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6 May 1977

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COVER PICTURE

A ground level miniature railway in Holland, the locomotive built by D. Heiden of Rotterdam. Colour photograph by L. P. Starrenburg.

NEXT ISSUE

Full report on the model hot air engines at the recent Model Engineer Exhibition.

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Remittances to **Model & Allied Publications Ltd.**, P.O. Box 35, Hemel Hempstead, Herts, HP1 1EE (Subscription Queries Tel: 0442 51740). Subscription Rate £11.50, Overseas Sterling £14.40, U.S.A. and Canada $24.00, Airmail $48.00, index included.

Editorial and Advertisement Offices:

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Hemel Hempstead, Herts, HP1 1EE
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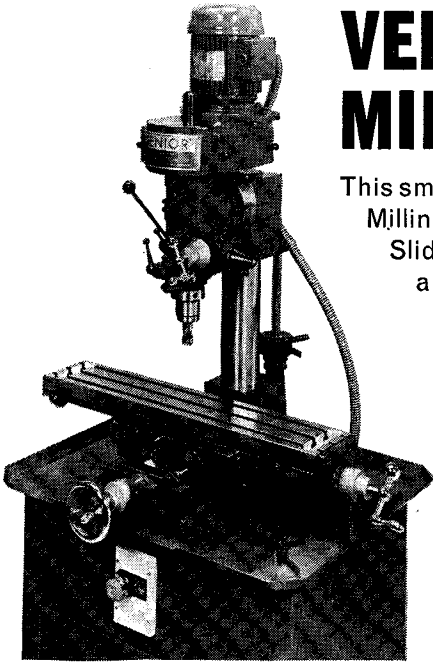

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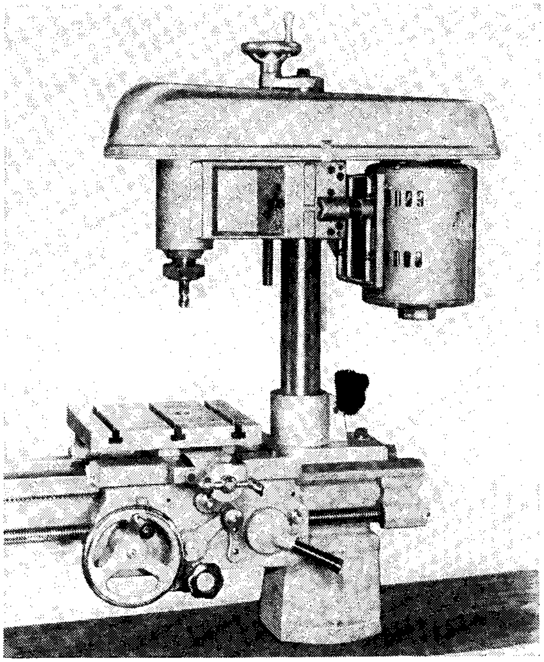

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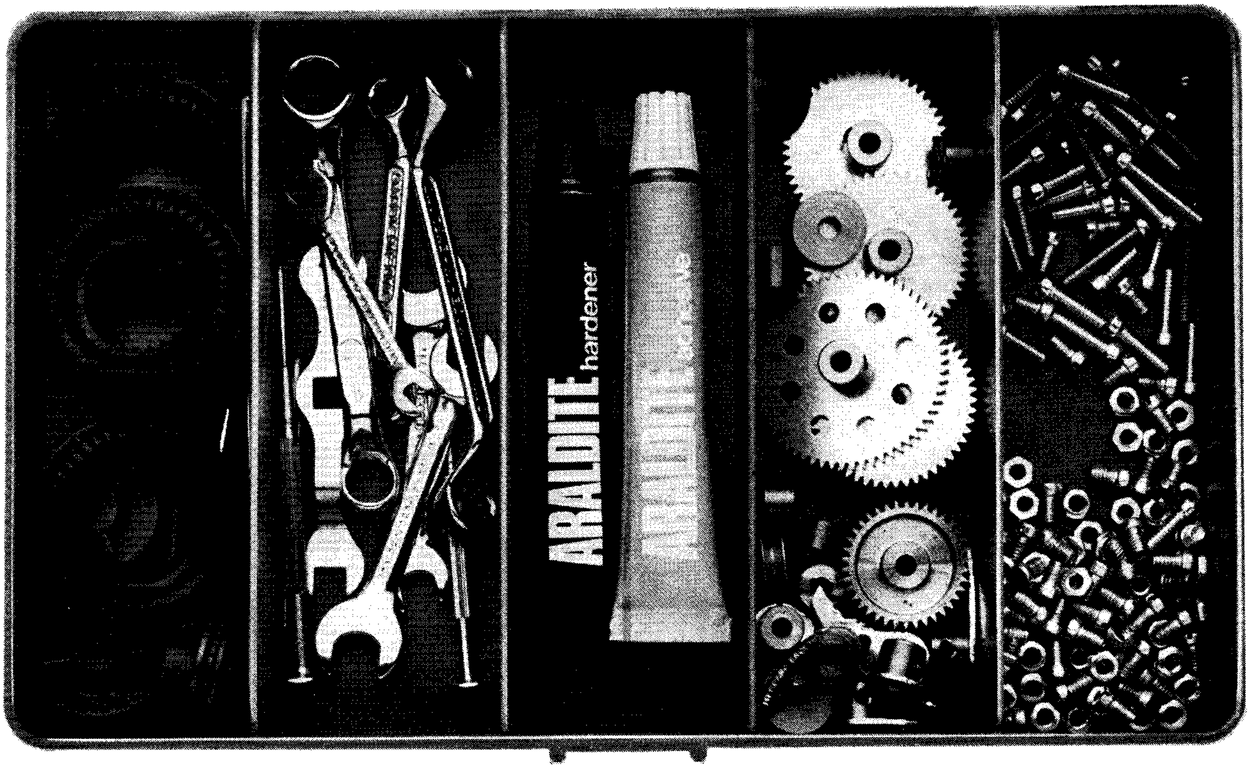

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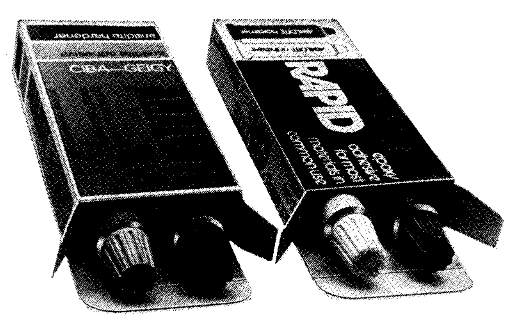

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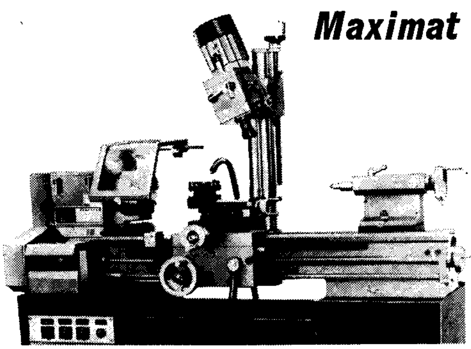

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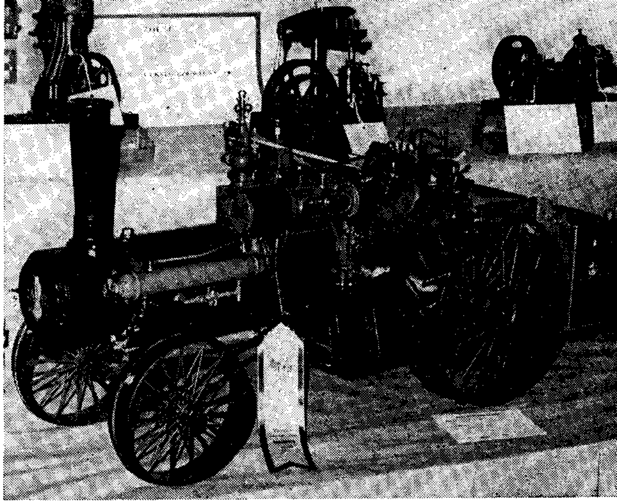
SMOKE RINGS

A Commentary by the Editor



A 1½ in. scale Case 60 h.p. traction engine built by Charlie McKenzie, seen at the recent Vancouver exhibition. (See 4 March issue.)

Greenwich Rally

The London and Home Counties branch of the Paddle Steamer Preservation Society are taking part in H.M. The Queen's Silver Jubilee and Greenwich Festival, patroned by Greenwich Borough Council Arts Council and Entertainments Department. The salute to Her Majesty's eventful reign of 25 years incorporated an historic but sad era, when most of Britain's paddle steamers steamed to an untimely end. Fortunately, we still have our models of these fine ships with us, and as a special Jubilee tribute the P.S.P.S. is offering a Silver Trophy, to be known as the "Royal Eagle" Trophy, to be sailed for on Saturday, 11 June at the Prince of Wales Pond, Blackheath, London S.E.3. Full details from Mr. J. W. Rickner, 16 Blunts Road, Eltham, S.E.9.

LBSC Rally

The North London Society of Model Engineers is staging a Rally as a tribute to the late "LBSC", on 26 September at their track at Colney Heath. The original *Ayesha,* which took part in the famous battle of the boilers, will be on display, also *Tich* and *Smokey*. Engines that it is hoped will be in steam include *Betty, Bluebell, Sir Morris de Cowley,* and the Brighton "Single" *Grosvenor.*

Welshpool Extension

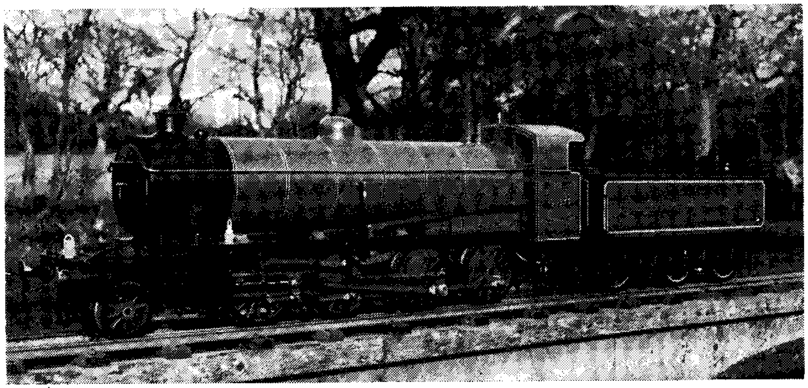
Enthusiasts for the narrow-gauge will be pleased to hear that it is hoped to re-open the remaining 2½ miles of the Welshpool and Llanfair Light Railway from the present terminus at Sylfaen into Welshpool. A meeting is being held at 2.45 p.m. on 14 May at Carrs Lane Church Centre, Carrs Lane, Birmingham (opposite Moor Street Station). The meeting, which is being held by the W. & L. Railway, is to launch a fund to finance this project. The proposals include the complete relaying of the track and the construction of a new terminus station at Raven Square, on the western side of Welshpool.

