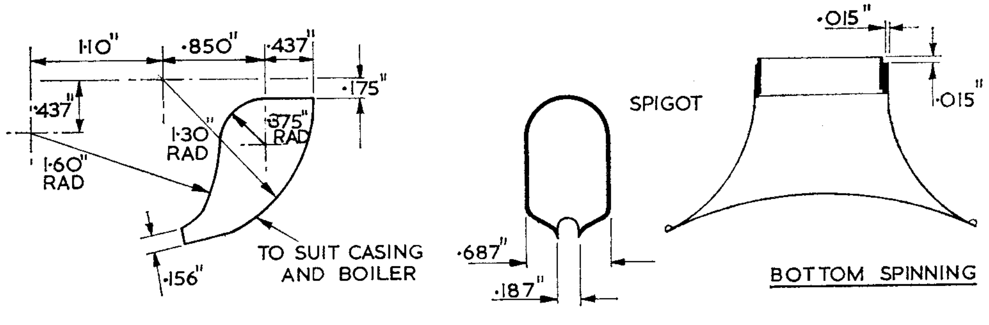




TOP FEEDS AND SAFETY VALVES



SAFETY VALVE CASING 20 S.W.G. SOFT BRASS SHEET



TOP FEED COVER 2 Off 20 S.W.G. BRASS

untouched side should match the rear of the taper barrel. Smoothly blend in these filed areas to the original curvature of the former. The casing should now be worked with a small mallet or ball pein hammer to fit the modified former. It should also be tried on the boiler and the flange coaxed to fit properly all the way round.

The next job is to make the top half. I have found that the same former can be used, and the small curve required can be raised without a support, but if in doubt make a former to the new shape; ensure, if you do this, that the conical diameter is identical to that of the first former.

A disc about 2¼ in. diameter is all that is needed for this part and it will take to the former much easier than the larger disc. Before removing from the former turn the outer diameter to the drawing size and turn away the inner diameter until you are just through to the former, cutting off the blank end. Now remove this item and refit the large cone and its former if you made a separate one. Fit the large cone tightly on the former and turn the blank end to form the spigot shown in the drawing. Now chuck the larger diameter of the top half of the casing and skim out the bore to fit the spigot on the bottom half. This operation will have to be taken very gently with light cuts.

The two halves may now be silver soldered together. Further bedding to the boiler taper will probably be required after this operation and the base flange can now be trimmed up to a smooth curve.

It should now be looking something like the finished shape and any small dents or lumps should be carefully tapped out against the former or a small anvil beak. When this has been done the outside can be filed and polished with emery paper etc. A small hemi-spherical section ring should be turned up and soft soldered to the top to simulate the wired edge of the full size article and a piece of thin brass wire soldered around the base flange edge for the same reason. The side slots should now be cut to clear the top feeds and this item is now complete.

The top feed covers are the next item and a former will be required, this is best made in aluminium to the drawing dimensions. To be strictly to scale, these covers should fit through the safety valve casing and be flanged outwards. They are held by rivets through these flanges to the casing.

To make a good job in this manner entails using very thin material for the top feed covers and it would be difficult to get a neat joint with the casing. I have used about 20 s.w.g. brass for these covers, they are held to the top feed clack covers by a 10 BA stud and nut and can be filed to a neat joint with the boiler and safety valve casing. This also enables them to be easily removed for painting (they are not polished as is the casing) and to get at the top feeds. To form these covers cut a piece of sheet about 2 in. by 2 in. and bend it U form around the vertical side of the former. Slit it along what is to be the top face, as far as the corner and beat each side inwards, removing surplus metal with the tin-snips as the sides overlap, until the metal is down to the former and making a neat butt joint along the top. During this procedure also beat the vertical side to fit the former. Several annealings will of course be required and don't worry too much about small dents, the metal is thick enough to file these away later. When the cover fits the former properly on all sides the butt joint can be silver soldered from the inside.

All that remains to do now is to trim it up and file to a good fit against the safety valve casing and boiler. It should also sit down on the clack cover; a packing washer may be used here if the heights do not tie up exactly. Soft solder this washer inside the cover when correct. The cover is finally drilled for the 10 BA stud in the clack top. Two of these are of course required and should be made together.

Turret and Whistle Valve

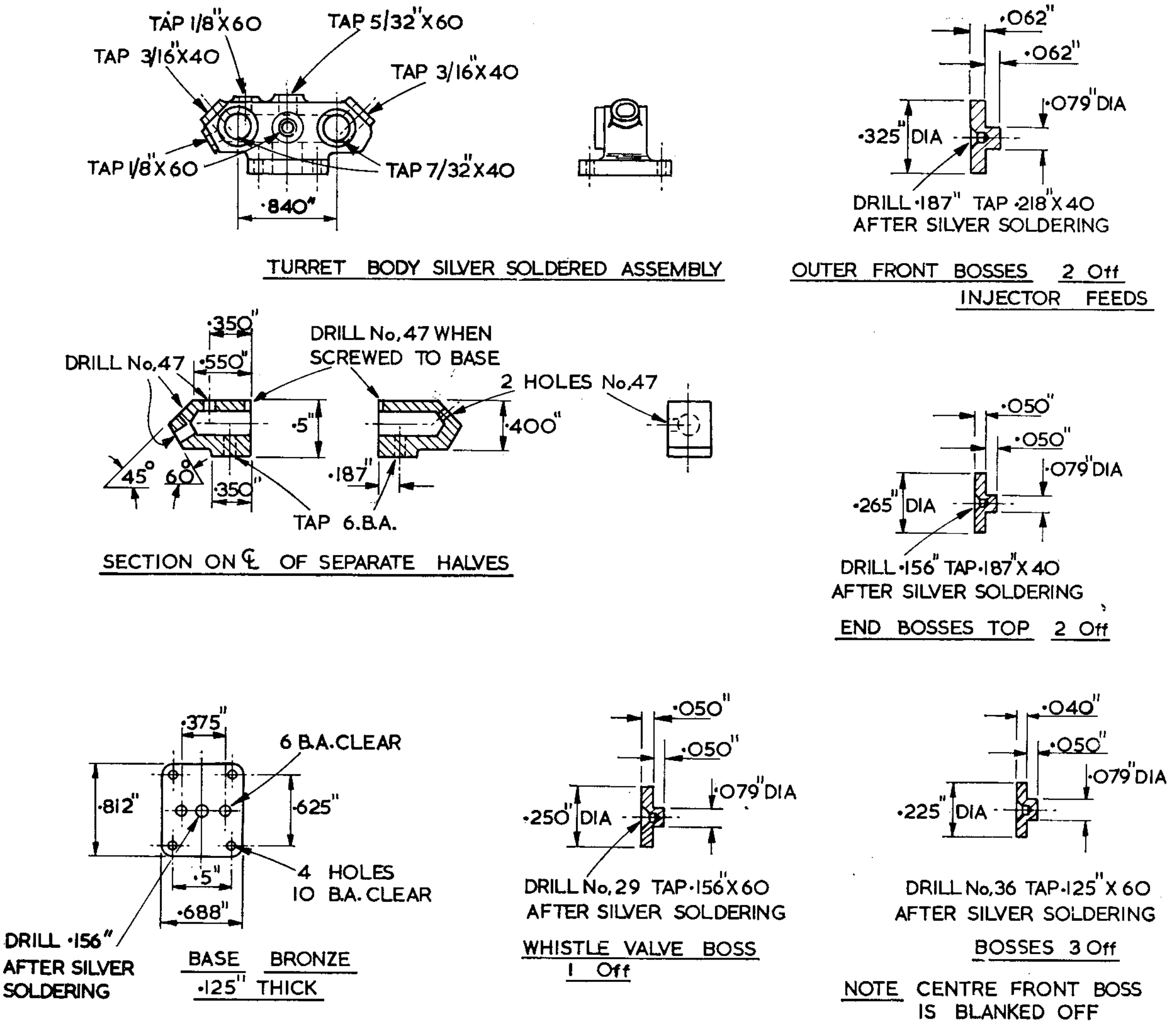
The turret does not need much description, the two halves of the body are held to the base with two brass screws whilst silver soldering, and all the various bosses should be put on at the same time. The various tapped holes can then be put in and the fitting cleaned up.

The screw down valves are similar to the valves already described, but note that the injector steam valves are chambered out to give a large steam passage way. The small valves at the extreme ends are right- and left-hand and silver soldering the elbow needs a simple steel fixture to which the two pieces should be attached by their threaded ends for this operation. Another simple fixture is required to hold the whistle valve feed pieces to silver solder the elbows.

The whistle valves are unlikely to pass the steam required for a decent whistle and I have used these to operate a relay valve attached to the whistle proper which is fed with a larger bore steam pipe from a convenient point. The other whistle valve feeds steam to the dummy whistle which then emits a realistic cloud of steam.

Brake Valve

The brake valve I use is the result of testing several different types of valve. In outward appearance it resembles a G.W.R. valve but internally is



TURRET BODY DETAILS

simply two ball valves, which are pushed off their seats by pins, as in a whistle valve. To operate, pushing the lever to the left releases the train pipe vacuum, and to the right admits steam to the ejector.

The correct steam valve can be made in place of the dummy, but I have found that when driving it takes too long to operate, if only a brief brake application is required the train has stopped before the brake can be released. A ball valve is used for the vacuum release because I have found it impossible to get an adequate vacuum seal with the correct slotted faceplate valve and also this would release the vacuum too quickly anyway. The construction should be fairly obvious, the body may be carved from the solid and the steam inlet soldered on, or the whole thing may be fabricated by silver soldering on the various bosses to a piece of $\frac{3}{4}$ in. round bar. The dummy vacuum valve is made by slotting a disc of brass with a fly cutter and then silver soldering the outer ring and handle to it—don't use too much solder here or the slots will be filled up and they takes ages to clean out with a needle file.

To be continued

BUILDING MODEL TRAMCARS

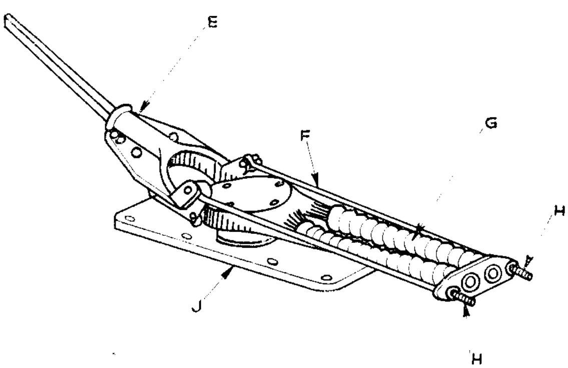
Part VI

by E. Jackson-Stevens

Continued from page 30

IN THE CASE OF a covered top double deck tramcar or a single deck tramcar the trolley-standard was not needed and a base only was necessary as the boom pivoted on this. The illustration is of a type known as the "dwarf trolley standard" as these were used when the clearance under railway bridges was very little, they were arranged with external springs. The trolley-arm "e" is attached to a forked section which is pivoted on the base. Two helical springs "g" are held in a frame to provide the tension necessary to keep the trolley-boom against the trolley-wire. The adjustable tension screws "h" are provided with locking nuts to prevent them losing the adjustment when set. The base, made from sheet brass, is shown at "j" and the forked section supports at "f". These latter are made from $\frac{1}{16}$ in. brass rod with the ends threaded to take the locking nuts. The actual base is, of course, threaded to take the pivot-screw. The tension of the helical springs can only be found by trial and error, depending on the rigidity of the trolley-wire and the pressure needed to prevent the trolley-wheel from dewiring. Once the correct tension of the springs is found, they can be adjusted by the tension-screws as in actual prototype practice.

Again, referring to the drawing of the tramcar, underneath the trolley-standard will be seen a trolley-plank. To this was affixed the base-plate of the trolley-standard. The object of the trolley-plank was twofold. It was constructed to distribute the weight and tensions of the trolley-boom and standard over the wider area of a lightly constructed roof and it also served the purpose of providing a "cat-walk" for maintenance staff engaged in oiling the trolley-springs and swivel-plate. In the case of a model, the trolley-plank is usually made from $\frac{1}{8}$ in. hardboard mounted on $\frac{1}{8}$ in. × $\frac{1}{8}$ in. hardboard strips affixed transversely underneath the trolley-plank (in $\frac{3}{4}$ in. scale to the foot). Both these and the trolley-plank are pinned and glued to the roof.

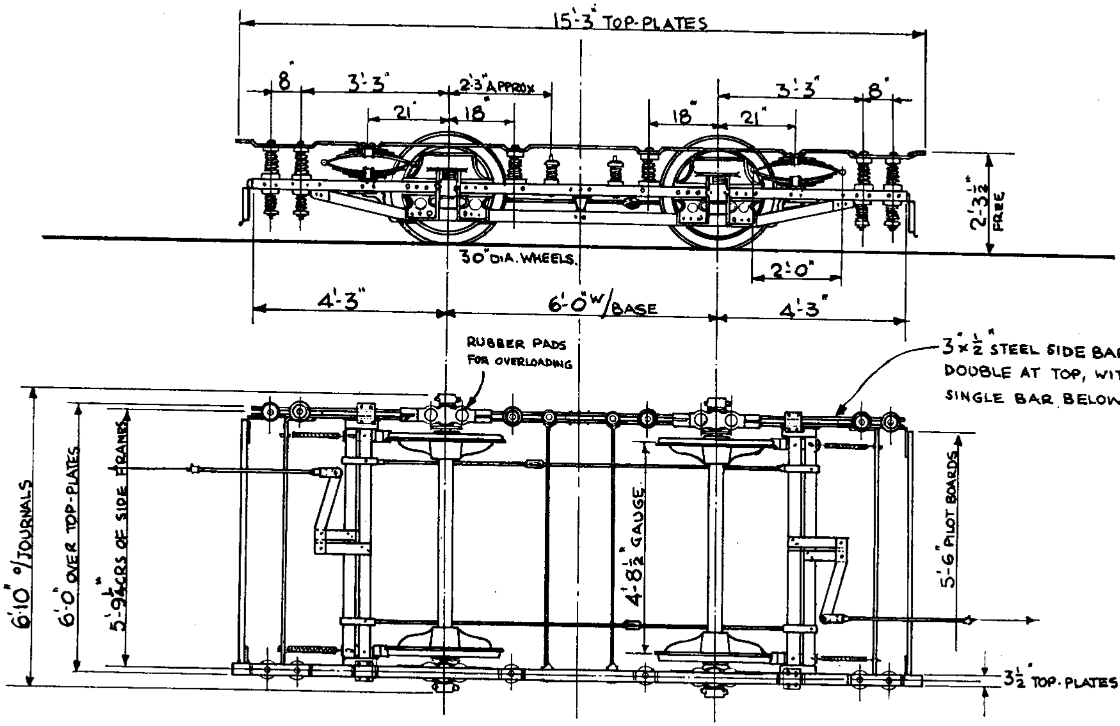


DWARF TROLLEY BASE

The main feeder-cable is taken from the brass base of the trolley-base to which it is firmly soldered, down the previously-prepared $\frac{1}{4}$ in. tube behind the side corner-pillar to the junction-box underneath the platform. The wiring of this can, of course, be concealed in the section of wiring from the trolley-base to the corner-pillar by enclosing it between the roof and the ceiling.

It had been my intention, following the fifth article in this series, to continue by describing the different mediums of body construction adopted by tramcar modellers, but in view of the number of requests I have received from enthusiasts who are constructing particular types of tramcars which were popular at the beginning of this century, I will endeavour to comply with their wishes. Quite a number of letters ask me why I have not described the construction of a "Peckham" cantilever truck and some ask if I could elaborate on the method of fixing the framing of a tramcar body together.

The whole object of this series, as I said at the outset, is to help model engineers wishing to construct model tramcars, who only have access to the minimum amount of tools and who do not want to incur the expense of an elaborate workshop. So many of us, devoted to modelling tramcars, have been saddened at Exhibitions and elsewhere when our models have been running, subsequently to discover that embryonic model tramway engineers, who have asked so many intelligent questions, return the following year to say that "the purchase of a lathe had deterred them" or "they had not been able to afford the necessary machine tools", and similar excuses. I can only reiterate that to purchase a lathe for the sole purpose of constructing a model tramcar would be an unwarranted extravagance for the extremely occasional items for which it would be needed. To which I will add that each edition of *Model Engineer* devotes half a page under its "Club Diary" to giving details of meetings of scores of model engineering clubs throughout the country. It would be difficult to find a town without a nearby society without an accessible lathe on which to turn the wheels or any similar small component, or to persuade a friendly model



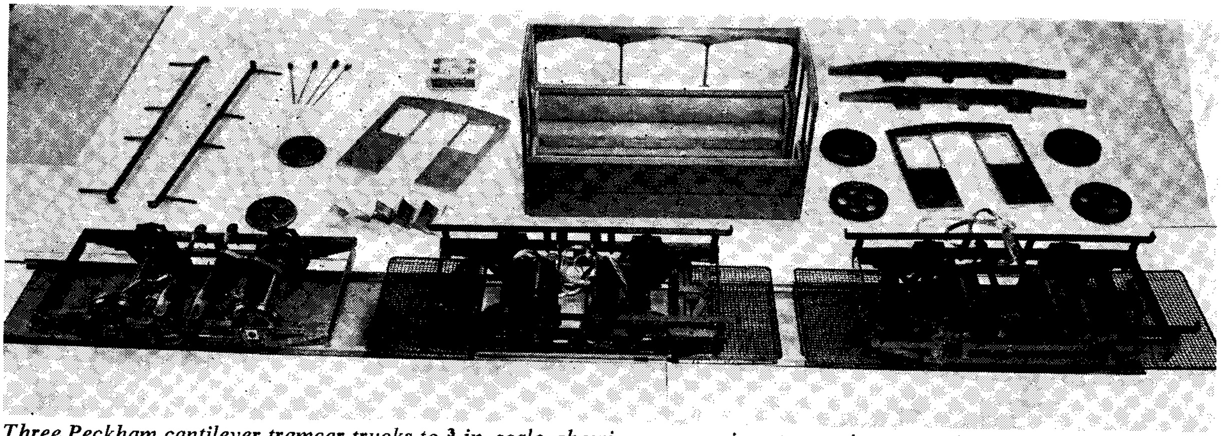
Peckham cantilever standard tramcar truck.

engineer to undertake this initial help, if one is not sufficiently experienced, for most model engineers are extremely keen to assist a fellow-enthusiast with a problem, or to share knowledge.

The only reason I did not deal with a "Peckham" cantilever truck when describing the construction of a four-wheel open top car was because the side-frames for this type of truck are not available from the Tramway & Light Railway Society. Additionally, this particular truck is a little more complicated than the straightforward Brill 21E which I described previously. I therefore assumed that the construction of a "Peckham" truck might prove discouraging to young modellers new to tramcar modelling.