Llangollen Society

The Flint and Deeside Railway Preservation Society has now become the Llangollen Railway Society Ltd. Future plans of the Society include the laying of a quarter-mile of track during 1977, and discussions are to be held with Glyndwr District Council about extending the Society's holdings of track as far as Corwen. The Society has acquired two railway coaches—a 1928 suburban coach on permanent loan from Mr. Nigel Rainbow and the other from British Rail. These two coaches are capable of carrying a total of 150 passengers and will form the nucleus of the Society's rolling stock.

I.M.L.E.C.

Entries are coming in well for this popular annual event. At the time of going to press, they include a 5 in. gauge G.W.R. "Castle", a 5 in. gauge G.N.R. *Nigel Gresley* 2-8-0, a 5 in. gauge *Springbok* 4-6-0, a 5 in. gauge *Speedy,* and a 3½ in. gauge G.W.R. "King", to be driven by a Belgian reader.



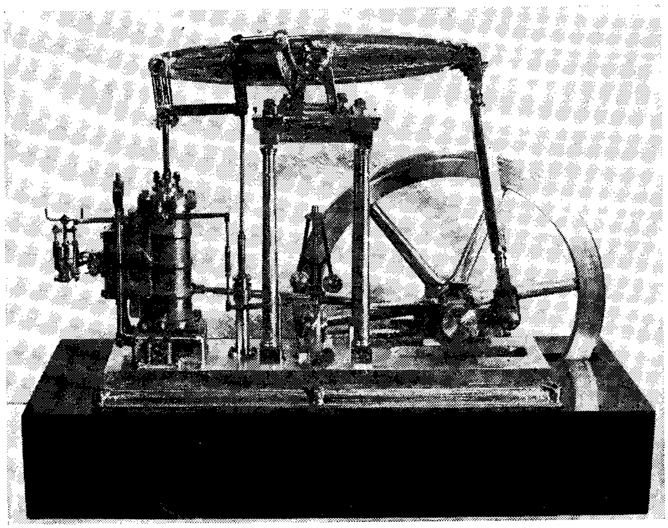
A very fine 5 in. gauge "Nigel Gresley" 2-8-0 built by P. D. Wardle of Acocks Green. It has now covered over 400 actual miles with no appreciable wear in the working parts.

A FOUR-COLUMN BEAM ENGINE

by "Tubal Cain"

HERE IS ANOTHER MODEL from the "Age of Elegance" in engineering. By 1850 an increasing number of engines were being built in the horizontal arrangement, but the slow-speed, solidly built beam engine still held sway in the larger textile mills, for ironworks blowing engines, and for pumping duties. Most of these were condensing types, but the non-condensing engine was not unknown and was universal in the West Indian sugar plantations. This was not due to any disregard for efficiency; quite the reverse. As early as 1803 Trevithick had pointed out that a non-condensing engine which used the heat in the exhaust steam for other purposes would be more efficient than a condensing engine which passed most of the heat in the fuel to the cooling water and would, moreover, be lighter and cheaper for the same power. He did, in fact, supply a number of engines to sugar planters using this principle. The engine drove the rolls which squeezed the juice from the cane, and the exhaust steam distilled and purified the sugar. (Making rum in the by-going, at that!) For a variety of reasons the beam engine became the standard type of prime mover on these estates and they were made and supplied till quite late in the nineteenth century.

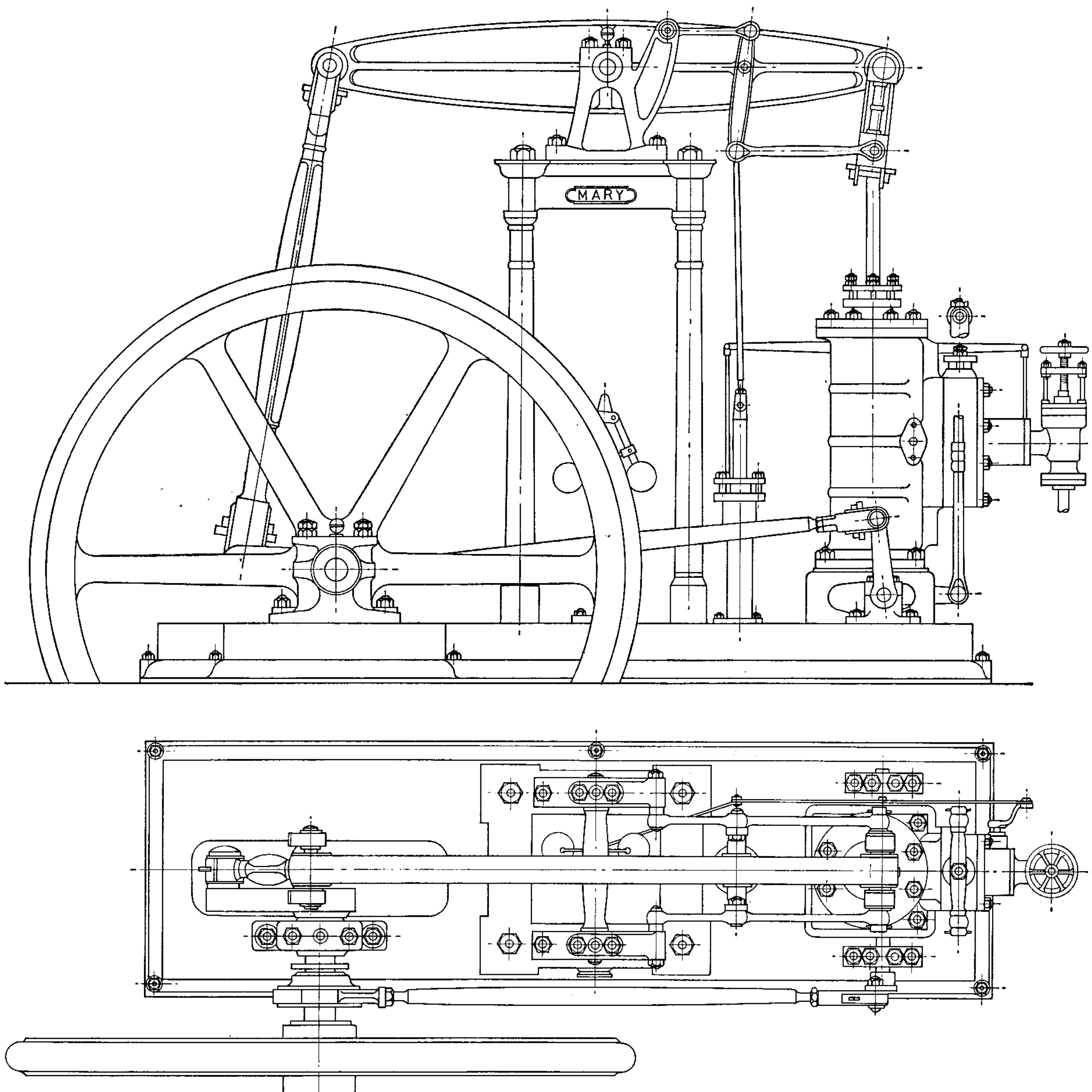
Some difficulty was experienced in selecting a suitable prototype, as it must be admitted that many were quite ugly; others carried such a plethora of embellishment that our castings suppliers' pattern-makers would have gone right round the bend—beam brackets shaped like dolphins, and column nuts in the shape of pineapples were two examples! There was the further point that I wanted, if possible, to include some unusual feature in the design, just to add to the interest. In the event, the model is a combination of three examples. The greater part of the design is that of a Peel Williams engine, but the print from which I had to work was so small that I had to "guess" at the profile of the base and entablature castings. This profile, therefore, is taken from a model of a Welsh tinplate rolling mill engine, this having been made around 1870 odd. The unusual parallel motion is from a very small engraving of an unknown make of engine seen in a mid-nineteenth century magazine. The object of this design was, of course, to avoid the "outrigger" necessary on any 4-column (or centre-column, for that matter) engine if the "normal" Watt parallel motion is employed.

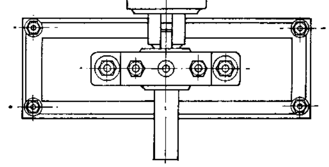


The four-column beam engine built by "Tubal Cain"

The model is based on a Welsh tinplate rolling mill engine.

Besides this marriage of prototypes I have had to take a few liberties with the design (which was done full-size, by the way, and then reduced to "model" proportions) mainly to bring the construction within the reach of beginners. The parallel motion *should* have split and cottered bearings on all the links. The valve-chest should be a closed box bolted to the cylinder face—leading not only to valve-timing problems, but also to the use of 14 BA studs! The governor linkage should have pins with collars and taper retaining cotters—which would have been only .015 dia.—and so on! However, the general appearance of the model is true enough to the period to satisfy all but "Mr. Inspector Meticulous" and there is no reason why





he should not undertake watchmaking if he feels strongly about it!

The parallel motion works on the same principle as the "normal" one, but the correcting arc is derived from a short link running backwards to a pivot above the beam centre instead of from one running forwards to a pivot below. This is just as effective, but it must be remembered that *no* Watt motion gives a really true parallel motion, and allowance must be made for this when dealing with the gland. The pump as I made it is a dummy, but is designed so that it can be made to work if desired, as there is plenty of room under the bed for a valve-box. Steam distribution is by normal slide valve, though shorter than that used on the prototype, driven from a single eccentric. Many sugar mill engines had expansion gear fitted, but contemporary accounts show that most of these were always operated in full gear. The governor is a standard "Watt" pendulum type, but speeded up a trifle—the "height" of a governor cannot be scaled. However, it does in fact work and will control the engine if care is taken in the construction. The correct form of cotter-and-gib is provided on the motion work, though I have not shown the often elaborately forged shape to the big end strap.

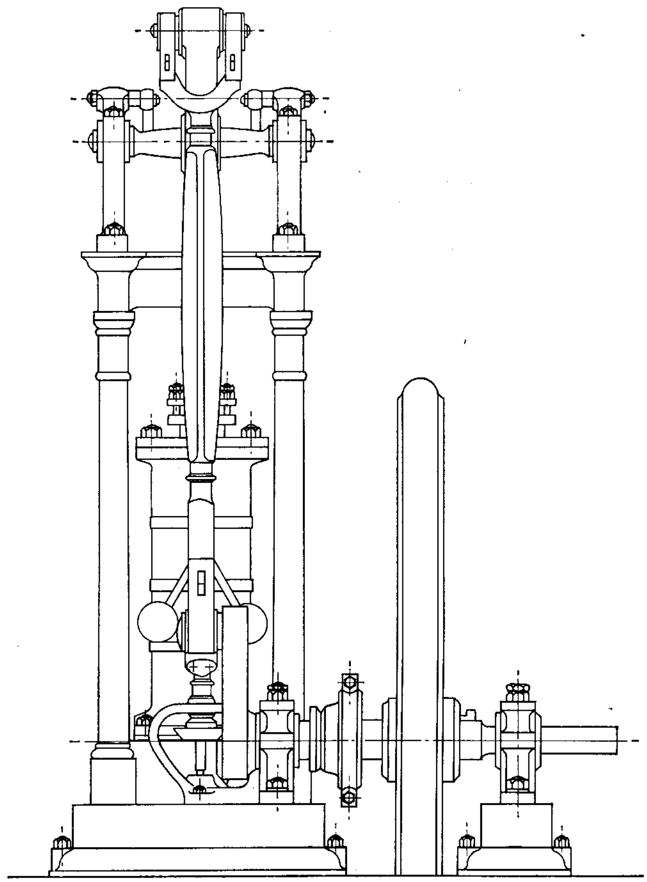
Apart from the baseplate, which is aluminium, and the cast-iron eccentric sheave, all castings are in gunmetal and are supplied by Messrs. Reeves of Birmingham. "O" rings are used in glands and piston, though I think the latter would be better with soft packing. The casting set includes the gears for the governor though these may need slight adjustment when fitting. The main problem has been the tiny pins needed on many of the collars. Fortunately Messrs. A. G. Thomas, Heaton Road, Bradford can supply both taper pins and the very small broaches to suit them; they are really "horological" items, but you will find them very handy about the shop later! One or two other materials may present problems—largely owing to metrication—but the engine won't collapse if you use 1.5 mm. instead of 1/16 in. for a cotter strap or make similar adjustments elsewhere.

The first job I always do is to trim all castings with a file, if only to get familiar with them, but it saves time later on. I then set up the 4-jaw and go through all parts which have chucking-pieces and true these up so that later work can be done in the 3-jaw. This saves time, but, more important, reduces wear on the mandrel nose from chuck-changing. I then spray all castings with a cellulose primer, to prevent rust on iron ones, and to keep oil from the pores of others; makes subsequent painting easier.

Cylinder, Part A

You will notice from Fig. 1 that the port-face of this is separate so that there are no long passages to drill. Now, there are "n" ways of boring a cylinder, where "n" is the number of model engineers, but this is the way I did this one; it is rather long in the bore. Knock a lead or hard-wood plug in each end and set up between centres, lightly, and tap it about till the outside of the barrel runs true. Now deepen the centres with a Slocumbe in the hand-drill. Check again for truth—you want to be within 1/64 in. at worst. Apply a carrier and machine the flanges to about 10 thou. oversize on the diameter and a little more than that over thickness (keeping an eye on the overall length). Take light cuts to reduce the risk of shifting in the centres. Remove from the machine and knock out the plug from the top end—which has a little boss to carry the governor link. Set this end in the 4-jaw with a bit of brass shim under the jaws and adjust till both ends are running true—the outer (bottom) end dead true, and the centre-pop in the plug will help here. Don't grip too hard in the chuck.

Set up the fixed steady to the outer flange and once you are sure this is true, and has dominion over the casting, carefully remove the plug. You can now rough out the bore to within 15 thou. or so of size. Don't let the job get hot or the bore will be 4-sided under the chuck jaws. Replace the roughing bit with a finished cutter, say 30 deg. lead angle in plan, and with no more than 1/64 in. flat or large radius to the nose. Hone this both on the top and the relief clearance faces—it must not only be sharp, but also dead smooth. Set up for a feed of about 6-8 thou./rev and a cut of 2 thou., and finish bore to size. If you have to take more than two traverses, hone the tool again before taking the final cut. Use a piece of $\frac{7}{8}$ in. PGMS or silver-steel as a gauge—if you haven't any you should make a plug gauge 0.873 in. one end, 0.875 in. the other, before you start boring. If you are using "O" rings it is important to get the bore to size. Finally, disengage the auto-feed and, using the leadscrew handwheel take out the 15 thou. (1/32



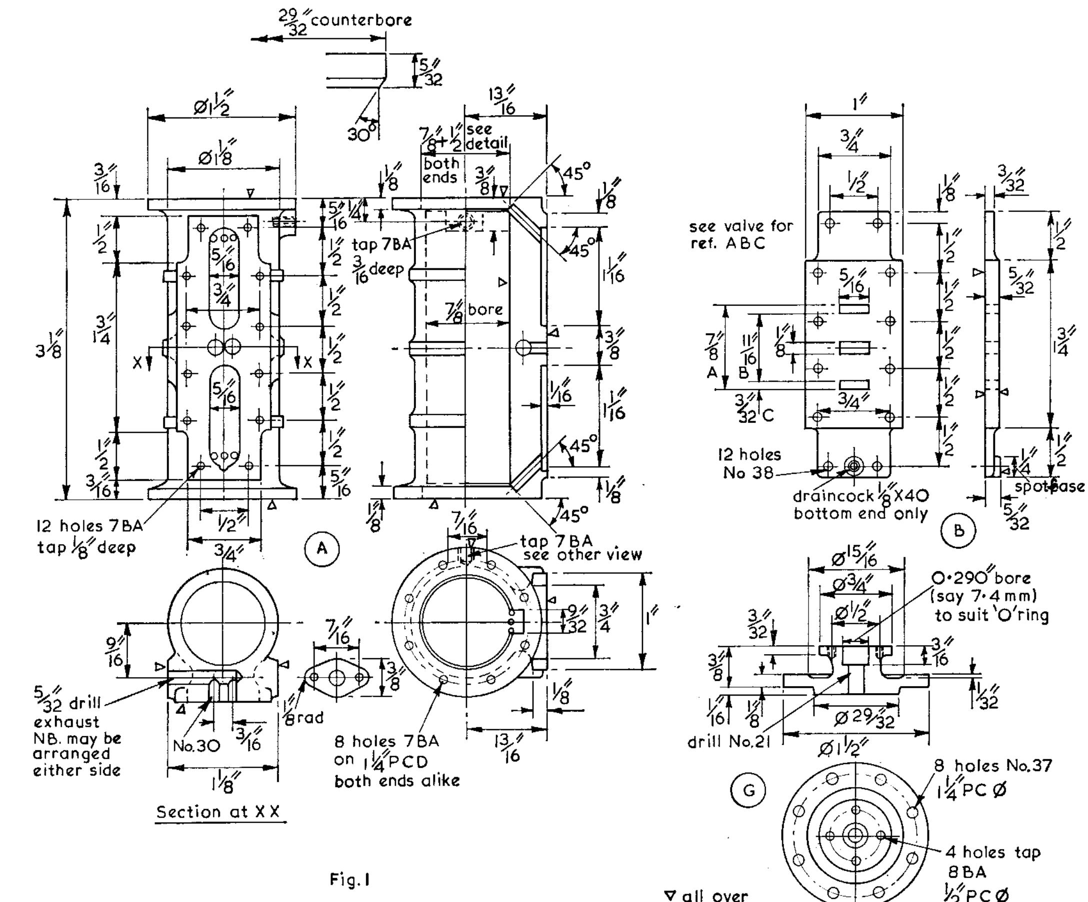


Fig. 1

in. on the diameter) counterbore at the two ends of the cylinder. The handwheel calibration will give you the correct travel at the inner end, but if you haven't got one, then you must measure the saddle travel with a rule. Now remove the boring bar and face the cylinder flange—take off half of the excess to the overall length. Fig. 2 shows this boring operation in progress, though I have had to use a photograph from a different engine, as there appear to be two cylinders and two lathes on the one I took at the time!

Remove from the machine, and set up either on a mandrel or hold in the 3-jaw with a large centre in the tailstock, and face the other flange to the correct length. Trim the O.D. of the flanges to the proper diameter too. We must now machine the flat side-face. Find a piece of 7/8 in. stuff which is free from burrs and which will slide freely in the bore. Set this up on V-blocks and packing so that the face is vertical and the centreline on the lathe centre and clamp to the cross-slide as shown in Fig. 3. Use a little toolmaker's jack or a short 3/8 in. nut and bolt to support the front face if you like. See that the 7/8 in. bar is square across the lathe. Make a little flycutter from silver-steel or use a large endmill and machine the face, working for a reasonable finish. Substitute a 5/16 in. endmill for the flycutter and cut the two grooves which form the steam passages. Finally, use your scribing block to mark out for the two exhaust holes.

Remove from the machine and file up the selected exhaust flange and the little boss at the top which carries the governor link. Mark out for 5/32 in. exhaust hole—leave the stud-holes till you have made the flange as a template—and drill this carefully; it is rather close to the cylinder bore. Drill the two No. 30 holes to break through. File the two little bevels at the ends of the cylinder and drill the No. 44 steam ports; these are at 45 deg. so you can support the job in the vee of a V-block. Leave all other holes till you have mating parts to act as jigs.

Top Cover, Part G

You could have brought the spigot and the flange nearly to size when skimming the chucking piece, but if not, do this now. Then grip by the

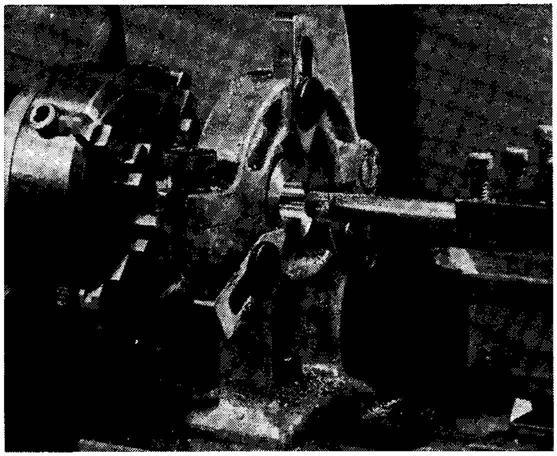


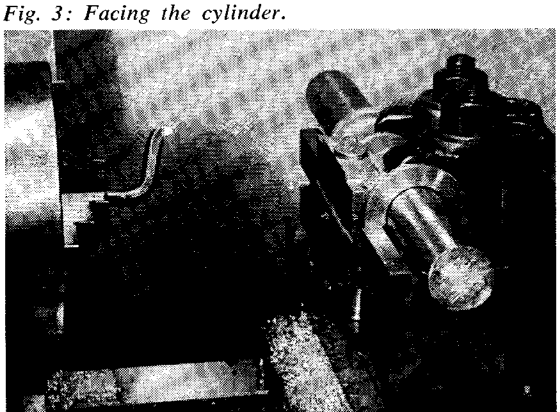
Fig. 2: Boring the cylinder.

chucking piece. You may find a bit of wangling necessary when machining the recess but it's the shape rather than the size which matters here. Face both the gland and main flanges and machine the O.D. of both. Centre and drill No. 21, follow with 9/32 in. going just under 3/16 in. deep, and then bore to the dimension shown; letter L drill is about right as a gauge, or the shank of letter M. Mark out for the cylinder bolt-holes whilst still in the chuck, but not for the gland. Reverse in the chuck, gripping lightly by the gland—or set up on a stub-mandrel in the gland-hole—and carefully skim the spigot and the faces. Let the spigot be a few thou. undersize to allow for adjustment on assembly.