However, these "Peckham" trucks were constructed by British manufacturers, notably the Brush Company of Loughborough, under patents acquired from the Peckham Car Wheel Company of America. They were used, in early days of tramcars in England, by a number of undertakings (the majority of Bristol's fleet were equipped with them throughout the entire life of that system). Many systems found the springing rather too soft and on 3 ft 6 in. gauge systems the tendency to excessive oscillation was very pronounced and their use was avoided on sleeper-track routes. Exactly the same tendency will be apparent in these trucks constructed to $\frac{3}{4}$ in. scale. This should not deter a modeller from reproducing one if he admires oscillation! For myself, I prefer a smoother ride on a bogie-car! Each to his own taste.

As truck side-frames are unavailable in $\frac{3}{4}$ in. scale for "Peckham" trucks, the modeller is thrown on his own resources. There are two methods of construction. Either they can be made from correct section brass strip, including the supporting stress-bar and drilled to take the necessary 10 BA nuts and bolts (in this scale) and the main side-frames, stress-bars and horns can be silver-soldered together, or they may be constructed from two strips of brass, as shown in the drawing by Mr Eric Thornton, marking out and sawing to shape. A feature of this particular type of truck was the number of round-headed bolts on the main side-bars and the extra springs (as compared with a Brill 21E truck). Only a larger-size scale drawing, obtainable from Mr Thornton, will emphasise the extent of the detail necessary. In this actual 6 ft wheelbase truck, with 30 in. dia. wheels, it will be seen that the length of the main side-bars is 14 ft 6 in. and the length of the cross bracers or transomes centre-to-centre distance of the truck side-frames is 5 ft $8\frac{1}{8}$ in. on the prototype. These are made from flat strip brass with each end bent through a right angle for fixing to the truck sides by two bolts. Remember when con-



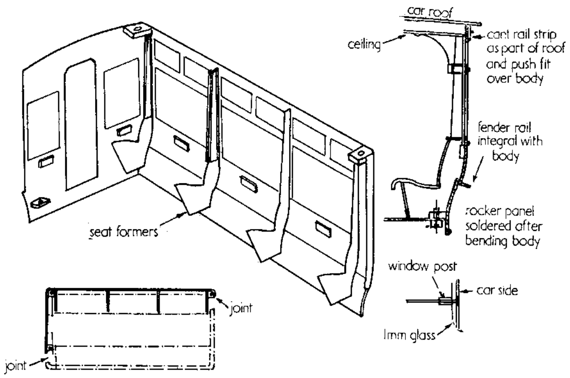
Three Peckham cantilever tramcar trucks to $\frac{3}{4}$ in. scale, showing progressive stages of construction together with a lower saloon body and ancillary parts ready for assembly—part of a batch of five Bristol trams under construction by Mr John Baylis of Westbury-on-Trym. Photograph by Mr Baylis.

structing the top-plates to bend them at the six points shown to allow for the holding-nuts of the spring (interior) screws to be recessed as the top-plates are screwed directly to the body of the car.

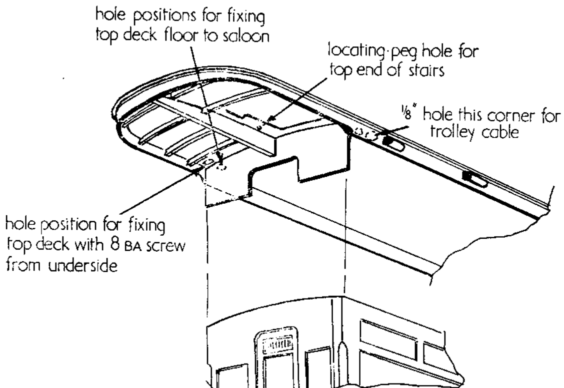
As in the prototype, the springing of this "Peckham" truck will require special attention, as I must emphasise again, due to oscillation difficulties which may be encountered when the completed model is running on the track. Coil springs are not difficult to obtain but may need cutting to correct length on assembly. Care should be taken in selecting coil springs since springs which are too strong will defeat any attempt to get them to work and if they are too soft they will close up until the car body rests on the top of the truck side. It is better to use a spring which is too light or soft than one which is too strong as a second and smaller diameter spring can be added inside the other if necessary. The reason for this is that, in addition to the coil springs, there are four leaf springs to share the load, as shown in the drawing. If the leaf springs are to be dummy or non-working then allowance can be made for the car body to be carried on the coil springs so there would then be a gap of, say $\frac{1}{16}$ in. between the spring pads and the truck top-plate. The leaf springs are attached to the cantilevers by inverted "U" bolts made from brass rod. The gap so left is completely hidden by the spring rubbing pads which have wing-like ear flaps on each side.

It is advisable when assembling the truck to do it in the upside-down position, using the two vertical ribs as the base. The side-frames of the truck receive lateral support by the diagonal brace bars. From this point of assembly the guidance given on page 844 can be followed as the motor suspension and ancillary details are common to both types of truck.

Below: Body construction, showing rigid type of assembly.



Below: Method of assembling body.



In order to obtain the most recent information on the construction of a "Peckham" cantilever truck, I contacted an enthusiastic tramcar modeller friend in Bristol who is, at this moment, constructing five Bristol tramcars in ¾ in. scale with these trucks. He has very kindly loaned me the illustration shown which not only exemplifies three of his completed trucks but also the lower saloon of one of his bodies, with the bulkheads and, in addition, a pair of "Peckham" side-frames and a pair of top-plates and some of his wheels. The illustration will serve to amplify the details I have been asked for in connection with the type of body construction shown in the drawings. On the left, a truck is shown in its first assembly stage, with the motors mounted and suspended but with the brake-rigging not yet installed and with the axlebox casings not complete. The centre and right illustrations of the trucks show them complete, with pilot-boards, brake-rigging and life-guard trays installed. (In a later article, I hope to describe tramcar brakes for those who like to equip their models with them.)

In this case, my friend made a mould for his "Peckham" trucks, and cast them in phosphor-bronze. He makes no claims to being an expert in casting but in this instance his attempt at casting was a success as can be seen from the illustration. Except for once casting finials for ¾ in. scale traction-poles, I have had no experience in this field so I am unable to discuss it.

And now for those enthusiasts who asked me to elaborate on the details of the method of body construction described in part II on pages 961/4. From re-reading the article in conjunction with your letters, it seems that the difficulties encountered centre on the actual interior of this model open top double-deck four-wheel standard balcony type tramcar. Although the drawings show the interior sections of this model, and I did describe the actual framing on page 964, I think the two drawings given in this issue will give the details required.

The drawing showing the interior of the side framing with the bulkhead attached will amplify how the seat formers should be made and attached to the interior side framing. Some modellers continue the seat formers right up the window pillars, as is shown, others are content to glue them to the waist and rocker panels only. If they are continued to the top of the window pillars they will have to be encased, as shown, above the waist panels. Again, it is necessary to stress that hardwoods *which have been seasoned* are preferable. Although I described a 4 ft 8½ in. prototype formerly where the rocker panel does not have such a pronounced "tumble-to" as in 3 ft 6 in. gauge tramcars, I thought it best to give a drawing of this latter gauge on this occasion and it will be observed that the rocker panel (underneath the waist panel) has a more pronounced "tumble-to". If the "tumble-to" is to be as pronounced as this, it would be better to bend it out of brass sheet making the fender-rail an integral part of it and attaching it firmly to the waist-panel with Araldite for a more satisfactory finish. The method of attaching the window posts to the car side is also shown and either glass or perspex may be used as I have discussed the merits of both.

The underneath of the two end seat formers would be panelled from seat-level to floor and the longitudinal seats were sectioned at this point to enable them to be lifted up, for underneath were the sand-hoppers which were filled daily. On some systems the panelling extended throughout the whole length of the longitudinal seats, on other systems the panelling from seat-level to floor was only at the ends, to hide the sand-hoppers, while ornate bulbous-shaped legs supported the central section of the seating. The illustration of Mr Baylis' completed interior of a model Bristol car clearly shows the sectioned seating divided as described. Unless one possesses an interior view of the prototype being modelled (and these are scarce) the only answer is a visit to the Tramway Museum at Crich in the interests of accuracy.

The method of attachment of the roof to the prepared car body is shown in the next drawing. The bearers underneath the balcony flooring are shown and, in this particular method of construction, it will be seen that the upper bulkhead insert has been attached to the car ceiling. This is another method for those who like to make their car roofs detachable, for easier interior access and, in this case, the cant rail strip (underneath the extremities of the upper-deck flooring) is part of the roof and flush-fits over the body. The hole positions for fixing the top-deck to the saloon are also shown. In the same drawing may be seen a small ventilating shutter at the top of the bulkhead door. Although these are somewhat intricate to make, they are well worthwhile in adding to the finish of the model (one enthusiast known to me makes them operative!). In actual practice they slid open and shut.

The illustration of Mr Baylis' interior of the Bristol car gives a good example of the apertures (at the seat ends) recessed to receive the sliding doors. These, of course, are always on the right-hand side (when entering) of the lower saloon. The interior bulkhead frames will be positioned over these as he completes this model. An improved type of ventilation was fitted to the Bristol cars about 1930 when the cant rails were fitted with upright louvre-type slots so arranged as to pick up a current of air from the direction of travel. This system of

Continued on page 128

A Miniature Railway in Cornwall

by L. A. Green

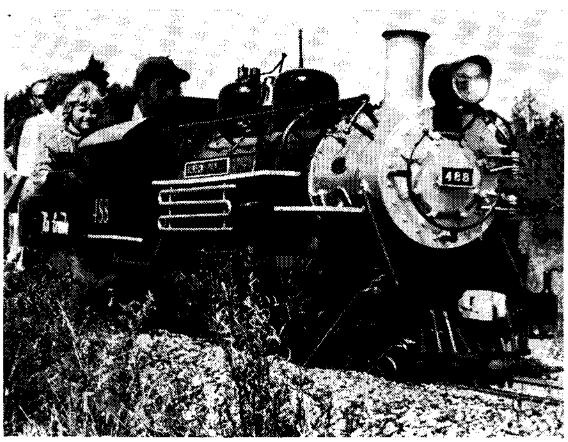
IN THE SPRING of 1964 when on a tour of Cornwall with a friend we called upon his nephew who was farming near Liskeard. This was John Southern and I wondered later why he had not changed his name to "Western" for he was clearly a Great Western addict. He was also a dedicated collector of railway miscellany, his collection including a fine selection of G.W. number and name plates and, I remember, even a "coffee pot" safety valve casing.

As we turned out of the lane into the farm, we could see on the left an extensive housing estate for the pig population, splendid modern apartments whose occupants were living out their short lives in ease and indolence. As I had feared, our party was taken on a conducted tour of the pig homesteads. Now I have always found pigs to be less than enchanting as animals and have avoided close contact with them, so I hung back and turned aside to a small eminence well to windward. From here I could see a large field on the far side of the farmhouse and earlier John had told me it was his intention to lay down a 5 in. gauge ground level track along the side of this field. From here I could appreciate what a splendid undertaking this would be. It was to be a double line with a large radius connecting loop at the far end and would provide a galloping stretch of something like half a mile. At that time I was starting on my *Springbok* and I could imagine the thrill of running it flat out on such a unique line. Alas, it was not to be.

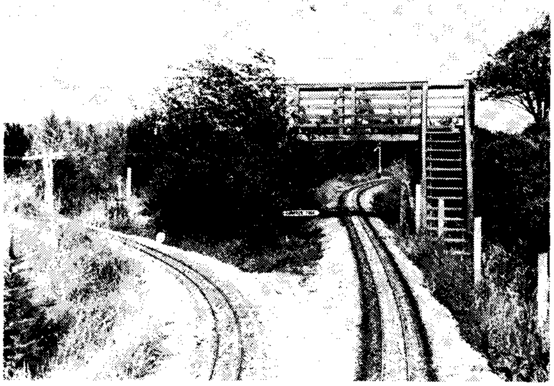
At the time of our visit, John had already made a good start on his enterprise, having bought a recently built splendid 5 in. gauge G.W. "King" *King John,* and having laid thirty or forty feet of track across the garden, headed for the open country beyond. His wife was just as keen as he and well able to handle *King John,* while a set of three small sons seemed to assure adequate footplate staff as time went on. These were early days, though, and at that time young Jamie was not all that much over scale for 5 in. gauge.

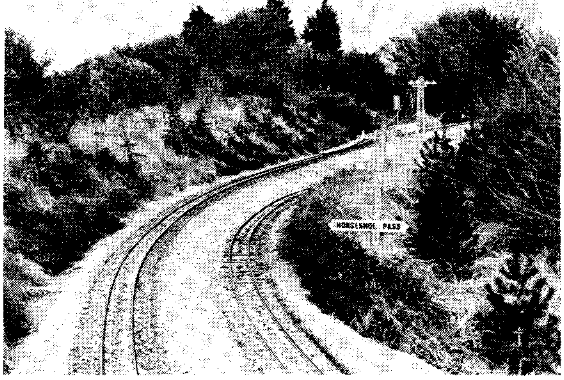
It was some time after our visit that word came through of a radical change of plan. John had seen the L.M.S. Pacific *Duchess of Sutherland* built by the late Harry Powell of Crewe for $7\frac{1}{4}$ in. gauge, could not resist it, so bought it and changed the project to $7\frac{1}{4}$ in. gauge. After careful consideration, and to my personal regret, it was decided that the long straight line across the field would not be a practical proposition owing to the extensive earthworks that would be required. Instead an area of some four acres of somewhat broken ground was set aside for a different type of line altogether. The result could best be described as an enlargement of a complex OO-scale layout and the accom-

Below: The Denver and Rio Grande 2-8-2.



Below: Approaching the tunnel.





Two views of the superbly built and maintained track.

panying pictures show that with its curves, embankments and cuttings set in now well grown trees and shrubs, the circuit has a charm of its own. Some 1,000 yards of Vignoles section aluminium alloy rail were laid on 7,000 wooden sleepers on something like 100 tons of ballast.

Activity on this scale did not go unnoticed. Whenever steam was up eager faces appeared at the perimeter hedge, friends came to see, and interest became so great that John decided the only thing to do was to "go public". This, of course, changed the whole complexion of the enterprise. Much further hard work ensued to provide a station, café, car park and a picnic area.

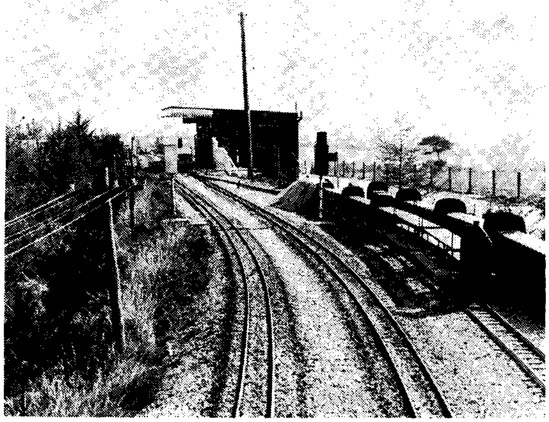
Public running commenced in May 1970 and proved an immediate and well deserved success. Four aspect colour light signals at roughly 100 yard intervals permit the running of three trains simultaneously at peak traffic periods and the layout has been designed to ensure that, providing they are running to time, at two points two trains pass each other in opposite directions.

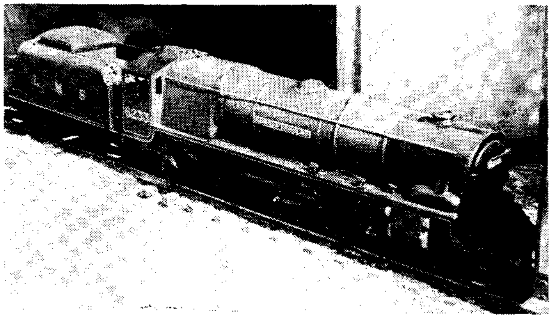
Sadly reminiscent of full-size practice, an abandoned viaduct on the 5 in. gauge line.

For the first season the Powell-built L.M.S. "Pacific", at that time over thirty years old, did most of the work having clocked up 1,500 miles without a breakdown. Although steam was the chief attraction, standby motive power was essential so two diesel outline locomotives, both built by David Curwen of Devizes, were acquired, one a W.R. D1000 class powered by a 500 c.c. Fiat petrol engine and the other an English Electric type shunting engine with a 1,000 c.c. B.M.C. engine.

For the 1971 running season, a new steam engine by Curwens appeared. This was the massive 2-8-2 model of a Denver & Rio Grande 3 ft 6 in. gauge engine and this proceeded to cope successfully with the ever increasing traffic, hauling up to 1,200 pas-

A view of the station and carriage sidings.





Powell's masterpiece on shed.

sengers a day, 40-50 at a time. Permitted working pressure is 150 p.s.i. but 110 is quite sufficient and full gear is never required even up the 400 yards of 1 in 30 gradient.

Work is now well advanced on a further extension to be brought into operation next year and there are three new locomotives on order. The first to arrive will be a 0-6-0 plantation type tender engine from Curwens, renowned for the robust machines so well suited to the exacting conditions on this line. This should be ready for the start of next season. The next will be a G.W.R. "Castle" Class, 5087 *Tintern Abbey*. This was to have been built by Harry Powell and he was well on with the preliminaries at the time of his untimely death at the end of 1969. Completion of the work has been taken over by Louis Raper of Failsworth and it is hoped that this engine will be in traffic in 1973. I look forward to seeing it, having read Bill Hughes's interesting article on Mr Raper's superb workmanship in M.E.s for the 2nd and 16th June last.

Yet another impressive engine is also on order. This is to be a Union Pacific 800 Class 4-8-4 from the shops of David Curwen. With these additions to the motive power the extended Forest Line will be a truly impressive affair. All this will bring satisfaction to Mr Southern in the pursuit of perfection in this most ambitious project, but he deserves the gratitude of all enthusiasts for the pleasure he has brought them in providing by his boundless energy a thoroughly practical miniature line in these delightful surroundings.