Port Cover, Part B

This is not an easy job to hold; you can try shellac if you like, but I soldered the part to a spare backplate, Fig. 4. File the outer face reasonably flat, tin, and after skimming the backplate (if you haven't trued it on the lathe before) tin this too and then sweat the parts together. Use a very

Fig. 3: Facing the cylinder.



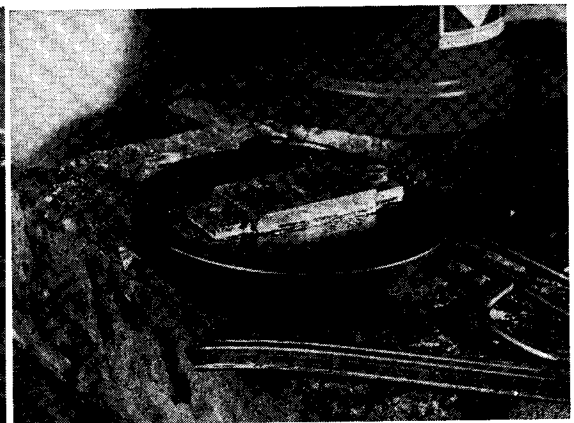


Fig. 4: Port cover soldered to a spare backplate.

sharp tool and machine till the $\frac{3}{4}$ in. wide ends are to thickness. By the way, make sure the backplate is quite cold before screwing onto the mandrel or it may shrink on! Reverse and re-solder to the plate and machine the port-face and the drain boss. I suggest you leave the part soldered to the plate whilst you mark out for the ports and the four holes at the ends. You can set up and mill the ports if you like, but as you can get a little file right through it is as quick to drill a series of holes and clean up with a Swiss file. There's a lot of "mystique" about steam ports but the truth is that provided the edges are square across the travel of the valve a few thou. won't matter and you can always (should always) make the valve to suit the ports. The reference letters A, B, C on the drawing are for this purpose, that for the valve showing how to allow for differences. So, I suggest you drill holes No. 44 or 45 side-by-side in the time-honoured way and then file the ports till a 3/32 in. gauge just slips in. It is more important to get the edges sharp and square across the face than that the size be exact.

Having done this, file the outside of the casting till it is a good "marry" to the cylinder face. Drill and tap for the drain cock, and if you find that this is blind when offered up to the cylinder, cut a tiny groove at the bottom of the 5/16 in. wide slot to meet it. The port cover has now to be soldered to the cylinder, and I will deal with this now, though you really need the steam chest first. Assuming you have this, mark through and drill the eight chest studholes in the port cover, and then spot through from this to drill and tap the holes in the cylinder—there are 12 altogether. Find some temporary steel screws about $\frac{1}{4}$ in. long (7 BA) and blacken these with blacklead so that solder won't stick to them (or dip in oil and heat till the oil flares up). Tin the face of the cylinder and wipe it smooth with a rag.

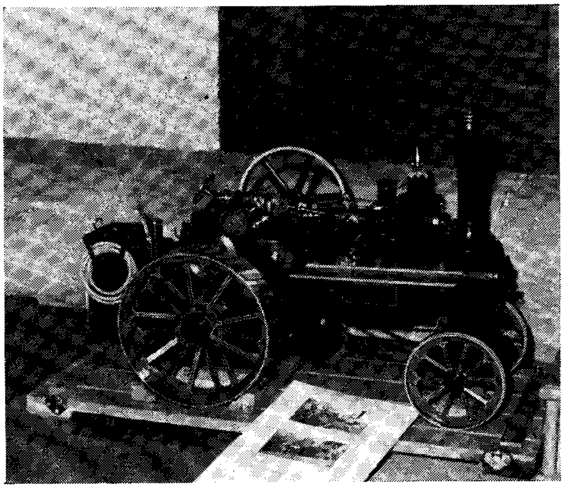
To be continued

CALGARY M.E.S. EXHIBITION

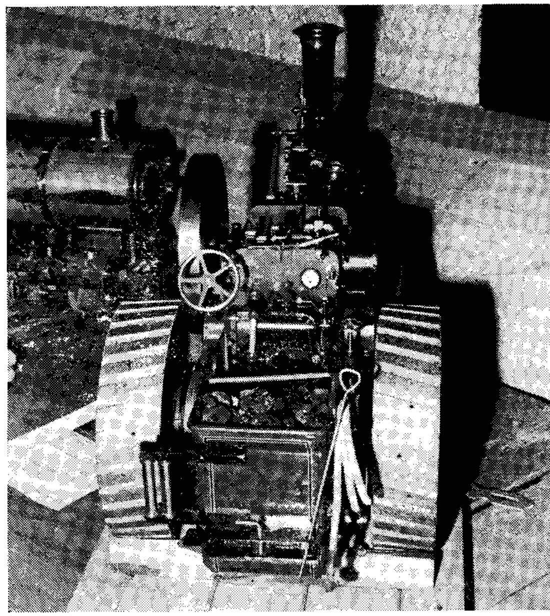
D. M. Marshall

A COMBINED social evening and exhibition was held at the Caboose Steak and Lobster Restaurant adjacent to the C.P.R. station at Banff, Alberta, on 29 January. Transport for members and their wives together with the exhibits was kindly provided by Brewster Bus Lines.

A total of 23 exhibits were presented including a "Quorn" tool and cutter grinder by Al Park and a vertical milling and drilling attachment for a horizontal milling machine designed and built by Bev. Herbert. The railroad atmosphere at the Caboose also accented the full complement of locomotives displayed in various stages of construction from $2\frac{1}{2}$ in. gauge to $7\frac{1}{4}$ in. gauge. Stationary engines were represented ranging from a trio of miniature oscillating engines by Frank Smith with bores and strokes of 1/16 in. x $\frac{1}{8}$ in.,

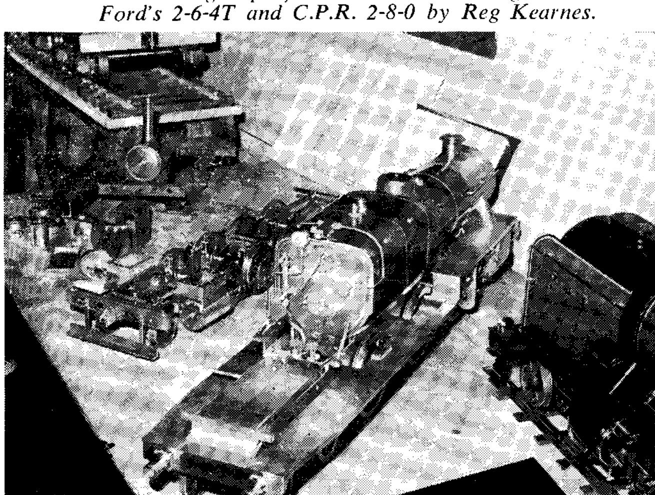


Allchin traction engine by Al Park.

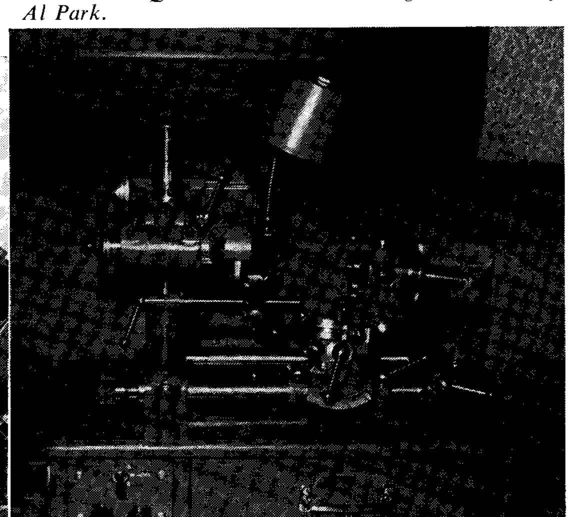


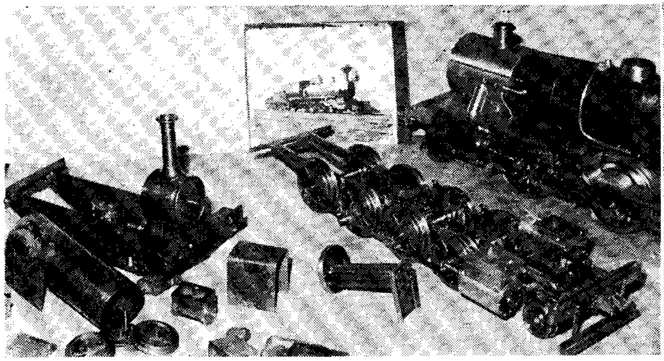
Another view of Al Park's Allchin.

Below: A group of locomotives—in foreground Mike Ford's 2-6-4T and C.P.R. 2-8-0 by Reg Kearnes.

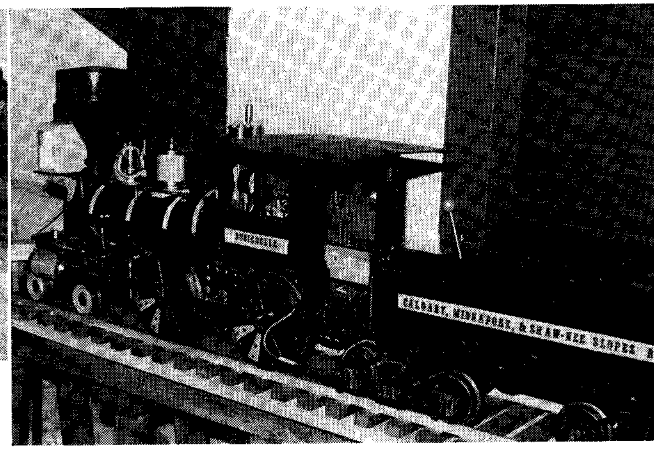


Below: A "Quorn" tool and cutter grinder also by Al Park.



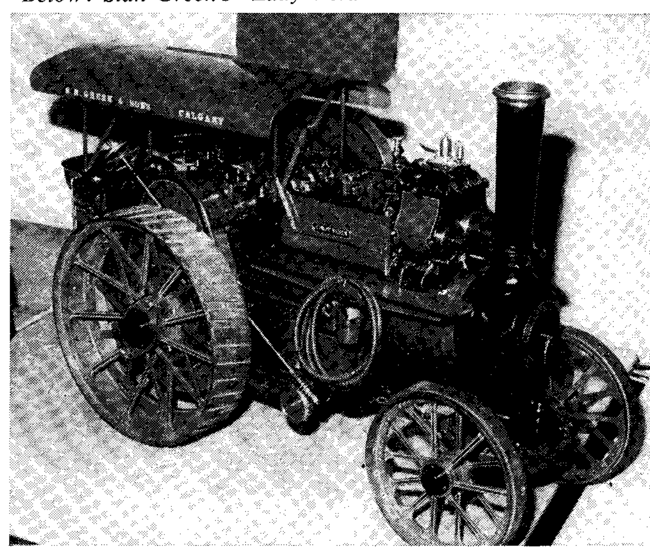


A "Tich" being built by Stephen Bryant, Reg Kearnes' 2-8-0 and Mike Ford's 2-6-4T.



A 7¼ in. gauge 4-4-0 by Eric Mortis.

Below: Stan Green's "Lady Vera".



1/32 in. x 1/16 in., 1/64 in. x 1/32 in. to a partly constructed 1 in. scale Corliss valve engine by Jeff. Simmons who also exhibited his partly constructed ¾ in. scale case engine. Two other steam traction engines were on display. Al Park's Allchin and Stan Green's Fowler both invited attention and a great deal of enthusiastic comment.

A familiar locomotive on the club track, the 4-6-2, 3½ in. gauge *Duchess of Calgary* by Stan Green, was seen in public for the first time in her finished colours. Among the locomotives under construction was a 3½ in. gauge *Tich* by Stephen Bryant being built with the aid of a Unimat lathe. The largest locomotive under construction was a 1½ in. scale C.P.R. 2-10-4 class T1A by Bill Lougheed, who showed the frames, drivers, two axleboxes, castings and patterns. Those ¾ in. thick frames really look massive but should finish up to be a great model in more ways than one.

Space does not permit a description of every model shown, but hopefully some of the photographs will help to show the high standards evident in all the exhibits.

AN INTRODUCTION TO EQUALITY IN VALVE GEARS

by D. L. Ashton

MANY OF THE STEAM ENGINES made by model engineers will be double acting, and will therefore give their best performance when each end of the cylinder or cylinders is receiving an equal volume of steam, thereby creating the opportunity to produce equal amounts of work.

"Tubal Cain" recently pointed out that the angularities of both connecting rod and eccentric rod confound equality in both the point at which steam enters (lead) and that at which it is cut off. He explained that unequal laps could ameliorate the problem where a single eccentric is employed, but where a full reversing gear such as Stephenson's link motion is used the matter is aided by a number of tricks which the early railway engineers devised.

These particular tricks became almost universal railway practice while other means possibly more suited to their application were used in other fields. The Meyer expansion valve applied to many

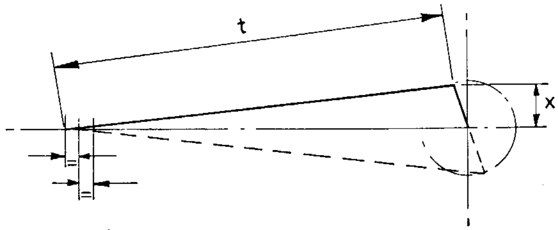


Fig. I

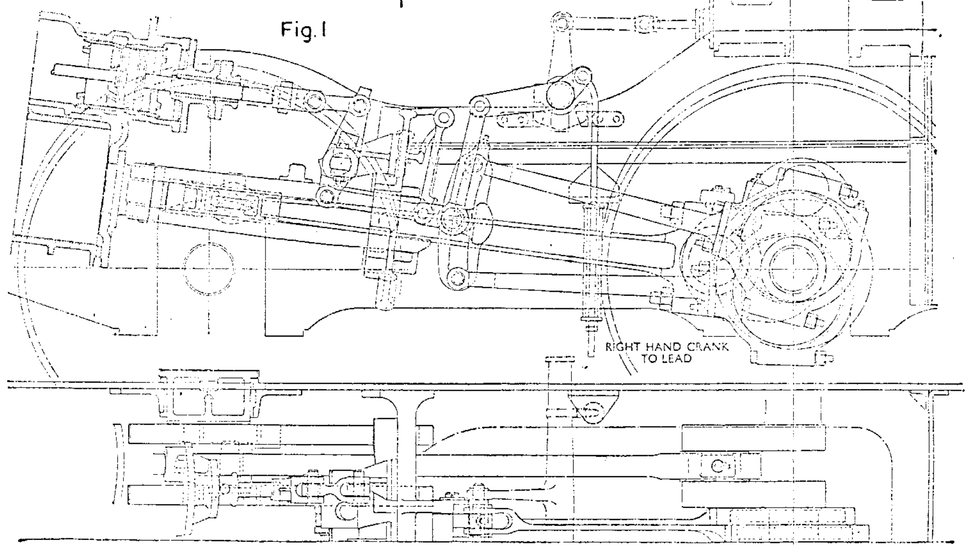


Fig. 2: The valve gear of Bulleid's "Q.1" class 0-6-0.

"fixed revs" stationary engines could be adjusted at the governing arm to offset the unequal cut-offs of the main valve.

In marine engines, where the inertia of the masses was so great at one end of the cylinder compared with the other, inequality of events in the right place was obviously desirable. More lead steam was required as the piston approached the lower end to cushion the enormous weight of reciprocating parts, and the effort required to move the piston and rods upwards was greater than that needed for the return stroke, giving a perfect case for unequal cut-offs. Furthermore, the wear problems associated with link slip in forward gear were heightened by the fact that a ship's gear would remain in the same operating position for hundreds of miles.

For locomotives, however, means were devised to make the steam distribution as near perfect as possible. This cannot be achieved at valve setting, as commonly thought, since any adjustment to one event of the cycle automatically alters all the other events in the inflexibility of the one-piece valve.

Admission

The Stephenson's link has a curved slot, the radius of which is equal to the distance between the axle centre and the dieblock's mid travel position established with the valve placed centrally over the ports. This dimension is also the *nominal* length of the eccentric rods, but a quick exercise on the drawing board will soon show that such a length will not give equal excursions of the dieblock to each side of the central point as the main crank reaches each dead centre. Translated to the valve this means unequal leads.

Equality is achieved by a slight addition to the length of the rods, found easily on the board or calculated from $\frac{x^2}{2t}$, where x is the 90 deg. component of the eccentric (launch link or equivalent) and t is the nominal length of the eccentric rods (see Fig. 1). Remember that the curved slot's radius for a launch link includes the pin offset, which is subtracted for the above exercise.

Cut-offs

The amount of inequality of cut-offs between one end of the cylinder and the other depends largely on the ratio of stroke to connecting rod length, as this determines the relative positions of the crank and piston at mid stroke, when the inequality is at its worst. "Tubal Cain" explained all this at length so a repeat would be superfluous, but unlike his single eccentric example we have in Stephenson's link motion an expansion link whose pivot can be moved to a position which will maintain equal cut-offs at, say, 50% of the stroke, with extremely small variation throughout the reverser's range — typically within 2%. Anyone who has studied a G.W.R. motion arrangement

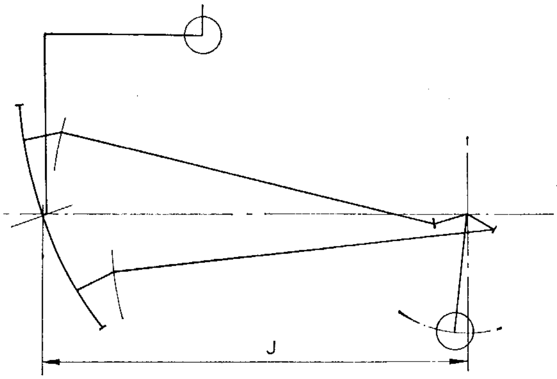


Fig. 3a.

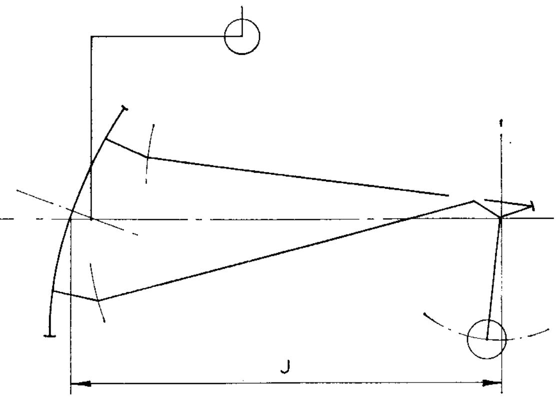


Fig. 3b

will have noticed that the launch link was suspended slightly behind the link slot centreline.

Choice of Link

Because the eccentrics take on a different relationship with the crank if slide valves are substituted in a model for the piston valves of the prototype, this offset of the pivot should change to a position which allows the link to slip more to compensate for the greater inequality caused. For this is essentially what happens: the correct offset will cause the link to tip, so slipping the right amount to push the dieblock into the required position to equalise cut-offs.

To avoid excessive slip there are a number of palliatives, but it was locomotive practice to specify locomotive links where the eccentrics were in advance of the crank and launch links where they followed. Often in models the "wrong" link is used (e.g., a launch link directly driving slide valves) necessitating a large pivot offset, and hence much link slip, if cut-offs are to be anywhere near equal. Many people criticised Willoughby's "Pioneer" 0-6-0T design in ignorance of this fact.

Fig. 2 shows an example of the "wrong" choice of link in full size. For some odd reason Bulleid, who was hardly famous for adherence to rules (!), chose locomotive links for his wartime Q1 0-6-0s. The offset clearly visible would have been much less had he chosen launch links. Note that the offset works out *ahead* of the slot centreline for locomotive links, which generally need rather less correction than launch links, whether in their correct application or not.