BUILDING MODEL TRAMCARS

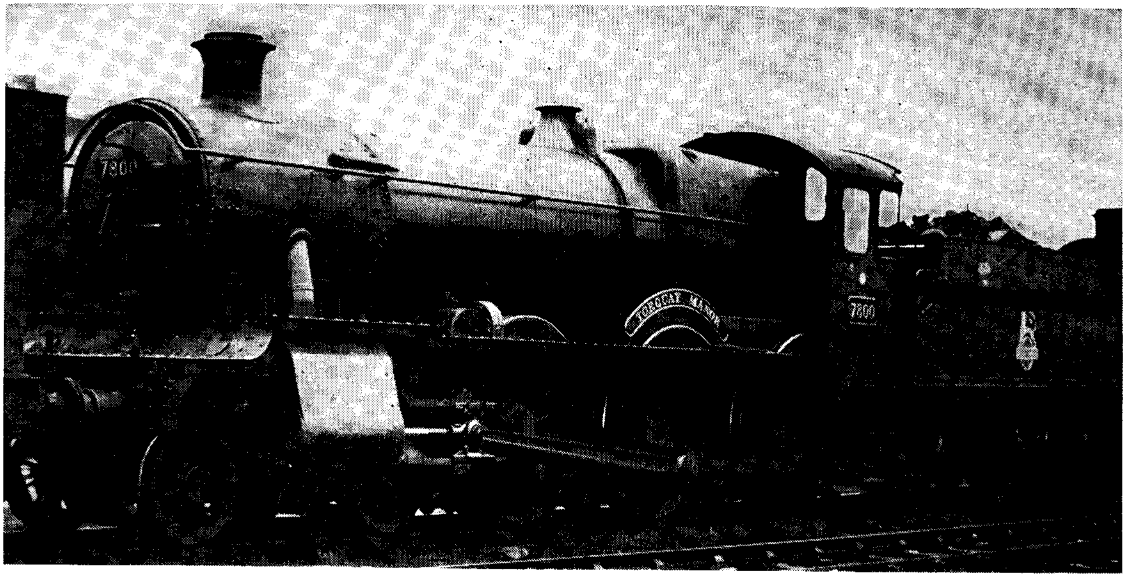
Continued from page 125

interior ventilation was in use in many other systems and can be observed on most scale drawings and photographs. It should not be overlooked by the modeller as every small detail adds realism to the finished model. The notice "Smoking Prohibited" always had its place either over the bulkhead door or over a bulkhead window, usually in gilt letters, while on some systems advertisements were provided in framed displays printed on glass at the tops of the windows. The hollow tube which held the leather straps, for "straphangers" to hold, had a cord inserted throughout its entire length which, when pulled, actuated the small hammer causing it to strike the canopy-bell on the driver's platform, for stopping and starting the car. All these details (and others, depending on the system which is being modelled) are accentuated at night when the lights are switched on and the interior of the model is illuminated.

If the methods I have described are followed carefully and the respective sections are glued and pinned firmly together at each stage, the resultant achievement will be a rigidity well worth the trouble taken. If the top of the saloon is made complete with cornice brackets onto which drops the saloon ceiling there will be a perfect drop-in fit without fixing screws. The top deck floor is fastened by screws to four fixing lugs in each corner so that the lower saloon, floor and top deck floor are now as one unit. Exterior mouldings should be added wherever possible before assembly and as the vertical joint at two diagonally opposite corners needs to be covered, there is no better way than using the corner cappings to half-lap the joint of the body, exactly as in the prototype car.

Screwed assembly is more time consuming, but it is desirable if glass has been used for the windows, for if a window should become cracked or broken at any time, the model can be dismantled and a replacement fitted without ruining it. And impact concussion has cracked or broken windows, especially at exhibitions when operators who are not fully conversant with the sectionalising in use, or the type of controllers, have not been properly instructed. For myself, I have always used perspex in my own models and, over the years. this has paid a dividend for they have appeared at many exhibitions entailing consequent transport problems over long distances.

Drawings of tramcars can be obtained from the Tramway and Light Railway Society, 102 Marlborough Lane, Charlton, S.E.7.



TORQUAY MANOR

5-in. gauge Great Western 4-6-0 by Martin Evans

Part XIX

Continued from page 80

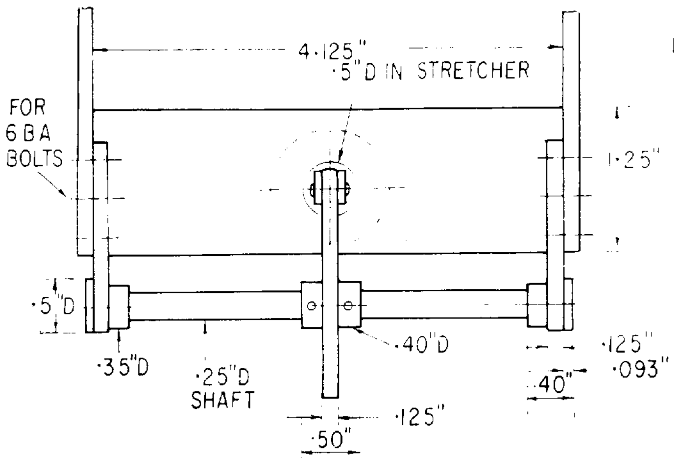
IN MY LAST ARTICLE, I mentioned that some builders of *Torquay Manor* might prefer to fit a steam brake to the engine, and as it has turned out, it was not at all difficult to fit this in using the existing frame stretchers and without having to make any structural alterations. All we need to do, in fact, is to remove stretcher "G", that is the one which is 2⅛ in. ahead of the leading coupled axle centre, and drill it centrally ½ in. dia., then cut out two pieces of steel angle 15/16 in. × ⅝ in. × ⅛ in. thick, shaped as shown in the drawing, and bolt them to the stretcher using three 6 BA hexagon-head screws to each. We cannot use rivets here, as one of the angles must be removed to insert the steam brake cylinder.

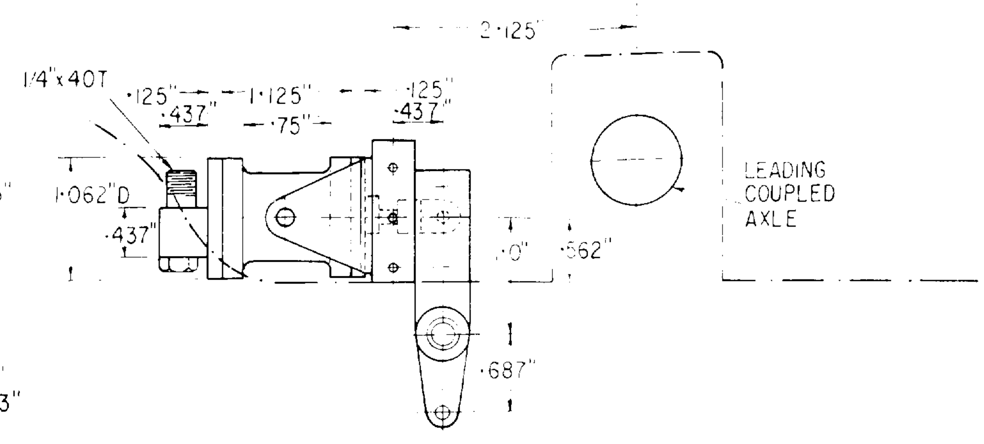
Replace the stretcher, then cut out and bolt on two plates to act as bearings for the cross-shaft. These are from ½ in. × ⅛ in. b.m.s. and are fitted with gunmetal bushes bored ¼ in. for the shaft, and they are located hard against the stretcher. Again, three 6 BA bolts are used to hold these to the frames; their heads should just clear the backs of the leading coupled wheels.

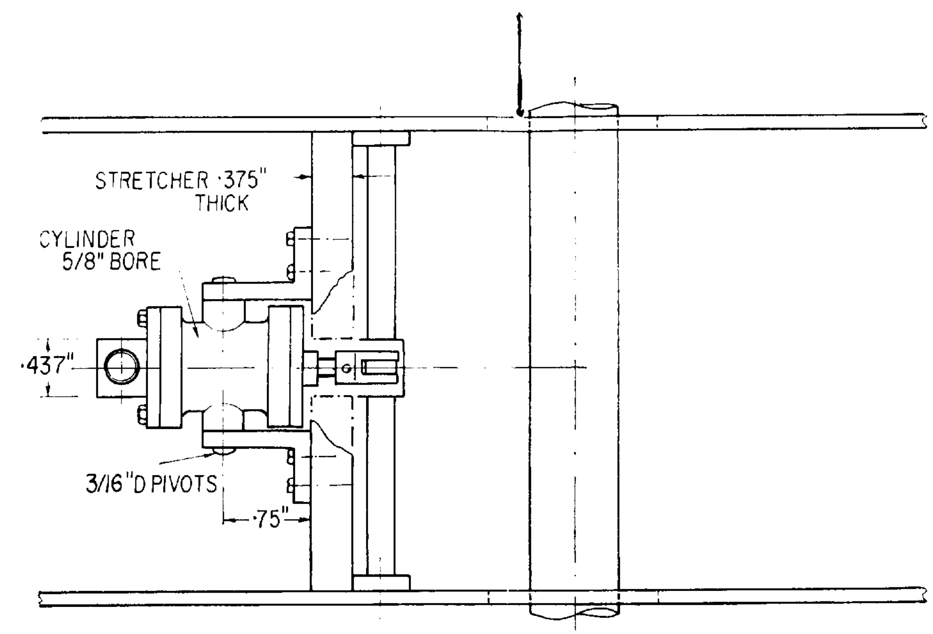
The steam brake cylinder is ⅝ in. bore, and can be made from a gunmetal casting, or turned from round bar, to an overall diameter over the flanges of 1 1/16 in. For the built-up cylinder, turn and fit separate suspension bosses; these can be about 11/32 in. dia. × 3/16 in. long, measured from the smaller diameter of the cylinder, but don't forget to allow for the concave shape where they bed against the cylinder. To hold them for silver soldering, use a 8 BA steel screw with a deep centre previously drilled in the head; then after soldering and cleaning up, this screw can be drilled away, the hole being opened out to No. 13 for the pivot pins —of 3/16 in. silver steel.

Next, bore the steam cylinder in the usual way, holding it in the four-jaw so as to clear the bosses, and turn up and fit the two covers, which are held to the cylinder by four 8 BA bolts each. The rear cover has a small boss, and is drilled and reamed ⅛ in. for the piston rod. The front cover is fitted with a ¼ in. × 40t. union for steam entry, and underneath is the usual ball valve for allowing condensed water to drain away after steam has been cut off. This can have a ⅛ in. dia. stainless steel ball on a 3/32 in. dia. seating, and a light spring is placed under the ball which should be just strong enough to push the ball off its seat when steam has been cut off. 32 or 34 s.w.g. spring wire should be about right.

ARRANGEMENT OF STEAM BRAKE







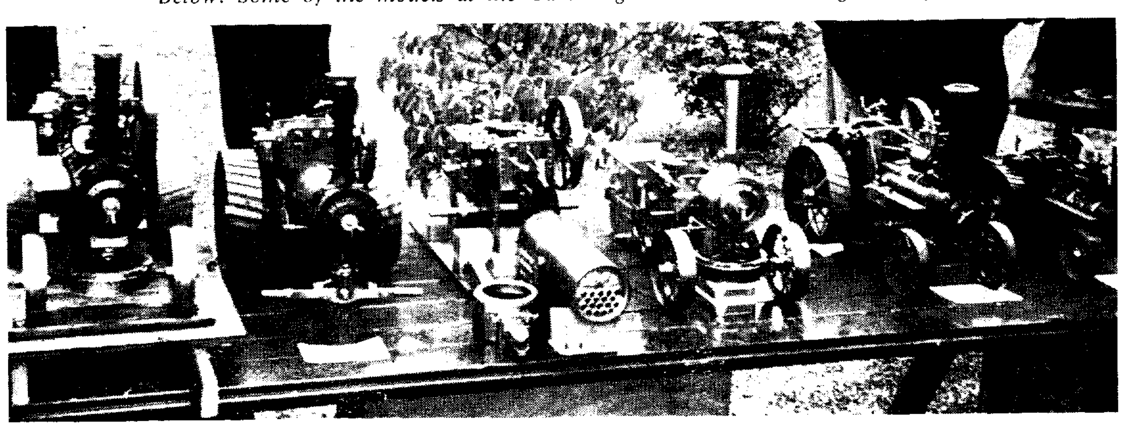
The piston, of drawn or cast gunmetal (dissimilar from the metal used for the cylinder) can be fitted with an "O" ring, and the piston rod is fitted up with a small forked crosshead to transmit the "push" to a double-ended crank on the cross-shaft.

Using the steam brake, only one pull rod will be needed, so this can be attached by another forked crosshead to the brake beam carrying the leading brake shoes.

Steam for the brake cylinder can be provided by the usual "driver's valve" in the cab, and we cannot do better than follow the drawings published in this issue by Mr C. R. Amsbury. I think this should now be sufficient on brakes, which will leave the decks clear for the boiler drawings, now nearing completion.

To be continued

Below: Some of the models at the Cambridge Model Traction Engine Rally.



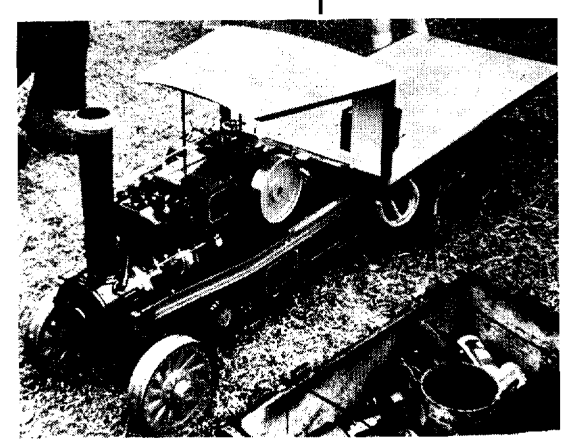
MODEL TRACTION ENGINE RALLY AT CAMBRIDGE

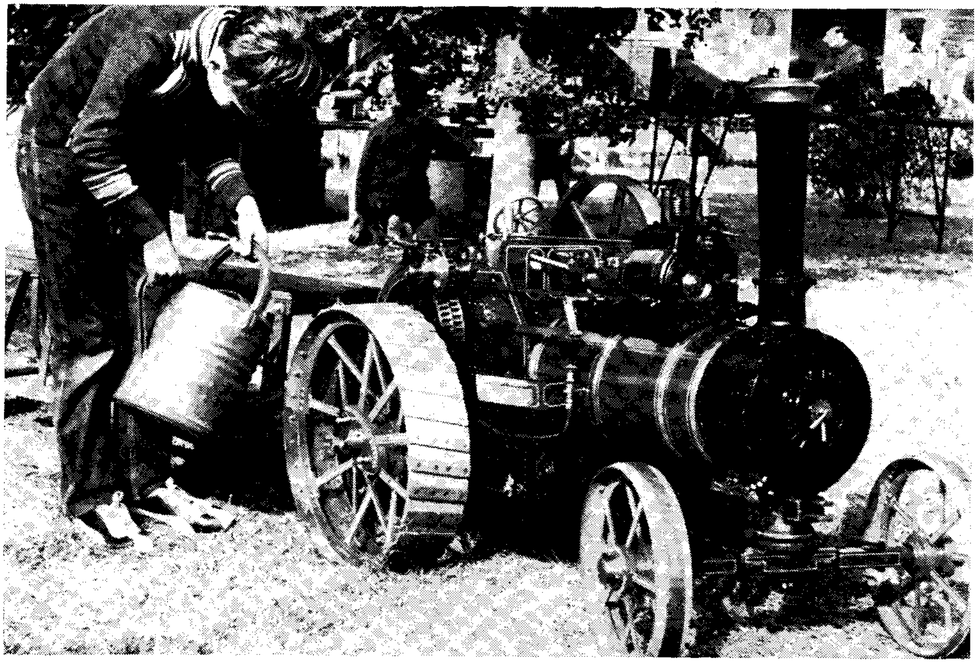
by C. J. Dawes

EAST ANGLIA was the home to many famous and not so famous traction engine builders: Charles Burrell of Thetford, Garrett of Leiston, Savage of King's Lynn, Fyson of Soham and Fowell of St. Ives, just to mention a few. Therefore, it is not surprising that many people in the area have a considerable interest in traction engines; consequently the modelling of these engines is very popular and is on the increase.

The Cambridge & District MES, although interested in every aspect of model engineering, have many model traction engine enthusiasts and because of this an invitation Model Traction Engine Rally was held on June 25, 1972. The object of the rally was not financial gain, but to bring together as many enthusiasts and models as possible for an enjoyable day of discussion and display. As this was the club's first traction engine rally no special arrangements were made apart from obtaining advice on any practical problems that were likely to occur. This was kindly supplied by Mr A. S. Harris of the Guildford MES who has considerable experience in organising such rallies.

Despite the fact that the rally was organised at short notice and only a limited number of clubs were invited, it was extremely well attended. The traction engines brought along ranged from a ¾ in. scale freelance, spirit-fired agricultural engine to a 12 in. scale Burrell steam roller. The steam roller acted as a centre piece to give an indication of scale. It was brought to the rally by Mr C. Hall, a well known local steam enthusiast. Many of the models were in various stages of construction. On the left is one of the display tables on which can be seen, from left to right, four 1½ in. scale Allchins (to the W. J. Hughes design) in various stages of construction, and two Burrells in 1½ in. and 1 in. scale respectively. All the models which were demonstrated in steam adequately displayed their builder's high standard of finish and engineering workmanship. These included a 3 in. scale Wallis & Steevens agricultural engine (next page) built by L. H. Smith and a 3 in. scale Fowler ploughing engine by H. Ellis, which I believe has been shown previously in *Model Engineer*. Perhaps, however, the most outstanding model was a 3 in. scale Wallis & Steevens steam wagon, left, by D. A. Shipman. This is a





A fine 3 in. scale Wallis and Steevens agricultural engine built by L. H. Smith at the Cambridge Rally.

very authentic model of the prototype and its performance matched its appearance—it easily won the obstacle race.

Mr Shipman also brought along a very nice pair of 2 in. scale Fowler ploughing engines; *Princess Mary* and *Princess Alice.* Both Mr Ellis and Mr Shipman demonstrated the power of their Fowlers by hauling loads with their winding drums. Mr Ellis recovered, with very little effort, an estate car from 50 yards away, which was in gear and with the hand brake on.

Apart from the demonstrations and static displays, many interesting discussions took place between builders, who readily exchanged ideas and advice. The discussions mainly took place over light refreshments that were supplied and served by wives of the Cambridge club members, and to whom the members are very grateful.

On reflection the rally, although confined to true enthusiasts and their friends, was very successful and will be repeated in 1973. Should any readers of *Model Engineer* who have or are interested in model traction engines, wish to attend the next rally, would they please write to P. Taylor, Secretary, Cambridge & District MES, 50 The Westering, Cambridge.

POSTBAG *(See also pages 147-150*

Cornish Engines

Sir,—When in 1970 I described my Cornish engine models, I deplored the non-existence of a written description of the valve gear of this type of engine. This description has now been provided in the excellent feature on the engines at Crofton.

The way of working without a cataract is just as single-acting rotative engines for driving stamp mills worked. It could also be seen on some engines for town water supply, where the speed of the engine was more or less controlled by the demand which in itself varied the speed of the delivery strokes.