I have been unable to trace a concise method of arriving at the proper offset in British textbooks. It is strange that our prolific writers of the 1900s did not seem aware of something which had been well known to railway engineers for years. For instance, Professor Dalby gave only a rather compromising exercise to establish the best weighshaft position some 60 years after the "invention" of the pivot offset. Several old American textbooks are most explicit and the *SMEE Journal* 1975 carries an explanation by H. S. Gowan, as does a handbook on Stephenson's valve gear written by the author. All these are listed as references to aid the interested reader, though the long out of print American books may prove difficult to trace.

Equality

A complete analysis of the various parameters governing the limiting of link slip *and* equality of events cannot adequately be covered in a short article and may in any case be outside the interest of many readers. Perhaps the simplest way to appreciate what treatment of the pivot does is to refer to Fig. 3a.

The crank is placed relative to the piston's midstroke position and the central dieblock position is marked on the gear centreline at distance J from the axle. From the eccentric centres arcs are struck, on which the link's pins must lie, of a length determined for equal leads. The link is then superimposed such that the slot centreline passes through the dieblock's position. The link slot's *horizontal* centreline will then cut the gear centreline at the point of suspension when in mid-gear. The link has therefore been caused to tip in order to maintain the central position of both dieblock and valve.

This is a graphical check for the full equalisation exercise, which essentially consists of orientating the *required* valve positions with those of the piston. The suspension is then made to allow the gear to conform to this predetermined pattern instead of accepting the angularity errors which the gear would otherwise deliver. Compare Figs. 3a and 3b, showing the difference in offset between identical drive arrangements where one operates slide valves and the other piston valves.

Inequality

Since we have the facility for equalising both leads and cut-offs to a high degree it is obvious that we can also build in amounts of *inequality* where desirable. Where a sloping port face renders one passageway longer than the other the leads can be arranged to bias one end of the cylinder; where a large piston rod is used, with no tailrod in the front end, the cut-offs can easily be set to compensate for the unequal volumes by retarding one cut-off relative to the other so that the work done is the same. For an engine which is likely to spend most of its working time in full gear we can set the equality to be exactly so at that stroke percentage.

Significance for Models

In a critical examination many models exhibit far greater inequality than could be tolerated in full-size valve events. A model engineer recently showed me his valves set such that on one side of the locomotive the leads were equal and on the other side the cut-offs were equal. The former side showed over 10% difference in the cut-offs in full gear—even more at 50% of the stroke—and the latter side gave +0.010 in. lead at one port and −0.010 in. at the other. A glance at the drawing revealed that the designer had done nothing about equalisation, which was rather unfair on the builder who could not rectify the problems without lengthy research into the causes and subsequent remaking of parts.

It has always struck me as somewhat of an anachronism that the model engineer should struggle on occasions to set his events within 10% when the railway engineers stuck almost passionately to Stephenson's gear for as long as valve gears remained between locomotive frames.

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"Square Distribution in Link Motion", by H. S. Gowan. *SMEE Journal,* 1975, pp. 126-135.

Practical Application of the Slide Valve and Link Motion, by W. S. Auchincloss. D. Van Nostrand, 1869.

Locomotive Valves and Valve Gears, by J. H. Yoder and G. B. Wharen. D. Van Nostrand, 1917.

Stephenson's Valve Gear for Model Engineers, by D. L. Ashton, 1976.

A New Stirling Engine Design

by R. J. Bourne

IN THE COURSE of the last twenty years I have built seven Stirling cycle air engines of various types, one of which powers a four-foot Mississippi stern wheeler very effectively; another drives a bicycle dynamo. This surprises many people, as it seems there is a common belief that model air engines have no power; I hope soon we will be able to change this image.

My ambition has long been to design an engine simple enough for amateur construction, with enough power to drive a model launch at a good speed. Obviously the engine will have to be light and compact. The graph of progress has been flat for a while, but seems to be taking an upturn lately.

While struggling with this problem, I tried to reduce the size of the engine by finding a way to make use of the large space within the displacer. Quite suddenly I saw a new way to make a displacer that would allow it to "contain" the cooler and power cylinder, so making all the parts of the power head fit within one another in a concentric arrangement.

No longer really a displacer at all as it is open ended and therefore cannot *displace* air, the new device can nevertheless *transfer* air from place to place within the engine. It is therefore a form of transfer piston, yet it does not need to touch the cylinder walls. The skirt of this piston also acts as a simple regenerator, so it seems logical to call it a "transferator".

For a long time the idea remained on paper, I rather doubted that it would work, but it was different and it nagged at me, so I built a simple engine to settle the matter. To my surprise it is very successful.

Comparison with the two engines previously referred to is interesting, all are about the same swept volume (power cylinder) of around 25 cc. The new type runs fastest of the three and by the "finger and thumb" test is producing almost as much torque as the others; it is quite hard to stop by gripping the 3/16 in. drive shaft. All were run on the same meths burner to get a reasonably fair comparison. Considering the way the new engine was thrown together its performance is a revelation.

Comparison between Fig. 1 which shows a conventional engine and Fig. 2 which shows the principle components of the Mark I transferator engine, will give an idea of the compact layout achieved. A slightly improved type of transferator is shown in Fig. 3; the first was made with a ¼ in. thick asbestos crown and a sheet aluminium skirt

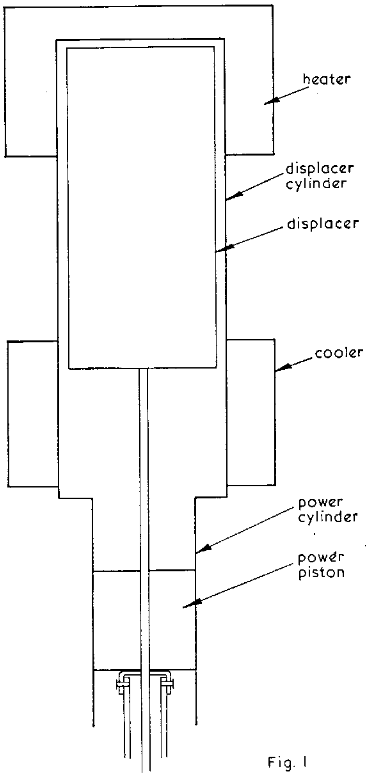


Fig. 1

epoxied to it. The idea was to insulate the hot and cold sides of the crown from each other, but it was heavy and when I substituted a gas torch for the meths burner the epoxy failed. I did not care, the thing worked! Still heady with success, I made another of thin steel shim silver soldered together; it was lighter, if somewhat warped. I fitted a disc of steel shim just below the crown to act as a heat reflector and to make a small insulating air space.

After hastily reassembling the engine I fired it up—it worked even better! Although plagued with water leaks inside the cylinder and similar teething troubles, that were almost enough to make me give up, I pressed on, for I had seen the engine run, albeit rather imperfectly. I eventually arrived at the point where I had a reliable engine, but with characteristics I had not expected. The time had come to test it as well as I could and find out why it was different.

To begin with I heated only the last inch or so of the transferator cylinder, but found it better to heat more of it; soon I was heating all but an inch or so from its base flange and the engine showed its appreciation by running faster and faster, until the cooling water overheated when it slowed and eventually stopped. The cooling water was changed, the lamp re-lit and the revs climbed even higher, eventually topping 500 r.p.m. I use a post office counter powered by a torch battery to

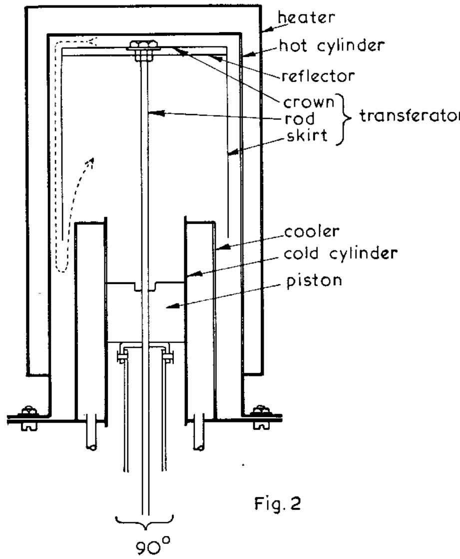


Fig. 2

measure r.p.m.; a simple contact on any reciprocating part of the engine, and a stop watch, suffice to operate it.

By now it was chattering away like a geiger counter in a uranium mine and began to miss a beat occasionally, as it could no longer keep up with the engine, which was itself starting to vibrate along the bench at a fair rate, due to unbalanced forces. This was something like the hot air engine I had in mind! Now that the engine is run-in it will reach 500 r.p.m. in under two minutes from cold and on a meths lamp only. The application of a very small gas jet in addition, creates a hot spot on the cylinder and will increase speed to 650 r.p.m. There is not enough heat in this gas jet to run the engine without the meths burner.

Most of my other engines work better with warm cooling water, as do many others I am aware of.

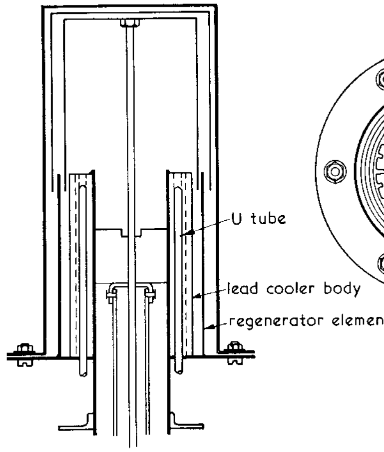


Fig. 3

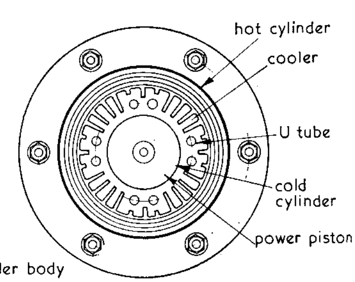
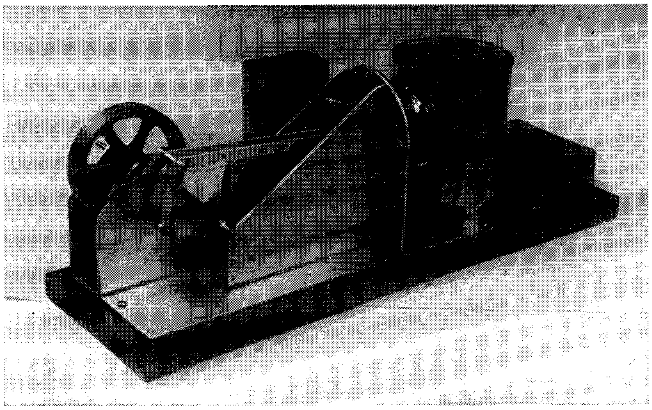
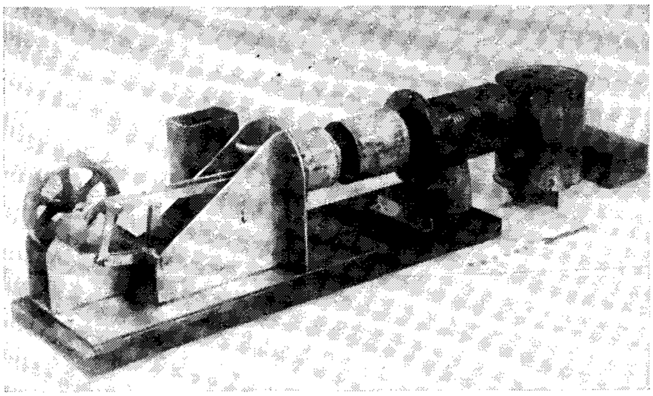


Fig. 4



The Mark I Transferator engine.