In contrast to this clear and well written description there was an article on these engines in M.E. in 1952 wherein the writer made the ridiculous statement that it was not known if the engines were single or double acting. One has only to look at the valve gear to find out.

Shipley. Frank D. Woodall

Taper shanks

Sir,—In your last issue No. 3455 "Tubal Cain" writes an interesting article on the workshop, but has made a very misleading error in his last paragraph when he says drill sockets drive by the tang and *not* by the taper.

This is most definitely the reverse of correct working as all drills and sockets with taper shanks drive by the friction fit of the taper and should never drive by the tang, in most cases this would result in the tang being twisted off, the tang is for the purpose of extraction by inserting a drill drift through socket or drill spindle.

To avoid dirt or swarf getting into sockets we keep our drill sleeves on a row of taper wood dowels turned a slack fit to inside of taper and then glued into a 2 in. square strip of timber which in turn is screwed to wall behind each machine, this keeps them perfectly clean inside and always ready for use.

Lincoln. C. A. Foyster

A Merryweather Fire Engine

by A. M. Tyrer

SOME TIME AGO, an article in our local newspaper referred to the existence of a horse-drawn fire engine which was used by the Bexhill fire brigade during the early part of this century. It had been hoped, the article stated, that this appliance could be housed in the new fire brigade premises, unfortunately there proved to be insufficient room to accommodate this historic engine.

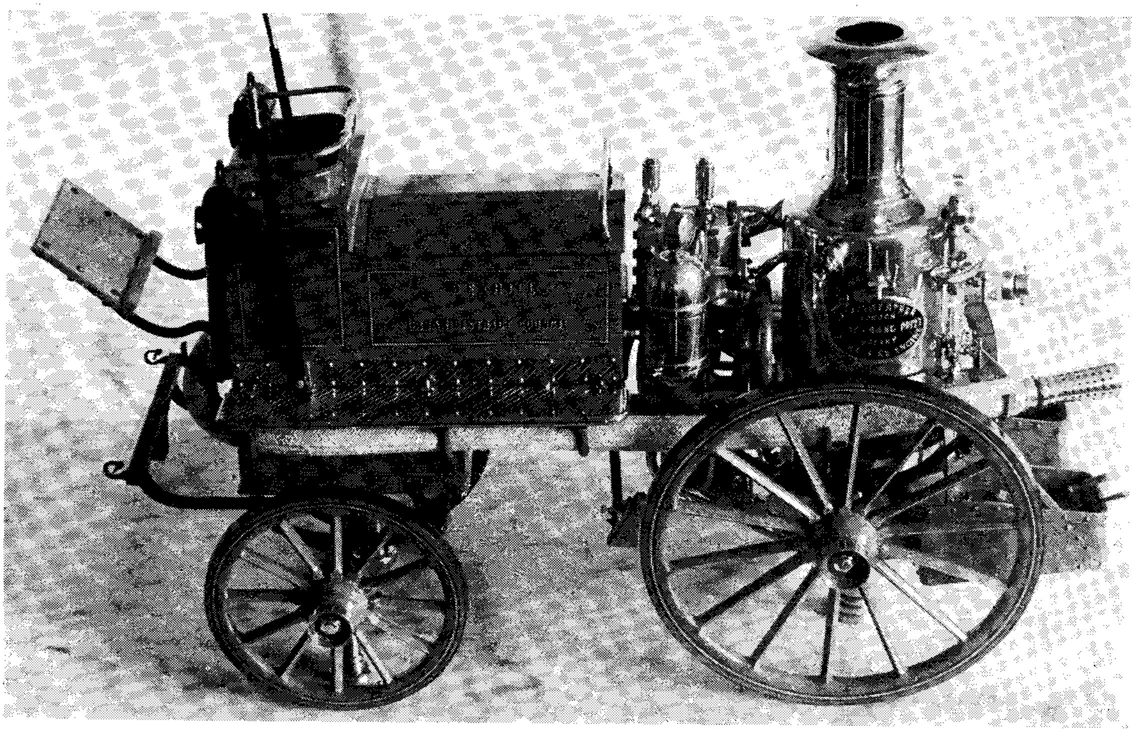
As I had previously built a model of the Shand Mason horse-drawn fire engine and had, at that time, almost completed a model of the Merryweather self-propelled steam fire engine, it occurred to me that it might be worth while looking over the old Bexhill fire appliance with a view to modelling it at some future date.

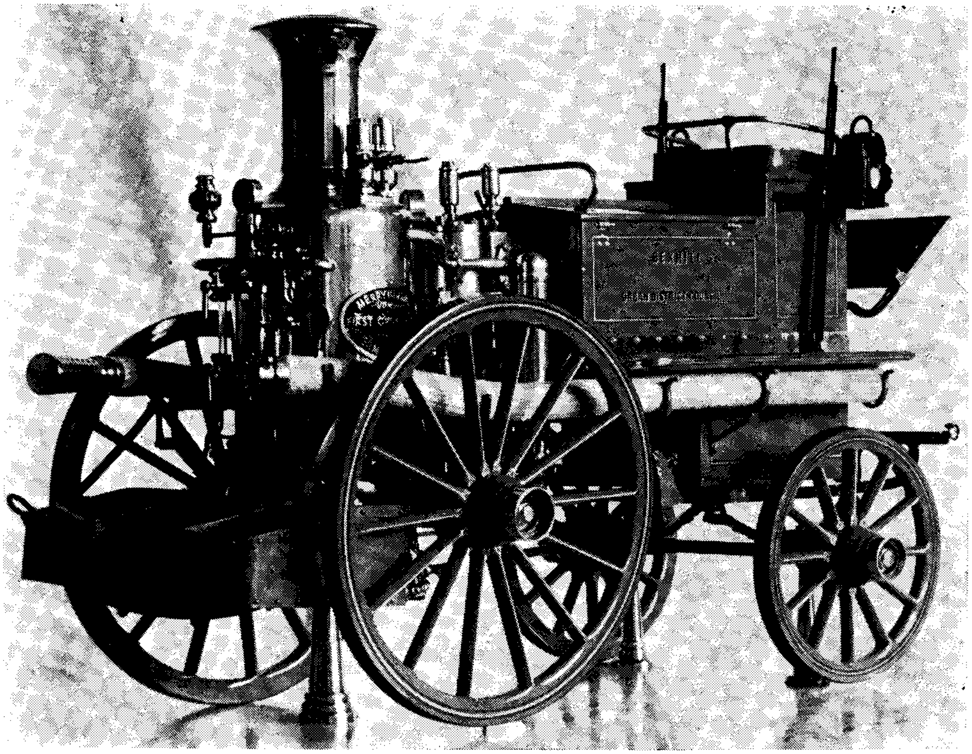
Several days and many phone calls later, I was able to establish that the engine was parked in the Bexhill council's depot and although not on view to the general public, I was given permission to photograph and measure the old fire appliance.

My first impressions of the engine were somewhat disappointing. It had stood in a leaky lean-to in the council's depot for some years and was, to say the least, in a sorry state. However, after scrambling under and over the engine for a few hours, taking measurements, sketches and photographs, I began to develop quite an affection for what, in 1896, must have been the pride and joy of the Bexhill fire brigade.

It was some months before a start was made on the detailed drawings for this model, by which time I had forgotten what most of the dimensions were dimensions of and the sketches might just as well have represented a steam mangle as a horse-drawn fire engine. Two more trips to the depot established that the scribble in my notebook did in fact refer to a fire engine and was not just the wanderings of a mechanically demented mind.

The appliance was made by Merryweather's and purchased by the Bexhill Urban District Council in 1896 and used by their fire brigade until 1920. The single cylinder vertical steam engine is centrally mounted and drives the pump via a "Scotch" crank. Initially it was intended that the model



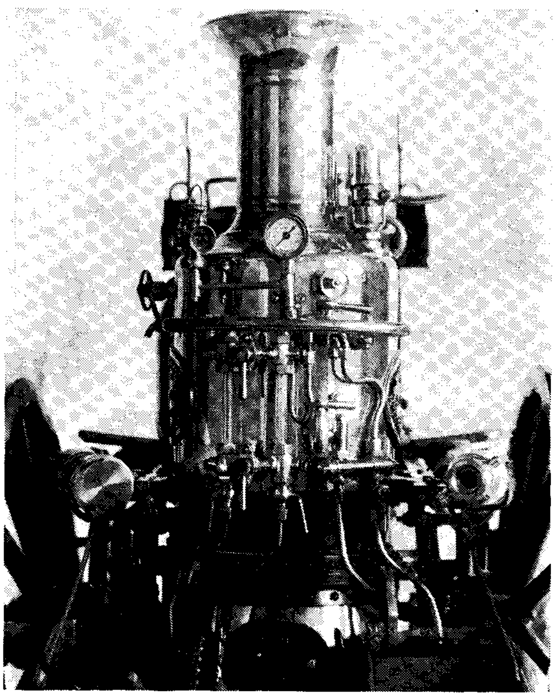


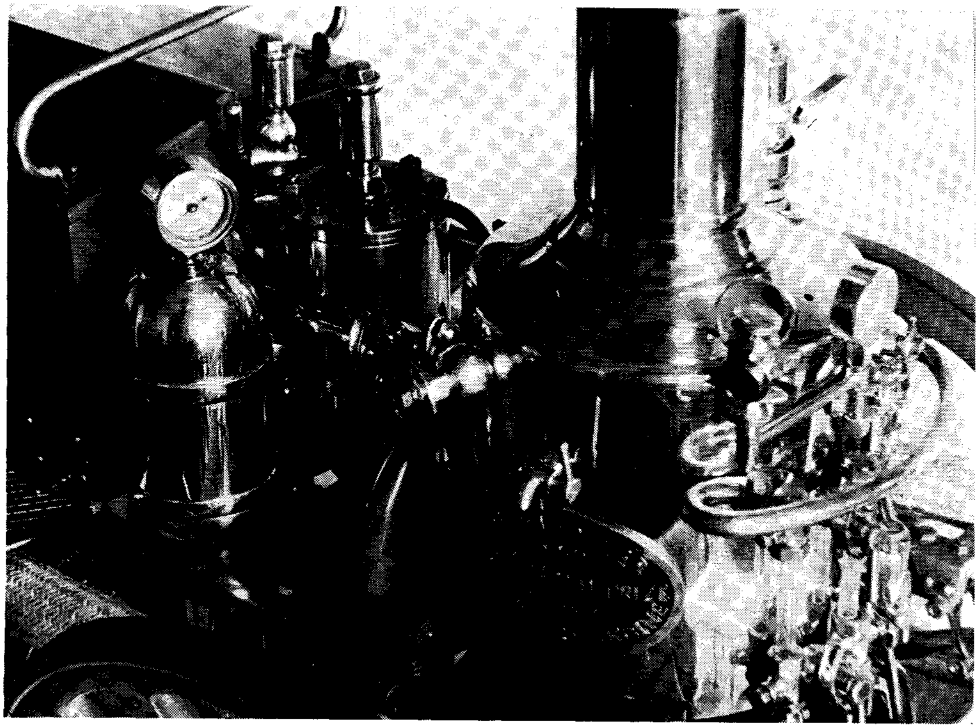
Off-side view of the Merryweather horse-drawn steam fire engine.

would be of 1 : 12 scale, but a general arrangement drawing indicated that a model to this scale would be too small; a further drawing to 1 : 10 scale was completed and this ratio was adopted in favour of the smaller size. The major dimensions of the model are: overall length 13.25 in., height 8.50 in., rear wheels 5 in. diameter, front wheels 3.20 in. diameter, wheel centres 6 in., width of appliance outside wheel rims 4.90 in., boiler diameter (outside lagging) 2 in., cylinder bore $\frac{5}{8}$ in. × $\frac{1}{2}$ in. stroke, pump bore $\frac{7}{16}$ in.

The wheels were built first by the method described by the late E. T. Westbury in his description of the Shand Mason horse drawn fire engine, the spokes are however alternatively staggered by 0.030 in. at the hub as on the prototype. Spring steel was used for the tyres, incidentally this steel was purchased from a local ironmongers and is intended to be used for unblocking drains, I have found that this is an inexpensive way of obtaining spring steel of approximately $\frac{1}{4}$ in × 0.020 in. The same steel was used for the leaf springs. The cylinder and pump blocks were filed into shape using filing buttons held in place by a bolt passing through the bores. Both engine and pump pistons are fitted with silicone rubber "O" rings, as are the piston, pump and valve rods.

Below: This picture shows some of the boiler fittings.





A close-up of the upper part of the boiler and pumps. The lower picture shows how the hoses are stored.

The boiler is of copper and contains 10 $\frac{3}{16}$ in. syphon tubes. The various boiler fittings and indeed all small fittings requiring a high polish were tumble polished in mixed steel shot as used in the jewellery trade. The two nameplates bearing the phrase "MERRYWEATHER LONDON FIRST GRAND PRIZE PATENT STEAM FIRE ENGINE" were made by cutting out each letter separately from brass strip and then sweating these onto an oval plate, after which the plate was bent over a former to fit the brass boiler lagging.

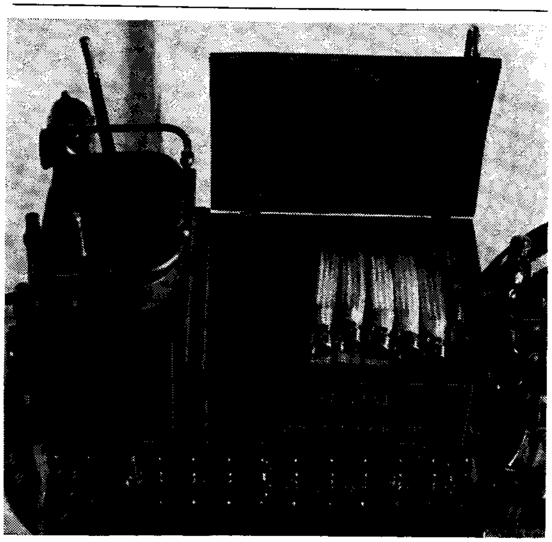
The box and footboards are made from oak 1/10 in. thick; I have always experienced difficulty in obtaining hard woods in very thin planks but once again the local ironmonger's shop came to the rescue with some strips of oak 9 in × 3 in. × 1/10 in. Unfortunately this is only sold in quantities of one square yard in area and is intended to be used for parquet floors.

The model is painted red (not always the colour of early fire engines) with yellow and amber lining. Lettering is black with yellow shadowing.

I am much indebted to Mr Sargent of the Bexhill museum for his assistance with regard to the history of this appliance and for furnishing me with a contemporary photograph of this engine. This model, together with the Shand Mason horse-drawn fire engine, are now at Oakhill Manor in Somerset where it is expected that interested modellers may view these and other models in the near future. The photographs were taken by Mr S. Ballard.

FIRE ENGINE DRAWINGS

Drawings are available of a Shand Mason steam fire engine. Ref. M.28, Price £2.50 the set.



A LATHE BORING TURRET

by A. Mackintosh

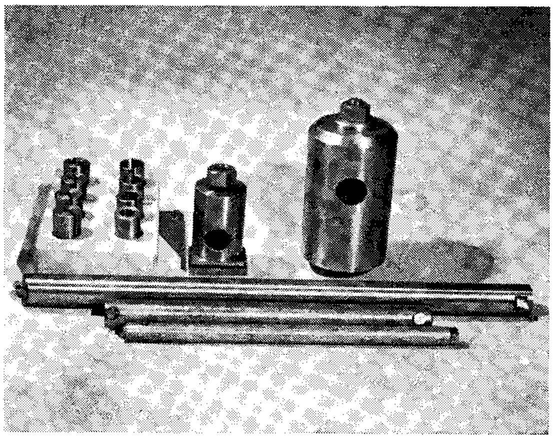
WHEN BORING in the lathe, the more massive the boring bar, the quicker the job goes and the better the finish obtained. It seems a little strange that the normal accessories provided by the small lathe manufacturers generally cannot hold a boring bar larger than half an inch diameter.

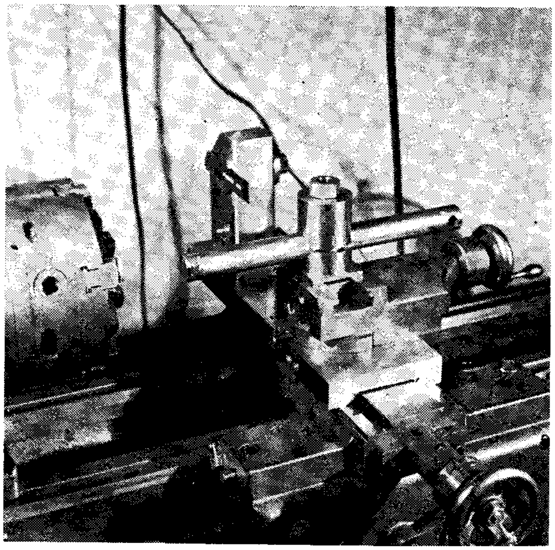
It is a simple matter to make a turret which will accommodate a boring bar up to one inch diameter and, provided the bore is sufficiently large to enter such a large bar, the rigidity of such an accessory will add to the pleasure of doing the job. For smaller holes, the turret can be provided with split bushings to take smaller bars.

To make a turret, the first thing to decide on is the largest diameter of bar that you are likely to use. I have two for my lathe (a $5\frac{1}{2}$ in. Logan—11 in. swing), one of which mounts on the top-slide and can accommodate a $\frac{7}{8}$ in. bar; the other mounts on the cross-slide and takes a $1\frac{1}{4}$ in. bar. The smaller one is provided with bushings to take smaller bars, the large one is only used for heavy boring.

If you only intend to make one turret, I recommend mounting on the top-slide as it is not then necessary to dismount the top-slide to get the turret in position. Both mine are made from stainless steel which happened to be available; this, of course, is sheer luxury and b.m.s. rod would be just as suitable.

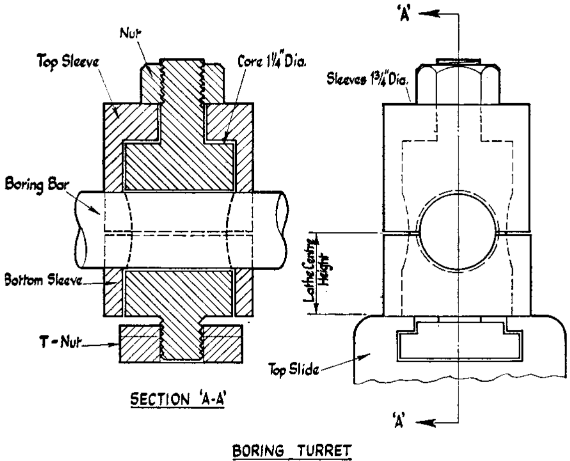
Below: Two turrets for mounting on top-slide and cross-slide and a selection of boring bars and sleeves.