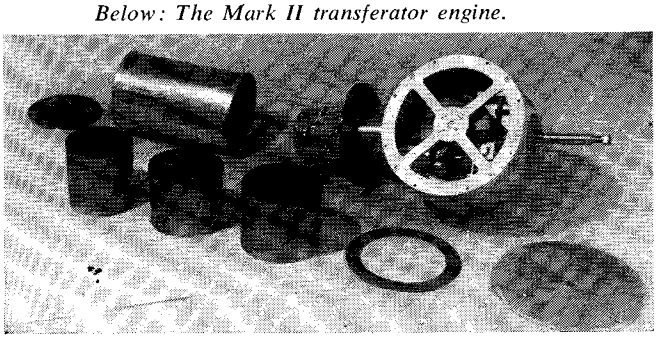
Below: Exploded view of Mark I engine showing the cooler, the transferator, its cylinder and the heater.



This is not the case with the new engine, nor did I previously heat almost the whole cylinder. Something was obviously very different about this one, but what?

I now know that a concentric arrangement produces a heat flow from the outside in towards the centre. Not from one end of the cylinder to the other. When one gets used to this sort of "concentric" thinking a better understanding results, though still far from complete, I regret to say.

Below: The Mark II transferator engine.



New terminology results also and I now refer to the cylinders as hot and cold, rather like a Rider engine, but not the same of course. Is mine a hybrid?

Rather than rush into print too soon, I was going to wait until Mark II was built, but much has been learned already and my friends assure me that others will want to hear of my experiments so far. I also hope someone out there may be able to offer suggestions for further improvement or perhaps even be encouraged to experiment a little with transferators.

At this point I would like to give a tip to anyone trying to design an air engine. Air is a poor conductor of heat; it is therefore no use just transferring it to a hot cylinder and expecting it all to expand, the air must be passed through a small space in a heater, i.e. between a displacer and the hot displacer cylinder or through hot tubes or gauze. This of course is why the air on the inside of my transferator is not appreciably affected by the warm underside of the crown. Similar methods are required to cool the air also.

The new transferator will have at least two skirts with fixed regenerator elements interposed. This will improve thermal efficiency by regeneration and I hope also reduce the amount of heat radiated directly from the hot cylinder to the cooler in the Mark I design, which occurs when the transferator is near the top of its stroke. Some form of improved insulation between the hot and cold cylinder base flanges will also be necessary. Continuing the outer skirt above the crown, with a suitable recess in the cylinder head to receive it, would increase the heating surface/swept volume ratio of the hot cylinder. Large bore/short stroke engines might need this feature. Upper cylinder fixed regenerator elements might be possible if the heat transfer problem caused by the hot cylinder head could be solved.

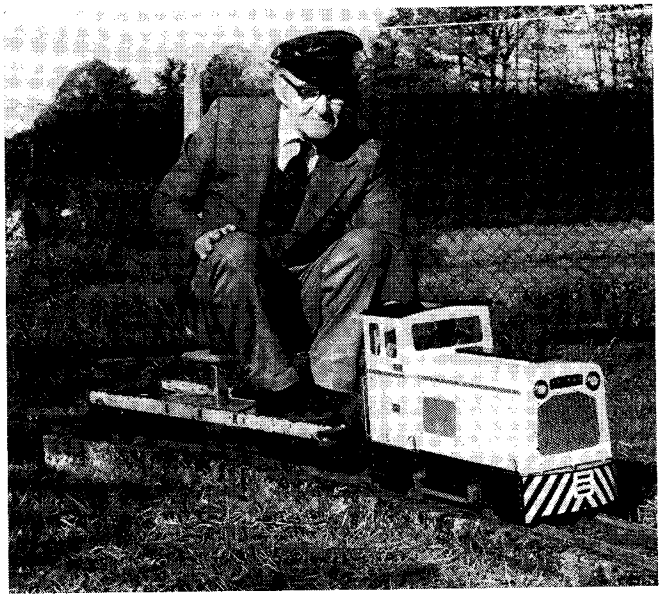
Getting back to Fig. 3. The inner skirt will be seen to have only a small clearance between itself and the cooler; this is to force the air between the cooler fins. The cooler is to be made of lead cast around copper U tubes, through which coolant will be circulated.

The lower end of the transferator rod will become the plunger of an air pump, for I intend to use a sealed, pressurised, system in place of the open crank and atmospheric mean pressure of the Mark I engine.

I am hopeful that an engine which is still fairly simple to construct, but with a useful power output, will at last result from my efforts. Perhaps the speedy model launch will soon materialise, with its air engine capable of long periods of unattended running. My paddle boat does five hours on a can of butane gas, without touching the engine.

A BATTERY-ELECTRIC LOCOMOTIVE

by W. J. Manley

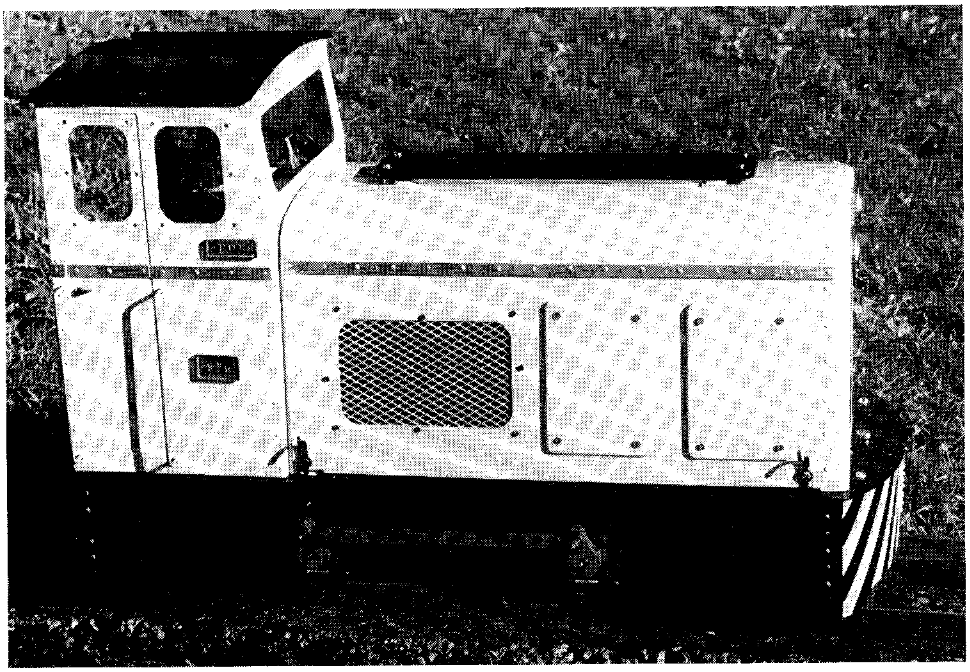


HAVING PREVIOUSLY BUILT one 5 in. gauge battery-operated locomotive that has been running successfully since 1964 hauling modest loads in my back garden (this was illustrated in *M.E.* No. 3401, 18 September 1970), I made up my mind that one day I would build another.

Several people have asked me from time to time where they might obtain a similar motor to the one that I had used in my first battery operated locomotive, so that they could build a similar engine for themselves.

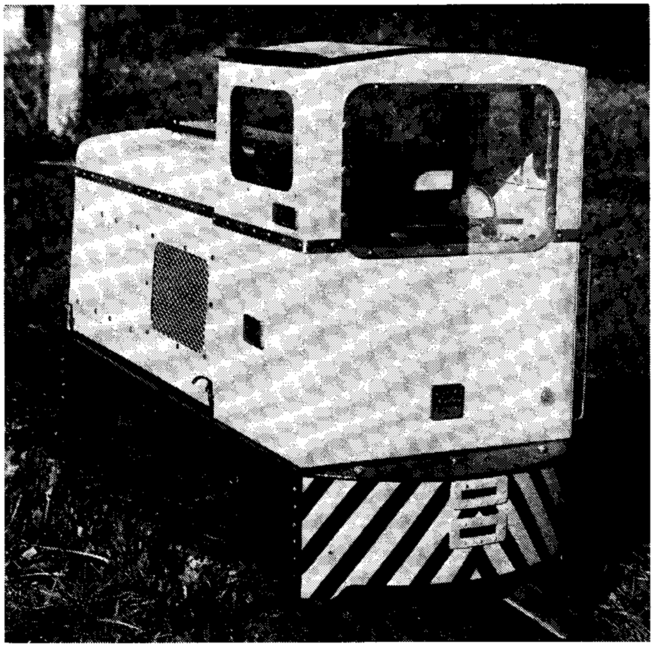
There are great advantages in such a model; mainly that it is always ready for immediate use, particularly if friends pop in for a while and have children with them. Steam, of course, is so much more real, but there is the time factor, and the smut and oil associated with a steamer, not relished if you have on your best clothes. No one is fonder of steam than I am, but I find a great use for something that is cleaner and quicker, and the electric locomotive has still to be driven and a ride behind it in the dark is quite a thrill, if only at 4 m.p.h. at ground level. Objects that are familiar enough in daylight loom up quite frighteningly if you can only just see them, and you always seem to be travelling much faster in the dark.

To obtain a similar motor to the one I had previously used would be well nigh impossible now, it being an ex-government United States Air Force fuel pump motor. It came to mind though, that there were several battery operated lawn mowers in existence, and which are still being made and sold, which operate from a 12 volt car battery. There surely was the basis for an electric locomotive and quite a powerful one at that, the rolling resistance of a locomotive on the track



Mr. Manley's 5 in. gauge battery-driven electric locomotive.

In the heading picture the builder is seen at the controls.



being considerably less than that of a mower running on the grass.