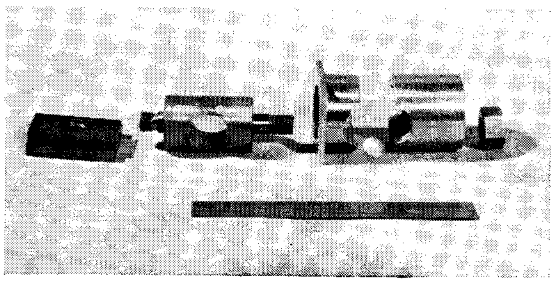


A turret mounted on the top-slide ready for use.

The drawings and photographs should make construction of the turret clear. Note that tightening the top nut clamps the turret to the top-slide



Below: Exploded view of turret parts.



and also clamps the boring bar in the turret in one operation. Dimensions given are for my lathe and should be altered for smaller (or larger) lathes.

All the machining is straightforward and can be done in the 3-jaw chuck. The join between the turret sleeves surrounding the core should come at exactly centre height.

When the turret parts have been made, they are assembled and tightened into position on the top-slide. The turret is carefully positioned on centre and the hole for the boring bar drilled and reamed (or bored) from the headstock, thus ensuring that the bar will be dead on centre height. The bore should be a close slip fit for the largest boring bar you are likely to require.

After the boring has been done, the turret is taken apart and the hole in the core enlarged $\frac{1}{16}$ in. in diameter. 0.010 in. is faced off both turret sleeves in order to give clamping action onto the boring bar and the turret is then ready for use.

The boring bar itself can be made up in any of the many ways that have appeared from time to time in M.E. and in the technical books published by M.A.P.

When using a massive boring bar, you will be surprised how easily a difficult boring operation can be done and at the tremendous improvement in the finish of the bore.

A LOCOMOTIVE REVERSING LEVER

by L. V. P. Clarke

WHEN ONE LOOKS AROUND the average small steam locomotive, there always seems to be some small detail which is not in keeping with the rest of the parts and which has continued in use more by tradition than any particular merit. One of these is the tension spring for the latch of the reversing lever which does not follow full size practice of any locomotive with which I am familiar, although it is common on traction engines.

A typical form is given in Fig. 1 which is taken from the late LBSC's *Tich* description. This shows the spring hooked to the end of the pin joining the latch and trigger, and anchored on a pin through the latch block. While there is no doubt

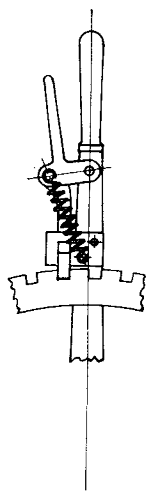
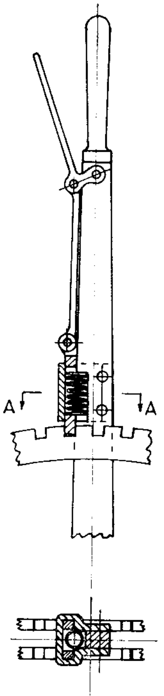


Fig. 1



Section AA

Fig. 2

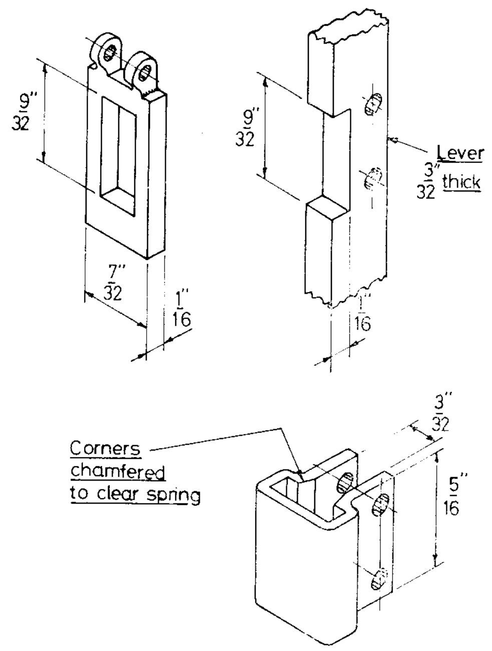


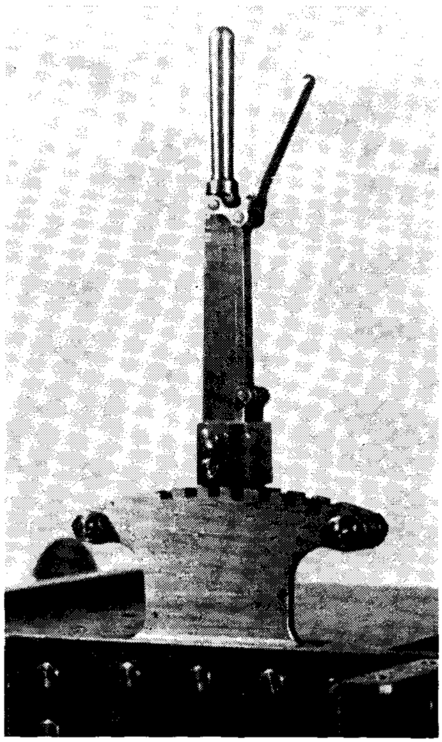
Fig. 3

that this works most effectively, it has always worried me by its unrealistic appearance and for the readiness of the spring ends to catch any bit of cleaning rag which may get near them.

While trying to work out some better way of supplying the necessary spring loading, I thought back to my apprenticeship days and the hours spent fitting new latches to locomotives in for overhaul. It then occurred to me to use something like the full size ones, where the spring is inside a slot in the latch. This was all very well, but in $3\frac{1}{2}$ in. gauge the latch is only $\frac{1}{16}$ in. thick and a spring of such small outside diameter is difficult to make with the necessary resilience.

After pushing around a few small springs which I had, the idea came of using a spring of $\frac{1}{8}$ in. O.D. and putting it half in the latch and half in the lever itself, so getting adequate space. The actual spring used was from the core of a car tyre valve. Fig. 2 shows in part section the arrangement on my own locomotive and Fig. 3 shows isometric views of the essential parts. The cutout in the lever and the slot in the latch are of the same vertical length of 9/32 in., but when the latch is fully engaging its notch in the sector plate, the top and bottom of its slot are about 1/32 in. above the top and bottom of the cutout in the lever. Thus the spring presses against the top of the cutout in the lever and the bottom of the slot in the latch, and so holds down the latch. This does mean that the latch block has to be a little deeper and its shape is a bit more fussy to make than the one shown in Fig. 1. By filing down the wall thickness to about 1/32 in. after cutting the slot, the finished job can be given a neat appearance as the photograph shows.

The additional pin joint immediately above the latch with a connecting link to the trigger is rather more necessary than the usual single pin, due to the greater length of engagement between the latch and its guide in the latch block. It certainly gives very smooth working and the whole arrangement has been a great success. The few dimensions given are for my small $3\frac{1}{2}$ in. gauge contractors' locomotive and will really be nearer to those suitable for a large type in $2\frac{1}{2}$ in. gauge. For normal use in $3\frac{1}{2}$ in. gauge the lever would be $\frac{1}{8}$ in thick and then the latch block will not need to be relieved to clear the spring.



Right: The neat reversing lever built by Mr. Clarke for his small contractor's locomotive.

JEYNES' CORNER

E. H. Jeynes talks about electric power for lighthouses

IN MY ARTICLE in *Model Engineer,* September 1st, I described the first dynamo with an electro-magnetically excited field magnet system invented by H. Wilde in his experiments following up Faraday's earlier experiments in electro magnetism. The success of this machine resulted in one being built for the Commissioners of Northern Lighthouses.

Exclusive right for Mr Wilde's machines were purchased by the Alliance Company for use in France. The first lighthouse in France to be equipped was near Le Havre in December 1863; a second lighthouse was equipped near the first one in November 1865. An extract from "Le Monde" of the time mentions these, also adding that this Company had proposed to install a generator on the S.S. *Great Eastern* while cable laying, capable of supplying electric light equal to 125 standard gas lamps, for the sum of £240. The power to drive Wilde's dynamos for the lighthouses were two steam engines, located in the bottom of the Tower.

Although Wilde had demonstrated beyond all doubt the superiority of the electro-magnet over the permanent magnet system for excitation, it is of interest to note that Professor Holmes continued to design machines with compound permanent magnet excitation.

In the *English Mechanic* for August 17th 1866, an editorial article entitled "Electric Light in Lighthouses" reads as follows, "Some years ago, electric light was introduced experimentally at the South Foreland Lighthouse. and certainly the fates seemed against the electric light. Trinity House, afer six months excellent results, under the supervision of the patentee Professor Holmes, bought the stock, and after sundry costly alterations, moved it to the Dungeness lighthouse, where it gave less satisfactory results. Between June 1863 and December 1864, the light failed wholely, or partially for a total of 119½ hours; the ordinary apparatus having to be called into use.

On scrutiny, it was found that none of this derangement was at all attributable to the electrical part of the machinery; the most frequent causes of failure being "Want of Steam", "Short supply of Water", and "Want of Draught". Of course if such items were written up against the light, it had no fair chance. The most important extinction of the light was on February 15th, when for 15 minutes there was no light. The cause was that the light keeper fell asleep during his watch; the engineer was reading a newspaper in the boiler room, and the carbon holder got to rest on top of the lens. The keeper awoke and finding no light, proceeded to see to the illumination, but down went this item of sheer carelessness against the light. The Secretary of Trinity House most innocently remarked that, "No oil lamp could be extinguished in the same way".

In due course, four more alternators were installed in South Foreland lighthouse, to supply power for "Serrin" arc lamps; the installation was in duplicate, two of the machines being available as stand by. The stators carried 56 compound magnets mounted in seven vertical planes. the rotor had six sub-divisions, each having 16 coils of copper wire wound on iron cores, and the rotation of the shaft passed the coils through the magnetic field, generating current in the coils. The current was transmitted to the arc lamp circuits by means of brushes and sliprings mounted on the shaft.

The alternators were driven by two horizontal steam engines of 10 horsepower, speed 400 r.p.m. supplied with steam by two Cornish boilers.

Each arc lamp gave a mean intensity of 1,520 candle power: the alternators were constructed by Buckett Bros to the design of F. H. Holmes the patentee. This installation was replaced in 1922 by a modern type, and one of the four alternators from South Foreland Lighthouse can be seen in the Museum of Science and Engineering at Newcastle upon Tyne. A similar installation existed at the Lizard Lighthouse and was replaced about the same period, a photograph taken in 1921 is unfortunately not suitable for reproduction. The alternator in Newcastle Museum is 100 years old.

E. H. JEYNES

Simple steam engines

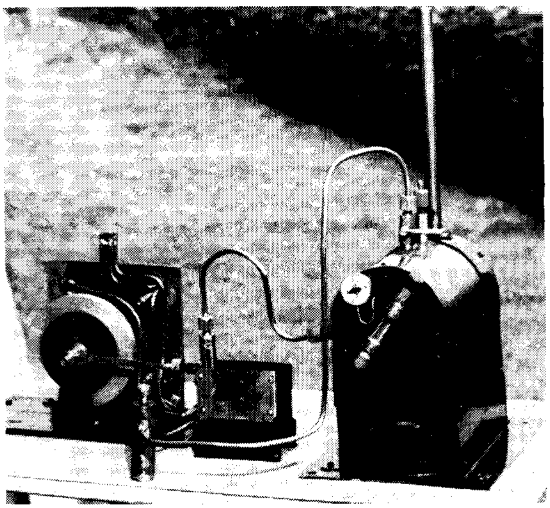
by F. E. Selway

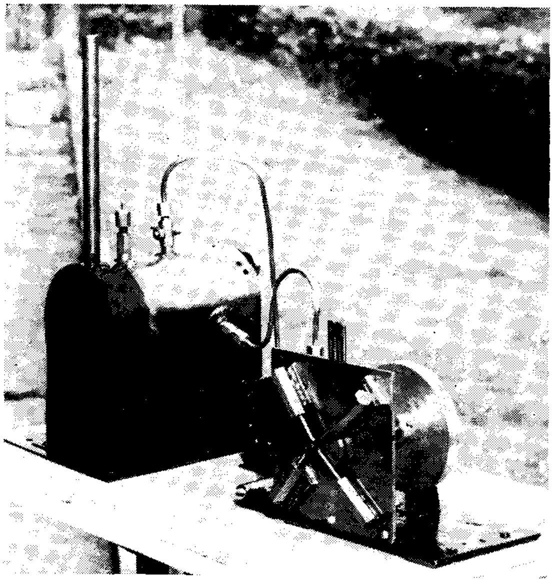
HAVING REACHED the age of 72, I have found that the only way to keep young is to occupy the mind, and model engineering does just this. I have an old workmate who will be 90 this coming Christmas, and he still works down in his little workshop, winter and summer, and his mind is as fresh as ever. Before I finally retired, I made plans for a workshop, having a spare bedroom, I decided (with the co-operation of my wife: this is important) to make this my workroom. So it was duly installed with a bench, a pillar drilling machine, and a 4 in. Drummond round bed lathe, which by the way I find an excellent little machine, of splendid design. I might add I was a maintenance engineer before I retired, but had done very little in the way of model making for a good number of years. So my first model was a simple one (as published in a previous copy of *Model Engineer*. This I might add was a great encouragement to me, to see my own creation in print).

Anyhow to come to the point of this article, I would have liked to have started building a 2½ in. gauge locomotive, but not having facilities to braze the boiler, I decided on another free-lance design, a bit more ambitious than the last. I find great fun in experimenting, and even if your model does not work, you learn quite a lot.

I started off with a square plate of brass, 5½ in. × 5½ in. × $\frac{3}{16}$ in., and set it out to accommodate four oscillating cylinders, working on a central crank. First of all I drew it out full size on paper, showing the position of each piston, in a complete revolution, just to see if they would work in harmony with one another. On paper, it looked as if it would work. So I commenced.

When the brass plate was drilled for the pivot pins, steam ports, and crankshaft, I then made the cylinders, these were made from hexagon brass as in my previous model, same bore and stroke. The piston rods were forked at the end, to work on the crankpin together. To accommodate the extra two cylinders, I had to solder a piece of ¼ in. thick brass to the backplate, to allow the two extra cylinders to clear the opposing ones, I thought it would look clumsy, but it looked quite neat. The pistons and cylinders were duly made, and the crankshaft. I made a long bearing for the crank-





shaft and soldered it onto the backplate, also I made a bracket, with a brass bush soldered in to support the other end of the crankshaft and flywheel. This flywheel by the way is about $4\frac{1}{4}$ in. dia., and was borrowed from an old horizontal engine, picked up in a scrap yard. It was badly distorted, but I managed to get it running reasonably true in the lathe, and skimmed it up and fitted a bush to suit the crankshaft.

The tricky part was fitting the $\frac{3}{16}$ in. dia. tubes for the steam and exhaust, as can be seen from the photographs, and the way they are coupled to a $\frac{1}{2}$ in. dia. copper tube acting as a manifold, I thought was rather good, and I was quite pleased with the whole setup. Getting the inlet and exhaust pipes in the right sequence, was a bit tricky, but this was done without mishap, so I finally got it all together ready to couple up to a steam pipe.

So to run it in, and get everything working smoothly, I rigged up a temporary drive from the lathe chuck, and ran an endless band round the flywheel. It looked quite fascinating to see the four cylinders rocking to and fro. When I first started, I thought it would be a clumsy looking engine, but I was quite impressed by its style and appearance. I was impatient to see it run, and rigged up a boiler from a piece of copper tube, and made a spirit lamp, and duly coupled it up. The marvellous thing about it was it worked. The boiler was only soft soldered and I couldn't get much pressure, but it ran at a tremendous speed, you could hardly see the movement of the cylinders, I was thrilled to bits by the sight of it and felt more like a boy of 12 than an old man of 72.

From the photographs it can be seen that the whole setup is fastened to a $\frac{1}{8}$ in. thick b.m.s. plate, the cylinder vertical plate is fastened to the base by three angle brackets.

The boiler was built up from a piece of copper tube, 4 in. dia. × 5 in. long, with five $\frac{1}{2}$ in. dia. copper tubes fitted the length of the boiler, on the underside I fitted two $\frac{1}{2}$ in. dia. water tubes 3 in. long. These are coupled to the boiler by two short $\frac{1}{4}$ in. tubes soldered in, Babcock and Wilcox style. The supporting structure is made up from $\frac{1}{16}$ in. plate and stands 7 in. high, having a gap of 4 in. for the firebox, which accommodates a methylated spirit burner 3 in. dia. by $1\frac{1}{2}$ in. high. The gauge glass is coupled to the boiler end plate by means of two pieces of brass hexagon, screwed into the end plate, having two screwed bushes soldered in. These distance pieces project through the firebox plate and the gauge glass fittings are soldered to these, as shown in the photograph. On the boiler top there is a steam cock and safety valve, in the side of the boiler there is a non-return valve, which is coupled to a small feed pump $\frac{1}{4}$ in. bore × $\frac{1}{4}$ in. stroke. This pump is fastened to a small water tank 3 in. × $1\frac{1}{2}$ in. × $1\frac{1}{2}$ in. A small eccentric drives the pump. To make the boiler more realistic I have fitted a dummy pressure gauge.

Coming back to the engine, the cylinders have a stroke of $\frac{5}{8}$ in. × $\frac{5}{16}$ in. bore. The crankshaft is 7/32 in. dia. The cylinders are $1\frac{5}{8}$ in. long made from $\frac{1}{2}$ in. hexagon brass. The port face is a piece of 3/32 in. brass plate $1\frac{3}{8}$ in. × $\frac{3}{4}$ in. soldered onto the cylinder. The pistons are made from silver steel, turned down in the centre to $\frac{1}{8}$ in. dia. one end to suit the cylinder and the other end for the fork which is drilled $\frac{1}{16}$ in. to suit the crankpin.

The complete unit is fastened to a base-plate 1 ft 8 in. × 9 in. × $4\frac{1}{2}$ in. The whole structure engine, boiler and water tank is built on to a polished wooden base 24 in. × 13 in. and it looks quite attractive.

The engine is not very efficient, it uses too much steam, but it is very interesting to watch, and within the scope of a beginner's workshop. I have since tried it out on compressed air and it ran as sweet as a nut, at a very high speed.

TORQUAY MANOR DRAWINGS

LO. 940, *Sheet* 4: *Final bogie details, cylinder drain cocks, coupling rods.*

Sheet 5: *Full details of side-valve cylinders and alternative piston-valve cylinders.*

Sheet 6: *Connecting rods, crossheads, motion plates, eccentric rods and part of valve gear details.*

All 50*p each.*

Billy Smith, the Buckinghamshire Farmer

by C. R. Tyler

THE STORY OF William Smith has recently taken a new turn, adding yet another mystery to the tale outlined in these pages. (See No. 3454, Volume 138.)

Mill Lodge, built by Mr Griffiths and his three sons, stands on a part of what was Church Farm and is situated about 200 yards from the original farmhouse, and stands near the site of a mill which obtained power from the River Ousel, running nearby. Due to being in a derelict state, the mill had to be demolished except for a bakehouse which was built approximately half way between the mill and the farmhouse. It was used for supplying the local requirements until some time into the twentieth century. The bread was guaranteed to be baked within 48 hours of the flour being milled.

One can almost smell the aroma of fresh baking wafting towards the farmhouse, the horse-drawn cart waiting to take the crisp hot loaves on the local round. This must have been a familiar scene to William Smith.

It was decided to convert the bakehouse into a garage and late in 1971 work commenced, the first job being to remove the ovens which were made of brick. It was during this work that yet another part of the Smith saga was brought to light. The exciting discovery consisted of two heavy cast iron nameplates which had been built into the supporting structure of the ovens. Mr Griffiths, aware of the historical associations of the farm with Smith, retained the plates, later very kindly presenting them to the writer.

The nameplates have been well preserved, although corrosion has damaged a few of the letters, but it is certain that they would have disappeared long ago if they had been in any other situation. It is not known when or by whom the ovens were built, except that it must have been during Smith's lifetime. Did he give the plates to the builder for entombment in the same way as the plough and windlass?

Each weighing 13½ lb, the plates are 23 in. long by 3¾ in. wide and ¾ in. thick. The working on them can be seen in the photograph of the plates. The fact that William Butlin was concerned with the early work of Smith is enlightening in itself. Very little is known about this firm; a contemporary advertisement shows an enormous range of farm and agricultural products which includes the "Smith steam cultivating apparatus". The extent to which Butlins worked with Smith is not known, but could well have been a useful firm to construct the prototypes of his equipment after his disagreements with Fowler, with the additional advantage of being situated only 18 miles from Church Farm.

Directories of 1854 and 1866 advertise Butlin's products from the Vulcan Steam Engine Works, Weston Wharf, Northampton, and what eventually happened to the organisation is lost in the mists of time. Butlin's name did not appear in local directories after 1868. In 1869 a new partner appeared in a Wellingborough firm of Butlin, Bevan and Co. Perhaps this Butlin was one and the same.

The recovered nameplates are significant in another way, being the only surviving work, as far as is known, of this Northampton firm and the second earliest relics of steam ploughing in existance.

Curiously, no mention is made of Butlins by Smith and whether they supplied engines to power the implements they made is not known, although the Ransomes portable purchased in 1855 would still have been in good condition, making another superfluous.

The cast iron nameplates recently discovered at the Buckinghamshire bakehouse.

An Experimental V8 Petrol Engine

by C. Hague

HAVING SUCCESSFULLY DESIGNED and produced both single and twin water cooled four stroke petrol engines, I decided to attempt a V8 type petrol engine. The initial basic information necessary I obtained from borrowing books at the local library, and with this as a nucleus, designed the engine as laid out.

The overall dimensions are $6\frac{1}{2}$ in. long by $5\frac{1}{2}$ in. high. It has $\frac{5}{8}$ in. bore and stroke, twin camshafts, overhead valves, three bearing crankshaft with crankpins at 90 deg. There are twin choke carburettors, twin contact breaker distributor units, lubrication by splash and water cooling.

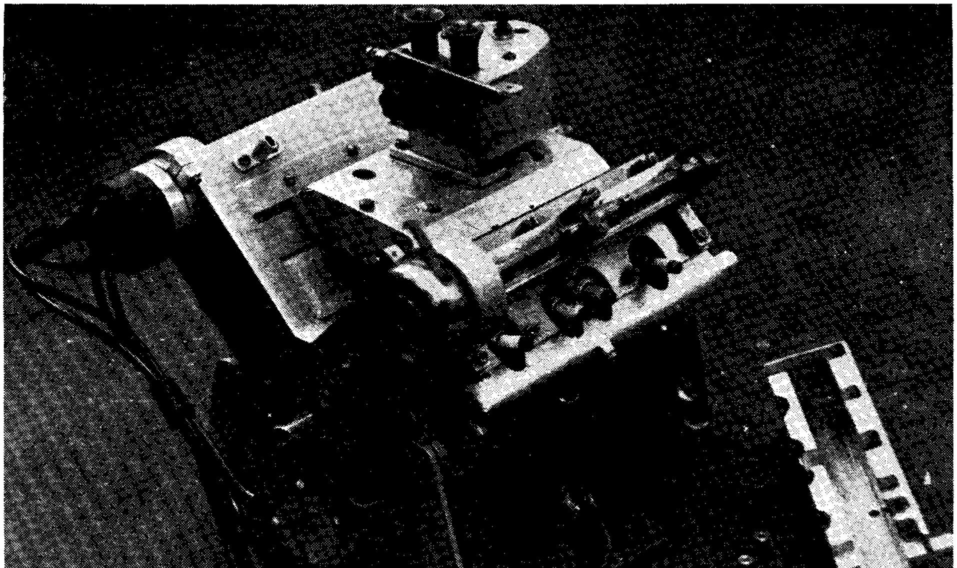
The engine is made throughout without any castings and, in fact, all the materials used were ex "scrap box". The main crankcase and cylinder block was machined as an integral unit from a solid block of aluminium and cast iron liners were pressed in the cylinder bores.

The next item to be tackled was the crankshaft, and for this I used a piece of soft cast steel and centre drilled five centres each end, then hacksawed and filed the webs and finally turned the crankpins on my "Unimat". The cylinder heads were milled on the Unimat from aluminium, with the recesses for the water covered by a stainless steel plate on the top.

The camshafts are driven by nine gears which were also turned and cut on the lathe. The camshaft proved difficult, being split, as each camshaft serves both banks of cylinders. This was the most tricky part of the whole operation and several attempts were made before eventual success.

The inlet manifold was made in three parts and sandwiched together, four passages from each carburettor feeding two cylinders on each bank, this, together with the firing order, gives even suction on each carburettor. The other components follow the usual practice, though I was fortunate in obtaining eight commercial $\frac{1}{4}$ in. by 32T sparking plugs, the sparks being supplied by two old six-volt car coils.

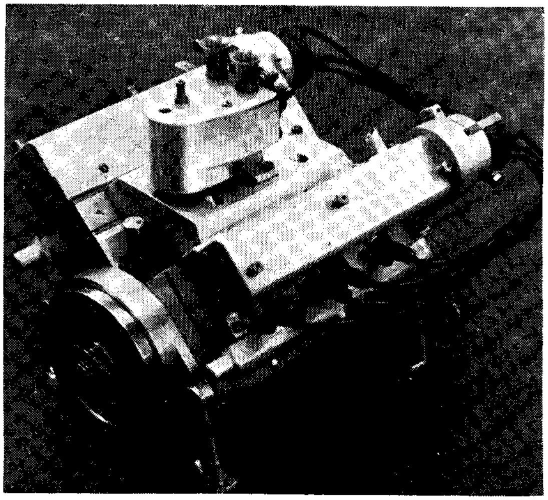
It would have been nice to say at this stage that the engine ran at the first turn, but alas no, not



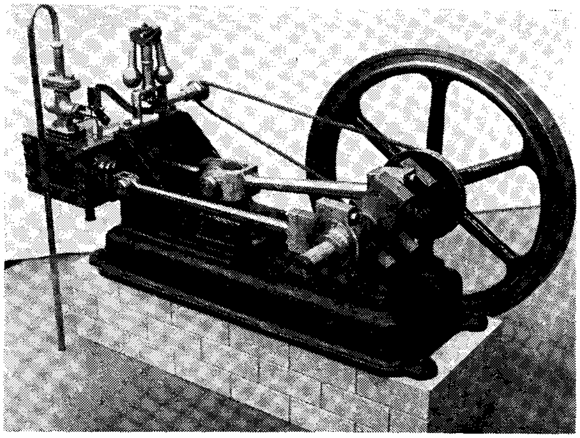
The V8 petrol engine built by Mr C. Hague, showing one of the distributors dismantled and a camshaft cover removed.

even a "pop". However, after much experimentation with various carburettors, start it did, to give a reasonable performance. It might be of interest to know that I had used a small vertical miller, but I feel sure that the work could be done on the average $3\frac{1}{2}$ in. centre lathe.

Finally, whilst I made the engine purely as an experiment and for the enjoyment derived from it, I have no doubt that it could well be used in a working model. Since completing the above, I have acquired a 3 in. centre lathe with which I hope to make a $1\frac{1}{4}$ in. scale "Minnie" traction engine.



Right: A view of the V8 petrol engine from the flywheel end.



A "Unicorn" stationary steam engine built to metric dimensions by apprentices at the Elswick Works of the Vickers Engineering Group.

by D. J. Holloway

IT HAS BEEN suggested that now metrication is the order of the day, model-makers building to old designs face problems with the decreasing availability of Imperial-sized tools and materials. While acknowledging this situation, the problem can be resolved in practice, and this is borne out by the experience of engineering apprentices at Newcastle upon Tyne.

As a project to form part of their training, the apprentices at the Elswick Works of Vickers Engineering Group successfully converted the design of a model mill steam engine to conform completely with all appropriate I.S.O. standards. As the photograph shows, the model has now been completed and its workings proved in operation.

The design selected for conversion is based on the late Edgar T. Westbury's *Unicorn* engine, published originally in *Model Engineer* during 1949/1950. It was scaled-up to make the best possible use of the machine tools and manufacturing processes available in industry.

The whole of the conversion design work was carried out in the Apprentice Training Drawing Office, the various patterns being made by second and third-year apprentices. To meet industrial safety requirements, completed patterns were subjected to the normal inspection standards of the Works Pattern Shop.

Iron castings for the model were made by apprentices working in the Works foundry, the non-ferrous ones being produced by apprentices during their day-release training at the Gateshead Technical College. The co-operation of the College in this work was greatly appreciated by the Training School.

Machining, fitting and assembly work was carried out by first-year apprentices during their final three months in the Works Training School.

It is acknowledged that purists may find faults with the modified design—for example, the lack of a well, in which to run the crankshaft web which

Continued on page 145

Depth stop for the lathe

by Tubal Cain

Part II

Continued from page 86

NOW FOR THE cutting. Carefully advance the tool until it just touches, and note the index reading with a piece of chalk on the bench. Withdraw the saddle to the right so that the tool clears the work. Set the chuck round until the handwheel index is at 0. Put on a small cut—2 or 3 thou—and wind the saddle chuckwards until the tool reaches the groove. Retract the saddle, put on another thou or so, and repeat. As you go deeper, reduce the cut. You will just have to try for yourself what the work will stand, but my own cuts were 4, 2, 2, 1, 1, 1 (thou) and the last cut repeated with no change. 11 or 12 thou deep should be enough; you need a groove about $^1/_{32}$ in. wide. Never mind the burr for the present.

Withdraw the tool, taking off all-the-cut-and-a-bit. Rotate the chuck to bring the index to 5. If you go too far, go WELL back and try again; you must always approach in the same direction. Then repeat the shaping process, and so on right round the drum. When you come to zero, set the tool so that it just shaves the groove, and go once round again, without altering the tool setting. This sounds a slow job, but it is surprising how fast the work goes once the initial trials and hesitations are over.

Once this is finished, remove the string and take out the sideways tool; machine the little bevel at the end of the drum, and polish off the burrs on the grooves with fine emery cloth. Part off to size, reverse and grip very lightly in the chuck to face and polish the head. Now degrease both screw and head, and anoint the former with Loctite. Hold the screw in the soft jaws of the vice and screw on the head; wipe off the surplus and leave overnight to cure. If you have no Loctite, no matter; simply drill about $\frac{1}{16}$ in. and fit a taper-pin, filing off the ends flush. (In this case, make sure the head is well screwed home; the pin is only an insurance, not a fixing.)

For a slide-bar, the ideal material would be a piece of $\frac{3}{4}$ in. × $\frac{1}{2}$ in. × $\frac{1}{16}$ in. channel section. The snag is that it is held rather far back from the point of contact of the screw, and there may be a tendency to lift. Channel section is, however, rare, and I have used a piece of $\frac{3}{4}$ in. × $\frac{3}{16}$ in., and stiffened the assembly with a strong-back. Smooth off the material, and square the ends. You can mill the slot if you like, but it is far quicker to drill a series of $^9/_{64}$ in. holes and finish off with a file. Make sure that the slot is parallel to the edges. Cut off a piece of $\frac{5}{8}$ in. × $\frac{5}{8}$ in. × $\frac{1}{8}$ in. angle a shade over $\frac{3}{4}$ in. long and square the ends. File the corners off to a nice radius on one leg—dimensions don't matter, only the appearance. This angle piece can be riveted to the slide-bar, but I prefer brazing and the boss has to be brazed to the bracket anyway.

You can do both jobs at once, and the little "GAZ" blowlamp should be sufficient. Degrease the mating surfaces. Spread a thin layer of flux and clamp the parts together. Be especially careful to clamp up well on the boss, for you want this to be dead square. Heat up to dull red, apply Easyflo, cool to black, and pickle. Don't be alarmed if the parts come out of the pickle coated with copper. This will wipe off, and does no harm. (Indeed, it is one way of reducing the copper content of the pickle-bath!)

Wash and dry after pickling, and then put a fine finish on the bracket and boss, to suit your taste and standards. It IS a piece of workshop machinery, and I would use a good draw-filed finish as being neat and functional. On the slotted bar you must trim up the ends of the angle piece to line up with the bar, finish off the whole, and then give a *very slight* set so that the bar is concave downwards. 0.010 in. is enough. (Dead flat is what is wanted, but as this is difficult to achieve we give a set that will make the bar flat when bolted down.) The strong-back washer is simply a piece of $2\frac{3}{4}$ in. × $\frac{3}{4}$ in. × $\frac{3}{16}$ in. stock, finished off smooth and the corners rounded. Give *this* piece a set of about $^1/_{32}$ in. before drilling the $^7/_{64}$ in. hole in the very centre. This set serves a different purpose—it transfers the point of pressure nearer the front of the job when the fixing bolt is tightened.

You can now offer the whole lot up to the lathe and see how it fits. You may find you have to make two alterations. First, the gib of the cross-slide may project beyond the end of the slide itself. It will then foul the new bracket. (The existing feedscrew bracket has a cavity, to clear it.) You can dismantle the slide and file a bit off the gib, but I never like disturbing a sweet running slide for any purpose. I simply marked the position of the gib on the back of the bracket using a fine felt pen, took it off, and chipped out a groove to clear the gib using a small chisel. You could use a file, but a chisel is quicker and on a job like this gives a better finish. The other interference you may find is between the feed nut and the bracket. The latter is simply filed out a little more to give clearance.

Assuming that all lines up properly, and looks well, we can proceed to make the detent. For this you will HAVE to experiment, unless you happen to have a piece of watch spring 1.6 mm $\times$ 0.25 mm of exactly the same "spring" as mine! Find a piece as near to this as you can. You may have to stone a bit down, or you can often reduce the width using a very fine 3-square saw-sharpening file. (The one called a "slim taper".) Without cutting any off, grip the spring in a little hand vice so that about $\frac{3}{16}$ in. projects and soften the end. With a small pair of pliers, put the kink in it. So it broke off? Try again, but get it a trifle hotter this time. The less heat you apply to draw the temper the better, so it is better to make three than to overheat the first one. Don't cut it off yet.

Find, or make, a little 4BA screw as shown. I was able to find a steel screw with a tall head which just fitted, but it is no trouble to make (use steel). Put a slot in the end as fine as you can manage; either use a fine slotting saw or grind the set off a 6 in. hacksaw blade and use that. Try to get the slot truly on the centreline and vertical. Don't use any oil, but if the piece IS oily, degrease it. Now remove the varnish, and any oxide film (e.g. tempering colour) from the spring and tin it with a small hot soldering iron. Enter it in the slot of the screw, but wrong way up, and offer it up to the drum on the bracket upside down—with the head of the screw, that is, resting on the bracket, and with the kink of the spring resting on the drum. Experiment with the projection of the spring until it feels about right, but make sure that the screw is not so far away from the drum that it would foul the feedscrew bracket.

When you are satisfied, remove the spring and flux both it and the slot. Put the spring back, but right way round this time. If it is too slack in the slot, by the way, simply tin another short length from the other end, cut it off, and use it as packing. Apply a hot soldering iron and tinman's solder—not the soft resin-cored stuff—and run a good dollop of solder into the slot. When cool, wash off flux, and then snap off the surplus spring, finally stoning it flush to avoid a sharp projecting edge.

Offer it up to the drum again, and mark the position for the tapped hole. Drill No. 30 and tap 4BA (you will have to remove the drum to do this). Screw a lock washer on to the detent thread, and screw the whole into place, with the spring about $\frac{5}{16}$ in. from the face of the bracket. Return the stop-screw to its place and then rotate the detent until the drum can be rotated without excessive resistance, but at the same time is held firmly by the detent. Tighten the locknut.

You can now assemble for serious work. There is no need to remove the bracket assembly from the lathe when not in use; only occasionally will it get in the way. But the slide-bar assembly may be a nuisance, and I remove mine after use.

In use, after setting up the work to be screwcut either in the chuck or between centres, screw the index drum almost right forward. Bring the tool to within ten thou of the workpiece and advance the slide-bar until it just touches the stop-screw. Tighten down, withdraw the top-slide, and then *really* tighten the Allen screw (within reason, of course; don't strip the thread). Now start screw-cutting in the ordinary way, with the cross-slide up against the stop. At the end of the cut, withdraw the top-slide; traverse back the saddle and then retract the drum one notch for every 0.001 in. of cut desired. You don't use the cross-slide index at all (unless, perhaps, if you are using it to determine a definite depth of thread; even then you only need keep an eye on it). At the beginning of every cut the slide is fed forward till stopped by the stop-screw; at the end of every cut it is withdrawn enough to clear the work from the tool. The method is the same whether you use the "direct feed in" or "angular setting of top-slide" method of screw-cutting.

Obviously the gadget can be used for normal turning jobs as well, but it is hardly necessary. It is only when screw-cutting that the operations of feeding in and out follow so quickly, with one eye on the leadscrew and the other on the tool point.

You will almost certainly find that after a little use you seem to be putting on about 25% more cut than the notches should allow. The screw has bedded in and backlash developed. Remove the bracket from the cross-slide and very gently close in the slot in the boss. This will act as a backlash eliminator, as it will hold the flanks of the thread in the direction which contact with the slide-bar will push them.

As a tailpiece, consider how easy the making of the grooves in the drum would have been had the device been available then!

UNICORN ENGINE

Continued from page 143

was eliminated to simplify pattern-making and casting. It must be remembered, however, that this was a project undertaken by apprentices who, up to that time, had never worked on a steam engine.

No claims are made as to the originality or authenticity of the model. The main objective was to provide something interesting and moderately complex that could be produced by apprentices working—in the main—in the Works Training School. Without doubt it proves that model-makers of the future have little to fear from metrication, and that models can still be made from old designs although Imperial-sized tools and materials no longer exist.

CLUB NEWS

Nottingham S.M.E.E.

On October 21st, this Society were able to use their Valley Road track after dark, by kind permission of Mr R. O. Stannion, Director of Parks. Among members who took part in the running, K. Macdonald had his 3½ in. gauge L.N.E.R. *Pacific*, F. Dudley and George Brown drove a 0-4-0 tank, G. Leftly a 5 in. gauge *Netta*, J. Gosling his 0-4-0 saddle tank, and R. Morris who came all the way from Grimsby with his splendid Garratt. Ian Trivett and Derek Hickling kindly provided a plentiful supply of refreshments.

Ardeer Recreation Club

Sunday, September 21st, saw the last Live Steam Day at the Ardeer track after another successful season. This also marked the end of almost 20 years with the track on its present site, as the local Council took over the ground in October. The Society is however fortunate in being able to set up the track on a new site and this should be ready for use at the end of May.

Throughout the last season, track days have been blessed with good weather and on this last Sunday some 11 engines were in steam with a further ten on static display, either under construction or being overhauled. One member. Tommy Donaldson, had driven his full-size 7 n.h.p. Fowler traction engine the four miles from his home in Ardrossan, while a Marshall tractor was brought along by Gawain Muir of Neilston. Proceedings started at 10.30 a.m. and first away was Bert McCready with his 3½ in. gauge *Bantam Cock*. Despite the handicap of only one active arm, Bert has built several locomotives over the years, his latest being a *Simplex*, which was in steam later in the day.

Bill Robertson of Kirkintillock was next away with his 3½ in. gauge *Maisie*, and he was followed by the 5 in. gauge free-lance 2-8-0 owned by the Glasgow Society and driven by John Rowley and Douglas West. Soon after, the Club engine, 0-4-0 tank *Ann of Holland* took to the rails to cope with an ever-increasing queue of passengers.

Other engines in steam were Phil Atkinson's 3½ in. gauge North Eastern 0-8-0, Iain McKenzie's 0-6-0 free-lance tank, Rolland Gill's 3½ in. gauge 2-6-2 tank, Matt Miller with his 3½ in. gauge *Juliet* and 2½ in. gauge *Flying Scotsman*. J. Robertson's Gauge "O" *Bat* also attracted attention, although not in steam. Among the static exhibits were three *Jubilees*, two for 3½ in. gauge and the other for 5 in. gauge, two *Doris*, a *Princess Marina*, a *P. V. Baker*, a 2½ in. gauge Barclay tank and finally a 1 in. scale *Minnie* traction engine being built as a fine first attempt by Frank Storey. Secretary: J. Robertson, 15 Whyte Avenue, Irvine.

CLUB DIARY

Dates should be sent five weeks before the event. Please state venue and time.

February 2 Taunton M.E.S. Demonstration and discussion "Lathe Attachments", Taunton Rugby Club; Priory Bridge Road, Taunton, 7.45 p.m.

February 2 Lincoln M.E.S. General meeting, Unitarian Chapel, High St., Lincoln, 7.30 p.m.

February 2 Kinver & West Midlands S.M.E. Meeting, Clubhouse, Kinver, at 7.30 p.m.

February 2 Brighton & Hove S.Min.L.E. Problem Evening (we will make your problems worse), Elm Grove School, Elm Grove, Brighton, 8 p.m.

February 2 East Sussex M.E. Railway Films—taken and presented by C. R. Cowlin, Mercatoria Hall, St. Leonards-on-Sea, 7.45 p.m.

February 2 Romford M.E.C. Competition night. Ardleigh House Community Ass., 42 Ardleigh Green Road, Hornchurch, Essex, 8 p.m.

February 2 Stockport & Dist. S.M.E. Bits and Pieces. "Wellington House", 324 Wellington Road North. Heaton Moor, Stockport, Cheshire, 7.45 p.m.

February 3 Stephenson L.S. (Sheffield). "Industrial Steam" by Alan Tyson, Livesey-Clegg House, 44 Union St., 6.45 p.m.

February 3 S.M.E.E. Talk—"Early Keyboard Instruments" by Ian Alderman, Marshall House, 28 Wanless Rd., S.E.24.

February 5 North Wales M.E.S. Meeting, Penrhyn New Hall, Penrhyn Bay, Llandudno, 7.30 p.m.

February 5 City of Leeds S.M.E.E. Talk by Mr Kirk about his 1972 locomotive "Moor Bay". Salem Congregational Church, Hunslet Rd., Leeds 10, 7.30 p.m.

February 6 South Cheshire M.E.S. Workshop Tips, Shavington Social Club, Shavington. Nr. Crewe, 7.45 p.m.

February 7 Coventry M.E.S. Hints on Machining, Maudslay Hotel, Allesley Old Road, Coventry, 7.30 p.m.

February 7 Bristol S.M.E.E. The task of reconstruction of a Derelict Fowler Ploughing Engine, by Hercules himself, Colin Waite with interruptions by David Yea, Unitarian Hall, Lewin's Mead, 7.30 p.m.

February 7 North Staffs Models Society. Annual General Meeting, Pitfield House, Newcastle, Staffs.

February 7 Stephenson L.S. (Luton). Talk on "Travels and Events in 1972" by G. N. Webb, Carnegie Room, Luton Central Library, 7.30 p.m.

February 7 Guildford M.E.S. Members' films and slides. H.G. Stoke Park, 7.45 p.m.

February 7 Stephenson L.S. (Bromley). "Further Experiences of a Locomotive Engineer" by A. V. Betterley, one-time manager of Bagnalls of Stafford, Halls of the Bromley Congregational Church, Widmore Road, 7.30 p.m.

February 8 Leyland, Preston & Dist. S.M.E. Roebuck Hotel, Leyland Cross, Leyland, 8 p.m.

February 8 Sutton Model Engineering Club. Members' 35 mm Slides, Clubhouse, off Chatham Close, Sutton, Surrey, 8 p.m.

February 9 Colchester S.M.E.E. "The Mysteries of Boiling" by J. W. Bramall, The Clubhouse, Old Allotments, Straight Rd., Lexden, 7.30 p.m.

February 9 Stephenson L.S. (Edinburgh)—jointly with the R.C.T.S. "In Search of Steam in Germany" by J. L. Stevenson, Royal Circus Hotel, Royal Circus, 7.30 p.m.

February 9 Stephenson L.S. (Birmingham). A.G.M. and cine film show presented by W. A. Camwell, "The North American Tour of 1972 and retrospective scenes of the 1950's and 1960's in this country". Dr. Johnson House, Colmore Circus, entrance now in Bull Street, through Friends' Meeting House, 7.15 p.m.

February 10 Stephenson L.S. (Manchester). "Sweden by Rail and Water", by Dr. H. Vickers.

February 10 S.M.E.E. Rummage Sale, Marshall House, 28 Wanless Road, S.E.24.

February 9 Worcester and Dist. S.M.E. Members' Railway Slides, Malvern College, Albert Rd. North, Malvern WR14 2TW, 7.30 p.m.

February 10 Huddersfield S.M.E. Exhibition. Slaithwaite Civic Hall, one day stand. setting up Friday night.

February 12 Stephenson L.S. (Ayrshire). "Freight Train Loading and Working" by Inspector G. Craig. Winton Arms, Kilwinning (adjacent to station), 7.30 p.m.

February 12 Clyde Shiplovers' & Model Makers' Society. Film Night (16 mm), Kelvingrove Art Gallery and Museum.

February 12 Peterborough S.M.E.E. Annual General Meeting to be followed by Junk sale, Clubhouse, 7.30 p.m.

February 13 Sutton Coldfield & N. Birmingham M.E.S. Workshop Questions.

February 13 Crewe Model Engineering Society. Members' film and slide evening, Queens Park Hotel, Wistastion Rd., Crewe, 7.30 p.m.

February 14 Harrow and Wembley S.M.E. Talk on Narrow Gauge Railways by Mr Catchpole, B.R. Sports Pavilion, Headstone Lane, 7.45 p.m.

February 14 Stephenson L.S. (Romford). A colour slide show presented by Mr Philip Tatt "Railway Rambles". Ilford and W. Essex M.R.C. Rooms, Chadwell Heath station, 8 p.m.

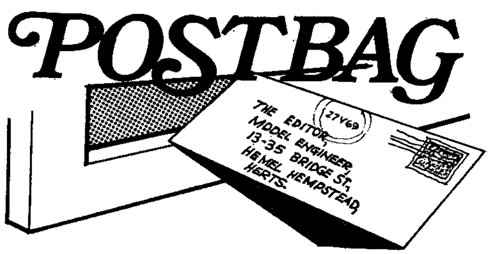
February 14 Birmingham S.M.E. St. Valentine's Day and Social Evening for the ladies. This time—food, drink, perhaps a film or two and plenty of chat! Sheepcote St.

February 14 Cannock Chase M.E.S. L.N.W. Locomotives, Mr Kendrick, Lea Hall, Colliery Social Club, Sandy Lane, Rugeley, 7.30 p.m.

February 15 Sutton Model Engineering Club. Steam Driven Rail Cars—A. P. Hancox, Clubhouse, off Chatham Close, Sutton, Surrey, 8 p.m.

February 15 Hull Society of M.E. Film show by E. Granville, Trades and Labour Club, Beverley Rd., Hull, 7.45 p.m. Room 3.

February 15 Glasgow S.M.E. "Steam Turbines"—by R. Low, Museum of Transport, 25 Albert Drive, Glasgow.



The Editor welcomes letters for these columns. He will give a Book Voucher for £1.50 for the letter which, in his opinion, is the most interesting published in each issue. Pictures, especially of models, are also welcomed. Letters may be condensed or edited.

75th Anniversary

SIR,—The reminder that *Model Engineer* is now seventy-five years old made me realise that it must having been going for nearly twenty-five years when I first came across it as a schoolboy. I thought of it then, as I think now, as a quite unique institution catering for a very special clientele in a very special way.

Obviously no magazine can please all its readers all the time, and *Model Engineer* has had periods when it lost that special touch and seemed to please none at all. However, since it was taken over by the present proprietors who had the good sense to retain the services of you, Sir, as editor, it has re-asserted its hold over the imagination of all of us who are engaged in this fascinating activity and has regained the respect of those great experts who continue to contribute and to give so generously the fruits of their studies and labour to those of us who depend on them for improvement of our own techniques and so for our greater satisfaction in our amateur efforts.

Sadly we miss the great contributors of the past such as Dr Hallowes, K. N. Harris and Edgar Westbury, but others come forward to continue the old tradition.

It is always a pleasure to read the construction articles such as those from Don Young who so pleasantly leavens his technical matter with reminiscences of his interesting days at The Plant and at Eastleigh.

Please accept my congratulations on having attained the seventy-fifth anniversary in such great form, my gratitude for the interest *Model Engineer* has given me and for the many friends I have made through it, and my good wishes for its continued success. I look forward with pleasure to the Centenary issue.

South Harting. BERTIE GREEN

Electric locomotive

SIR,—Having built a 5 in. gauge model of a Metropolitan Railway Electric locomotive of 1920 vintage some 20 years ago, may I congratulate Ken Toone on his model of a modern main line express electric locomotive, as described in the M.E. issue No. 3454.

My 20 year old model which was described and illustrated in the M.E. shortly after its construction was completed, has subsequently been rebuilt twice.

The first rebuild was about ten years ago when I removed the two forward bogies and used them when constructing a Hymek type Diesel/Electric locomotive. The latter, motivated by a 50 cc 2 stroke Trojan engine driving a 24 volt 40 amp ex-aircraft generator is now in the possession of two fellow members of the D.S.M.E.E.

I fitted new bogies to the Metropolitan locomotive and used a 6 volt car generator as a motor to drive the front bogie only, the power being supplied by a 12 volt car battery. It was used in this manner until some three to four weeks ago when I decided more efficiency was needed to put up a reasonable performance on the D.S.M.E.E. track, which is probably the most steeply graded in the country, for in ascending from the lowest point under the bridge, the locomotive, train and passengers are lifted 4 ft 6 in. over a distance of just over 500 ft, an average climb of almost 1/100. I have now motorised both bogies, but having failed to obtain another scrap 6 volt generator, I have installed a 12 volt one on each bogie.

A drum type heavy duty switch was modified in such a manner as to give a central off position to the control handle, three notches to the right for forward series, parallel and weak field, on three notches to the left for resistance braking and reverse series and parallel. The same 12 volt battery is employed and preliminary tests have been satisfactory.

Whilst writing, I would like to make a few comments on my 5 in. gauge L.T.S.R. locomotive *Thundersley* (see M.E. issue No. 3446 August 4). This locomotive was constructed in the late 1950s and was basically an outside cylinder *Maid of Kent* L.B.S.C. design, but was completed as a tank locomotive.

I rebuilt the valve gear in 1964 replacing the locomotive type links (bottom pin suspension and swinging die blocks) with launch type link with centre suspension and straight line movement, die blocks driving the valve rods direct. I believe the late K. N. Harris designed a similar modification about that time as also has Don Young in more recent times. Here I would like to support Arnold Throp's comments in his letter which also appears in issue No. 3454, because I fitted his white silicone rubber "O" rings to the pistons at this time (1964) and the locomotive has run consistently over the last eight years, completely trouble free in this respect. I regret I have not recorded the distance covered, but I feel it probably exceeds that of the Chesterfield locomotive mentioned, by a considerable margin.

Incidently, during the 1964 rebuild, I used one of the discarded locomotive links to modify the boiler feed pump drive, using one eccentric and one concentric sleeve on the driving axle, with a second weighshaft and lifting links, operated from the cab, to give a variable feed to the boiler from the axle pump, a feature appreciated by all who have driven this engine. Early last summer I fitted a steam operated brake and erred by fitting an "O" ring (described by the supplier as Ethylene Propylene) which worked perfectly when tested on compressed air, but when steam was applied swelled to such an extent that the piston became immovable and had to be driven out of the cylinder by force. I have now fitted a white silicone ring and have had no further trouble.

I became a "senior citizen" last January and have consequently had much more time to spend in my workshop.

I am now building two L.M.S. 6 coupled tank locomotives simultaneously, Nos. 47480 and 47481. I have not received any technical or engineering training of any kind and what knowledge and ability I now have, still limited in many respects, is entirely due to having read the M.E. for the past 25 years and to advice and assistance of fellow members of the D.S.M.E.E. I therefore had neither the ability nor the inclination to design all the parts of these engines in detail and make my own patterns for special castings, so I decided to shop around for existing castings, etc., most suitable for this purpose. I have actually married *Firefly* driving wheels and *Princess of Wales* valve gear to *Pansy* cylinders and slightly modified *Pansy* boilers. Both chassis have now been completed and tested on compressed air, and the boilers are virtually finished and have been tested hydraulically to 120 p.s.i. I hope steam tests of both locomotives will be possible on the club track early next summer.

It may encourage beginners to know that I commenced model engineering as a complete novice on leaving the R.A.F. in 1946 and including models under current construction I have since then built, as nearly as memory permits in the order listed below, the following:

1. 3 ft 6 in. working model of R.M.S. *Queen Elizabeth*.
2. $3\frac{1}{2}$ in. gauge locomotive and tender *Hielan Lassie*.
3. 5 in. gauge Metropolitan Electric locomotive.
4. 5 in. gauge L.T.S.R. locomotive *Thundersley*.
5. 5 in. gauge Hydraulic Diesel/Electric locomotive.
6. "Hipp" movement Electric clock.
7. $1\frac{1}{2}$ in. scale traction engine.
8. 4 ft 6 in. working model of Passenger/Cargo liner *Cicero*.
9. 3 ft 6 in. working model of Vosper M.T.B. (later converted to cabin cruiser).
10. 5 in. gauge G.W.R. locomotive and tender *Lord of the Isles*.
11. 6 ft working model of U.S. liner *United States* (this is a rebuild of a damaged waterline exhibition model).
12. Clarkson 2 in. × 2 in. vertical steam engine.
13. 5 in. gauge L.M.S. 6 coupled tank locomotive, No. 47481.
14. 5 in. gauge L.M.S. 6 coupled tank locomotive, No. 47480.

Items 2, 5, 7 and 9 have been disposed of, the remainder are still in my possession. All the vessels have progressive radio control.

I also constructed a continuous $3\frac{1}{2}$ in. or 5 in. gauge track, approximate length 300 feet, around my garden in the early 1950s, well before the D.M.S.E.E. even considered track construction. It became redundant however, when the society installed their first track in 1963, so I eventually, in 1971, emulated Dr Beeching and removed all but a short straight section which was retained for testing purposes.

My decision to take to model engineering in 1946 has never been regretted. I have made many friends in this field and I have a hobby which I can pursue with considerable enjoyment in my retirement.

This extra leisure time enabled me to assist in the construction of the semaphore and colour light signals recently installed at the club track.

The impression given that I did not use any tools before 1946 is perhaps misleading, I built several crystal wireless sets in 1922-1925, and listened to the opening of 2 L.O. Savoy Hill in my bedroom at Harrow, Middlesex, where I then resided. This explains my interest in the Metropolitan Railway, which ran alongside our school playing field and on which I travelled when visiting London up to the time my family came to Derbyshire in 1923. It was interesting to observe the exchange of the electric locomotive on the Aylesbury branch trains, this took place at Harrow in those days, later I understand the exchange point was extended to Rickmansworth.

I regret not having made a model of a Metropolitan steam locomotive, I have the book "Metropolitan Steam" published by Roundhouse Books in 1963, this is well illustrated but does not include any scale drawings. I favour the "H" class 4-4-4 tank locomotive type. If any reader can suggest a source from which a drawing could be obtained I would be most grateful.

Horsley, Derby. S. B. Whitmore

Foden

Sir,—One of your correspondents states that the recent articles on the Foden steam wagon were of great interest to him, and so they proved to my son and I, so much so that we decided to build the 3 in. scale wagon, as we do not have a track for locos, and the wagon could be run on any reasonably level ground at any rally or meeting of M.E. enthusiasts.

At present the boiler is complete, and has had a water test up to 150 p.s.i. The test pump, which we made for the job, unfortunately turned out to be unequal to the job. 150 lb. was its limit, and we want a test pressure of 300 p.s.i., therefore, it is at present being modified, ready for another attempt.

We personally know two other model engineers who are collecting material and studying drawings prior to getting the tools out, so should others be considering or building this model, let us consider the few snags met up-to-date, none, I might add, due to lack of detail in Mr Terry Morris's excellent drawings.

After considering the high cost of large bore copper, we made our minds up that our model would be of all steel and welded construction. Like all model making a decision as to where to start had to be made, and after a lot of thought, my son and I decided to start on the job that we knew would give most trouble, i.e. the tubes, therefore the rear and front tube plates were marked out, shaped and drilled, ready to receive the tubes.

Various tools were made to expand the tubes, but none gave satisfactory results. A tube expander patterned on the type used on full-sized marine boilers failed as the threads stripped repeatedly. Taper drifts and a hammer were useless, great difficulty being experienced in recovering the taper drift, and holding the nest of tubes whilst hammering. Many frustrating hours later, and a session in the think tank, brought a new approach to the work in hand.

Four lengths of stud iron were obtained, and the four corners of the tube plates were bolted together, using four nuts to each rod to locate and hold the tube plates at the correct distance apart. A tube was then inserted and welded into place, using a number 10 Mirror speed rods at 90 amps. and the process repeated till four tubes were welded at both ends, and the stud iron was then removed. Highly delighted, the job was then put away till next weekend.

Next Saturday, after lunch, my son with a handful of tubes and welding rods said, "This won't take long, get cracking, Dad". I did, and soon found it extremely difficult to weld small dia. tubes closely spaced, without the weld and slag running "over-the-mark", i.e. partly blocking the next hole, so more thought was required.

The next approach was to weld alternate tubes, but the intermediate tube holes were blocked with weld and slag, and would not accept the tubes. All welds were then dressed across the face, all tube holes redrilled out, then all tubes inserted and welded at one end only. On looking down the tubes we were shocked to find that the clear dia. of the tubes was down, in some cases to as little as ¼ in. dia. So the job was once again back to the think tank.

The solution was to extend a drill to 12 in. and to drill out the tubes by putting the drill, which was a neat fit, down the tube from the opposite end. This method kept the drill located. Attempts to drill at the welded end failed as the drill wobbled all over the place.

Eventually all the tubes were in position at one end, and after dressing the welds on the grindstone, and finishing off with a file the job looked neat except for the top edge, as the weld followed the dia. of each tube, so a run of weld was put along the top edge to straighten and finish the job off. It now looked right, so this method was then used on the other end.

The boiler wrapper and firebox were then prepared. All pieces prepared were marked with the part number and ticked off on the drawing to avoid confusion, as my son's workshop is miles away from mine.

We then ran out of drawings, so a phone call was made to Mr Terry Morris, and he was, I think, a bit surprised to find that we were so far ahead. and he said that he had made his boiler in copper, and after much discussion on the phone—just about an hour—an invitation to visit Mr Morris was made, and immediately taken up.

Next day my son and I duly arrived at Seisdon, long before Mr Morris arrived home, and we were graciously received and entertained by Mrs Morris, and their children, one of whom showed me his "Foden" built in wood (firewood?) and cardboard, of which the boy is justly proud. No doubt he is a future model engineer, and I have no doubt that he will be a good one.

Our Foden boiler, at this stage, did not have the nest of tubes welded into position, and so Mr Morris was able to examine the construction in detail, and permission was asked for, and given, to Mr Morris to photograph our efforts. The prints, unfortunately, did not turn out.

Mr Morris suggested that we contact a boiler insurance company regarding insurance, as we had said we would probably tax and put the finished wagon on the road. We did, and a good job too, as the Insurance Co wanted to examine the boiler at four stages of construction in order that they could verify that the materials used were up to specification, and they also took the drawings away to have the specification checked for safety factors.

Arrangements were made for inspection, and the boiler duly inspected in detail, and some plates were measured and checked against the drawings. This taking about 1½ hours in all. The boiler inspector was duly impressed with the detail, and the amount of work on both the model and the drawing, and made two interesting remarks. . . . "That is the first boiler inspection that I have been on that I have not needed overalls, torch and test hammer." His other remark was that his company had only once previously been involved in insurance for a small scale boiler, and model, and that was some years ago, when a 3 in. scale traction engine was steamed at Liverpool Museum and went under its own power, by road, to Liverpool Blue Coat Chambers for an exhibition, and was escorted by a police motorcycle escort at the front, and a fire engine at the rear. These conditions were stipulated by the Museum authorities, and the insurance covered one outward and one return journey. However, to our boiler. It passed with flying colours.

The next stage was to weld the nest of tubes in, and to weld the firebox and foundation ring. A second boiler inspection was arranged. The boiler inspector said that his chief concern had been that there was a gap all round the front tube plate and between the boiler prior to welding, and that when welded that the weld was free from blow holes and carbon, slag, etc. The inspector was satisfied, and he said he wanted a water pressure test and suggested that we take a test not exceeding 210 lb., i.e. 1½ times working pressure prior to his inspection, so that we could take up any leaks at rivets, etc. This was good advice, as when we had reached only 50 lb. we found we had seven rivets leaking, one manhole joint, and one firebox stay, which is not too bad when you have 95 firebox stays, and I dare not count the rivets.

I hope the above is of interest to your readers, but I had better stop after covering the main points, that is to say the boiler tubes, and inspection to date by a certified boiler inspector, as opposed to club officials, as I could almost write a book on the subject, including a few modifications I would make, should I ever attempt Foden No. 2. So I will close full of confidence that whatever the difficulties, I and my son will get test inspection No. 3 (water pressure test), and No. 4, steam and boiler fittings, to the Board of Trade Inspector's requirements, and we both look forward to the day when we watch the Inspector stamp our boiler "Passed Test, Date: . . . . Test pressure 280 p.s.i., working pressure 140 p.s.i.

Birkenhead. RUSSELL NEWHOUSE

Jersey Lily

SIR,—I was sorry to read in Postbag that the *Jersey Lily* design offends the feelings of Mr D. H. Yarnell. From his letter it would appear that the three years spent researching this project, together with nearly 1,000 hours of preparation of the drawings, not to mention the script, have been entirely wasted. This is not true and, for me, Mr Yarnell's remarks do a disservice to the memory of the Great Central Railway and Mr Robinson. A *Jersey Lily* incorporating a few honest mistakes is infinitely better than no engine at all; in this respect it must be admitted that I am biased!

Mr Yarnell kindly wrote to me immediately after the General Arrangement drawings appeared. Many of the points raised were at variance with Beyer Peacock Drg No. 63526, to which the Curator of Historical Relics had allowed me access at Clapham. In fact, the complete drawing set for the full-size engine was viewed. Now, I have often stated that actual engines do differ in detail from official drawings, from personal experience. But until proof to the contrary is produced, I maintain that No. 192 started her long working life very much as the Beyer Peacock drawings. *Jersey Lily* is a fair copy, within the limits of a working 5 in. gauge engine. From what has been written in the series, it goes without saying that Mr Yarnell is a greater expert on matters Great Central than I can ever hope to be.

Regarding the charge of bad draughtsmanship on the smokebox door, the answer lies on page 1051 (Nov. 3-16, 1972). As for the cab front, this was varied for ease of construction. But once the roof is fitted, the nett result should look like the G.A. drawing.

Generally within the cab, fittings have been based on my K1/1. In this respect they are more "Doncaster" than "Gorton", but I can assure builders that they will function satisfactorily. That includes the injectors referred to by Mr H. H. Nicholls. The positions of fittings were selected to be where the driver would expect to find them, very important when one hands over such an expensive engine to a colleague at the track. In this respect I am guilty of not adhering to the prototype.

The firehole door should appeal to Mr J. J. Mather, if not to Mr Yarnell. For it is strictly functional, resulting from experiences with more true-to scale versions. The K1/1 has the proper L.N.E.R. door, but one cannot fire through the air flap as full size. So the door has to be opened for firing, a happening that was frowned upon in full-size practice. Even Bill Carter's magnificent "Atlantic" suffers from this shortcoming!

It is very much doubted if any *Jersey Lily* builder is under the illusion that his engine, if built in line with the series, will be exact in every detail. For the past two winters I have monopolised Vol. 3 of "Great Central" by George Dow from our local library. This winter I cannot obtain it; a local *Jersey Lily* builder is obviously making good use of the contents!

The current series, when completed, will number roughly 30 parts, or over 130 pages of valuable *Model Engineer* space. Our worthy Editor has to make these pages as interesting as possible, despite my continued attempts to thwart him. There have to be limitations, and readers not particularly interested in *Jersey Lily* would welcome a change of scenery.

One final point. To avid readers, the fortnightly interval between issues may seem an awful long time. As a humble contributor, I find the reverse is true!

Cowes. DON YOUNG

Gear Cutters

SIR,—I am writing to say thank you to you and all your contributors in *Model Engineer*.

I often wonder if the writers realise how useful their articles are, and how much we readers appreciate their finding time to set down their experience and knowledge for us.

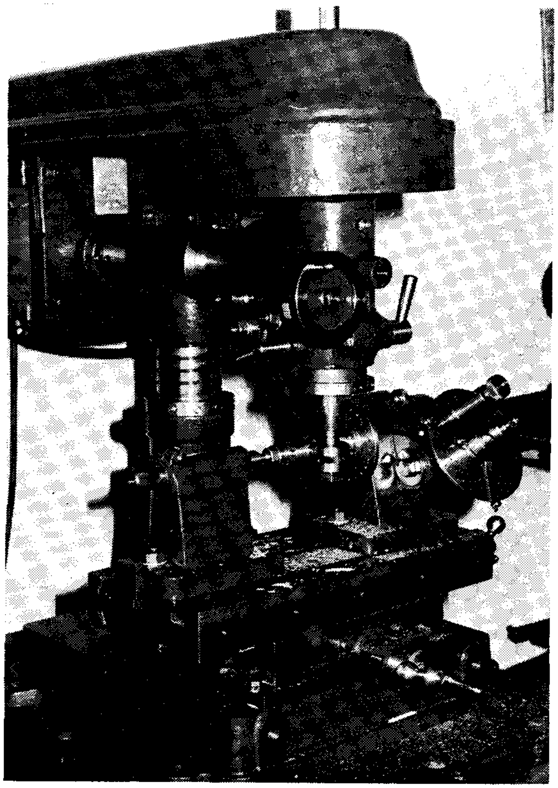
I particularly wish to thank Mr D. J. Unwin for his very practical method of making form relieved cutters for gears (M.E. 21.8.70 and 1.10.71). I have used this method with much success in making gears for the Allchin traction engine.

I also used the method of producing the 100, 50 and 26T gears from a piece of plate mild steel as described in L. C. Mason's book: "Using the small lathe". I could go on for hours about the many hints and ideas shown in *Model Engineer* and M.A.P. books, which I have used.

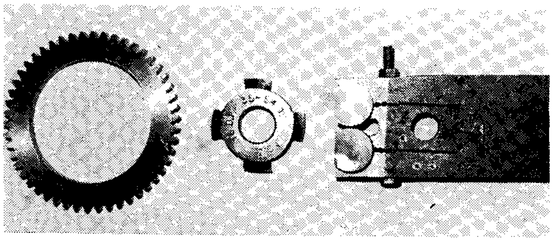
My photographs show one of the gear cutters in use on my home-made Westbury milling machine and dividing head and the gears, gear cutters and tools used in making the cutters.

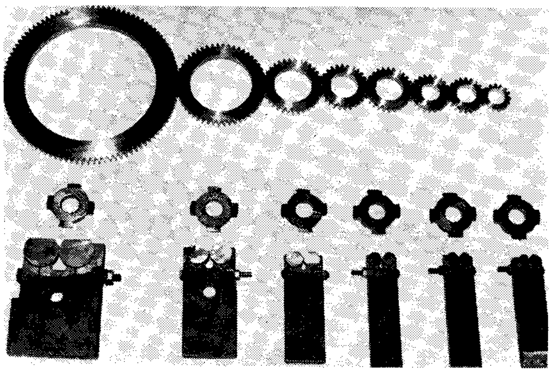
I was also delighted when the article appeared on the Allchin by W. J. Hughes. I look forward to the remainder. Once again, thank you M.E.

Rotherham, Yorks. D. R. MACHIN



One of Mr Machin's gear-cutters in use in his vertical milling machine. On the left are gears, gear-cutters and tools used.





Morse Tapers and Tempering

SIR,—Firstly may I correct a very serious error (page 1233, M.E. 3455), which could mislead young or inexperienced readers.

Morse Taper Shanks, tanged or tapped, are defined as self driving, that is, they are designed and made to drive off the taper—NOT THE TANG. The tang is for ejection purposes only. To quote one drill manufacturer, "The tang is for ejection only. Allowing torque to be taken by the tang will result in breakage.

Always ensure that the taper socket is free from foreign matter and damage so that friction alone drives the drill through the taper of the shank". Incidentally, I was recently informed that Jacobs no longer supply drill chuck arbors with tapped ends.

Following a number of years searching for a reliable and easily controlled method of tempering in school workshops, may I recommend to the model engineer the Baby Belling type of electric cooker. The hotplate section makes a good tempering hearth, with or without a sand tray. The oven, particularly if thermostatically controlled, is suitable for plastics, curing and softening, and epoxy resins (also sausage rolls). We now have two in the Dept., obtained from scrap yards for £1 each in working order but very dirty. The slow even supply of heat makes for easy control, even on tools of extreme sections.

Hassenbrook School, A. DAYKIN
Hadleigh, Essex. Head of Technical Studies

Oil Firing

SIR,—I was shown the editorial in *Model Engineer* of December 1st, and was surprised to read what was written, since obviously the editor is still living in the Railway Enthusiast's cloud cuckoo paradise.

Whilst all the railways specifically mentioned rely to some extent on the support of the Railway Enthusiasts, they supply only a fraction of the financial and practical support. It is the general public who travel on the trains who provide the bulk of the revenue, and although some lines rely more heavily than others on volunteers, those that have to work steam locos are by no means so averse to oil firing as you might imagine on the F.R.

After the F.R. got satisfactory performance from *Linda* two years ago, the decision was taken to convert all locos from coal firing to oil. On the F.R. fuel economies had very little bearing on the decision, it was the problem of forestry fires caused by sparks thrown out from coal fires, a problem which the Forestry authorities refused to accept any longer unless the F.R. took some action.

Whilst the British steam loco has been fired on coal by tradition, in many other parts of the world oil firing has for many years been the predominant means. Perhaps if B.R. had adopted oil firing on its more modern steam locos (as has been done in Germany), and slowed down the dieselisation programme, more money would have been available to speed electrification, and steam locos would have run far longer, to the pleasure (or otherwise?) of steam loco enthusiasts.

Perhaps if the editor had to work regularly on coal-burning locos, cleaning ashpans and tubes, and coping with the N.C.B.'s dubious supplies of steam coal, he would soon find that the oil-fired steam loco had more attractions than the coal-fired one.

Portmadoc. A. G. W. GARRAWAY

"Workhorse" locomotives

SIR,—With reference to Mr J. J. Mather's letter on 5 in. gauge "Workhorse" engines, I would like to comment on my own efforts in this field.

I am at present engaged in building a 5 in. narrow gauge locomotive based on *Edward Thomas* of the Talylyn Railway. 90 per cent of the design is taken from Martin Evans' *Simplex* engine. The only alterations are as follows:

(a) Removal of last pair of coupled wheels, substituting a pony truck.

(b) Small boiler adaptations such as repositioning of dome, safety valves and rear mounting brackets.

(c) Redesign of buffer beams, platework and smokebox.

I believe that this "rebuild" offers the following advantages:

(1) Ease of building due to the excellent *Simplex* design and availability of castings.

(2) Large amount of space between the frames for ashpan, etc.

(3) Narrow gauge on line allows a large coal and water capacity and also provides plenty of room in the cab.

(4) The increased size of engine (roughly equivalent to $7\frac{1}{4}$ in. gauge) means that it can be easily operated on a ground-level track.

So far the boiler and its fittings are almost complete and it is hoped that it will be steamed as a stationary exhibit during the 1973 rally season, feeding several stationary engines. The frames and cylinders, etc, are to be constructed during the following winter.

My models to date include a traction engine based on *Tich* (very freelance!), several stationary steam engines and an almost complete *Tich* locomotive.

Wareham, Dorset. T. R. HOLLAND

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Continued from page 155

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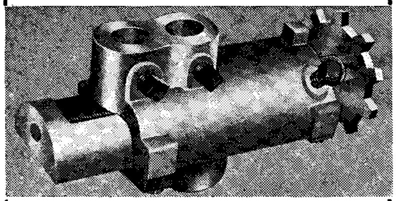

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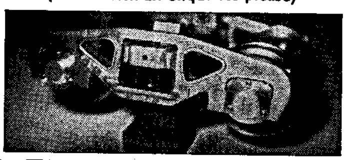

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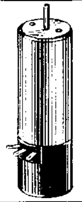

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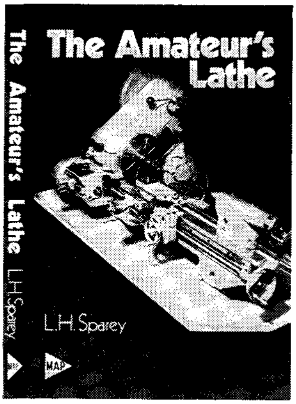

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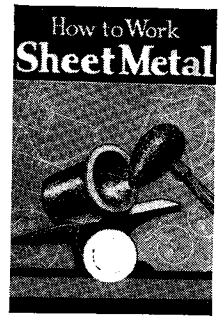

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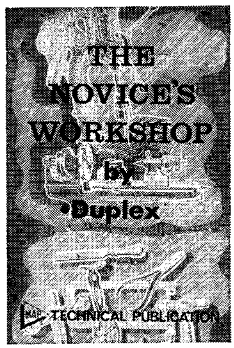

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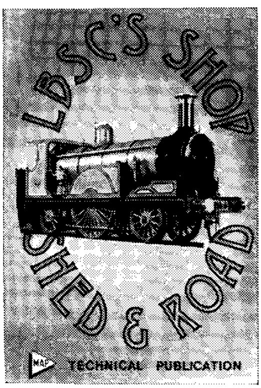

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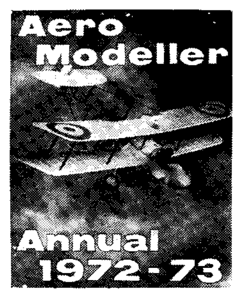

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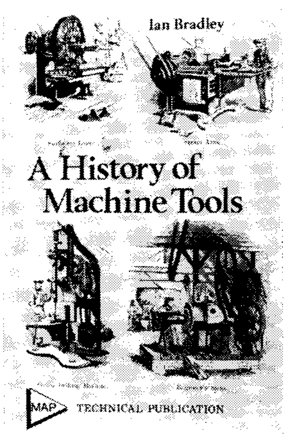

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