Before very long I was able to pick up at a sale a second-hand Atco battery mower, just the thing that I had had in mind. It was in excellent condition, apart from the battery. That had previously done probably one season's work and then had become seriously neglected and let run down and the interest lost. Anyhow I was to benefit from this, because on checking the various chains and sprockets I found them to be unworn, nice and oily and in excellent condition.

I substituted another 12 volt battery for the faulty one, I inserted an ammeter 0-50 amps in the motor circuit, and made a few test runs cutting grass. I noticed that on contact the ammeter went right over full scale, but immediately dropped to about 25 amps when I was under way. It hovered at about this figure all the time I was cutting, unless I came across a tougher clump of grass, when I noticed the current rose to the occasion.

Walking speed when mowing was about 3 m.p.h. and I guessed that with less rolling friction and a slightly higher gear ratio, this might become 4 m.p.h. on a track. Quite useful for a simple electric locomotive.

For my first experiment I stood the complete lawn mower on my multi-gauge track (7¼ in., 5 in., 3½ in.); coupled behind this was my 5 in. passenger truck by means of a piece of sash cord. I sat on the passenger truck, or at least hung on whilst I endeavoured to steer or control this contraption along the track without running off it. I got used to the method of controlling it eventually, and noted that even on my uphill gradient of 1 in 80 the current consumption was not more than about 20 amps. The speed I estimated to be about the same as when mowing, and more or less constant, due, I felt, to it being a shunt wound motor. A series wound motor would, I know, be better, but then "beggars can't be choosers" and I made up my mind I would proceed from there.

A suitable prototype had to be chosen and I felt a simple type would be best, and preferably an 0-4-0. I had in my possession a Triang "Big Big" Ruston Diesel, "O" gauge model and driven by four HP2 Ever-Ready batteries connected in parallel giving 3 volts. This looked ideal to copy. I scaled this up on paper as near as convenient by 4-1. This would give me a 5 in. gauge model 26 in. long, 9½ in. wide and 15½ in. high, or thereabouts.

Using as much from the Atco mower as I could, that is the ¼ h.p. 12 volt 25 amp G.E.C. Atco motor, 2400 r.p.m. shunt wound, together with the various assortment of sprockets and chains, and also the built-in 1 amp charger, there would be little else to get that was not readily obtainable.

I wanted, naturally, to be able to reverse the locomotive, and this meant that I had to open up the motor and bring out the field connections separately. A double-pole double-throw switch connects this field winding first one way and then the other across the armature winding. The field current I measured at approximately 3 amps constantly, so the switch required for that need not be unduly heavy. In actual fact I used an old G.E.C. double-pole double-throw lightning switch of bygone radio days. The re-connection of any leads inside the motor required to be bound and soldered. Electrical connectors are not good enough, I found, the current is after all quite heavy at times.

Running light on 12 volts I found the motor took 10 amps, 3 amps of which were for the field, and this, the total current, I knew would naturally rise as soon as I took power from it and the motor and switch leads had to be heavy enough to carry what was expected of them.

I had some wheel blanks in stock that were originally intended for a 3½ in. gauge passenger truck and when machined with a generous flange depth, gave me wheels 3 7/16 in. dia. on the tread. The diameter of the wheels naturally controlled the height of the soleplate.

I used 9/16 in. dia. mild steel for the axles, ¾ in. x ¾ in. x ⅛ in. bright steel angle suitably shaped for the hornplates, and axleboxes that were cast from type metal, each of which contains two ball races. Incidentally, I have used type metal for axleboxes before and it wears quite well sliding up and down in the horns. I departed a little from the prototype by putting the wheels inside the frames and the cranks and coupling rods outside. This gave me more room between the frames for the wheels, sprockets, chains etc. It was then possible to convert the gauge from 3½ in. to 5 in.

A very keen friend of mine in North Devon was at this time building a 3½ in. continuous line in his garden, and I was anticipating paying him a visit from time to time with this locomotive and this is where the dual gauge would have come in handy: alas, since then he has gone over to 5 in. gauge himself and the problem does not arise. Nevertheless I am sure that it will come in handy one day.

The wheels are a push fit on the axles and are located in position for either gauge by ¼ in. Allen grub screws sunk deep into the axles, and I have had no trouble so far with this arrangement.

Although the finished model is quite heavy and fairly big, I find she is very stable, even on a 3½ in. line. I was able to follow, during the construction, my original scale of the "O" gauge model multiplied by four and only altered the dimensions from this where I found it more suitable or convenient.

After various experiments with the chassis running on the track, the final ratio of motor to axle was fixed at a little over 4 to 1 down. The experiments were carried out using as much equipment as possible taken from the mower. That is, the 9-tooth wheel as was fitted to the motor armature shaft driving by ½ in. x ⅛ in. chain to a 20-tooth wheel on the countershaft. This wheel is ganged to a 9-tooth one which is coupled by ½ in. x ⅛ in. chain to the final wheel of 18 teeth on the axle. This one I had to make myself from ⅛ in. steel plate, case hardened and attached to a collar on the axle.

There was a spare 20-tooth sprocket available from the mower and I used this on the axle originally, but I found that the diameter of this with the chain on, exceeded the diameter of my driving wheels measured on the tread. This gave me trouble on my points. Had the driving wheels been a little larger, this problem would not have arisen and I would have saved myself making the 18-tooth wheel. Anyhow I enjoyed doing it.

The Atco wheels on the countershaft had to be bushed and suitably ganged together to use them, but there were no problems here. If I were doing the job again, I think I would fix the countershaft wheels to the shaft and run it in a ball-race at either end.

The frames are of 3/16 in. blue mild steel plate, sheared to width for me by the local steel stockist, as were the buffer beams, or what would be the buffer beams had it been a steam locomotive. These beams are covered by the curved dumb sheet (I say dumb sheet for the want of a better name) bearing the familiar yellow and black striped lines and the pull and push is taken from a drawbar passing through reinforcing plates to the buffer beams. One extra slot and reinforcing plates are provided lower down in the dumb sheet for use when operating on 3½ in. gauge. A drop-in pin engages the end of the drawbar when passed through the soleplate and steel angles riveted to the buffer beam and the pull is therefore directly onto the chassis and not the dumb sheet. No frame stays other than the buffer beams are fitted, although I did make provision for them. The frames have ½ in. x ½ in. x ⅛ in. steel angle riveted to the top inside and the 16 s.w.g. soleplate is secured down to this by 5 BA countersunk steel screws. The whole assembly is most rigid.

Slight differences had to be made from the prototype to give me a working proposition. First the rear window had to be made larger to enable me to get my hand in to the controls, and as the battery was under the bonnet, ventilation had to be provided for the gassing to take place under charge and discharge. Therefore the appearance of the bonnet differs inasmuch as there are two openings in the sides covered with a panel of small mesh expanded metal, as is also the radiator grill. This gives the necessary ventilation. The aluminium expanded metal is used for display purposes and somewhat similar material was used in the past for loudspeaker grills.

So much for the air getting in, and now to provide for the air getting out. I cut a long wide slot in the top of the bonnet and turned the edge of this up all around about 3/16 in. deep, to prevent the rain getting in. I covered this with a suitable cover a little larger than the slot and likewise flanged the edge downwards, this standing clear with suitable spacers.

The controls accessible through the back of the cab are the main four-step stud controller with an "off" position, the double-pole double-throw switch for the field reversing, a master plug fused at 45 amps for removal when the locomotive is not in use, and to prevent playful fingers setting the engine in motion when not attended, which on a club track may prove disastrous. Between each of the main controller studs is a dropping resistance which gives a smooth get-away and controls the speed. Also in the "off" position the field circuit is broken. I found that for efficient control this had to be at full voltage the whole time and control had to be on armature voltage only.

A horn button controls the high frequency horn situated under the soleplate behind the front buffer beam. The other accessories in the cab are fuses for the horn, indicator lights, charger etc. There is also the main discharge ammeter, a charge ammeter for the internal-built battery charger. A socket is situated behind the main fuse plug and when this is withdrawn the battery charger mains input is accessible.

I have copied the prototype by fitting one door only on the right-hand side. This does not open, of course, and the handle is therefore a dummy. Steps and handrail are provided for the cab also. The windows are glazed with 1/8 in. perspex held in position with 10 BA brass countersunk screws and nuts. Number plates, name plates and works plate were made from 1/8 in. copper sheet suitably annealed and metal stamps did the necessary marking. The copper plates have a brass surround soldered to them from the back to give a little finish. The brass surrounds were made from slices of brass tube formed to fit the copper plates correctly.

The front lamps are dummies and are escutcheon plates from radio indicator lamps and the small red lamp at the bottom and rear of the cab indicates if the main fuse is in position and is visible at a distance, and there is a small green indicator lamp in parallel with this inside the cab. Perhaps just a little unnecessary swank on my part, as is also the amber and red forward and reverse lamps to indicate which way the reversing switch is positioned. The cab and the bonnet were mainly made from galvanised sheet about 18 or 20 s.w.g., but the cab roof was of 16 s.w.g. aluminium.

The finish for the main frames is black. The old Valspar lacquer and the last of it that I had, unfortunately no longer obtainable, dries to a very hard finish. The body and the cab are Humbrol yellow. Three coats were rubbed down in between with very fine wet or dry emery, used wet.

The top panel for ventilation on the bonnet and the cab roof are black, as are the drawbars and bonnet fasteners. The expanded metal in the bonnet sides and radiator grill is left silver as purchased and the 3/8 in. x 1/16 in. beading to the bonnet and cab side is silver to match. The cranks and coupling rods are bright red, and with the name and number plates polished copper, the effect overall is quite pleasing.

The weight of the finished locomotive is approximately 65 lb. and the battery an additional 25 lb. when fitted. For ease of transport, the bonnet comes off quite easily and is held down by four simple bonnet fasteners, similar to the early motor cars of my boyhood days. One does not forget these things.

An insulated bar secures the battery to the soleplate and removal is quick and easy. The battery is a Mini car battery of about 40 amp hour capacity 12 volts and the normal discharge is 17 to 20 amps.

The inside of the bonnet and the top of the soleplate where the battery sits is treated with black anti-acid paint. The roof of the bonnet inside is covered with rubber insertion sheeting to prevent any accidental contact with the battery terminals. A hole in the centre of this allows for ventilation.

Well, that just about finishes the description of *Bill,* my 5 in. come 3½ in. gauge battery operated copy of the Ruston diesel shunter as portrayed by the Triang "Big Big" trains of a few years ago. I am very pleased with the final result and I feel sure she will be a fine supplement to my existing stock of 3½ in. and 5 in. locos. The time taken to build this locomotive was six months, spaced out over two sessions of four months and two.

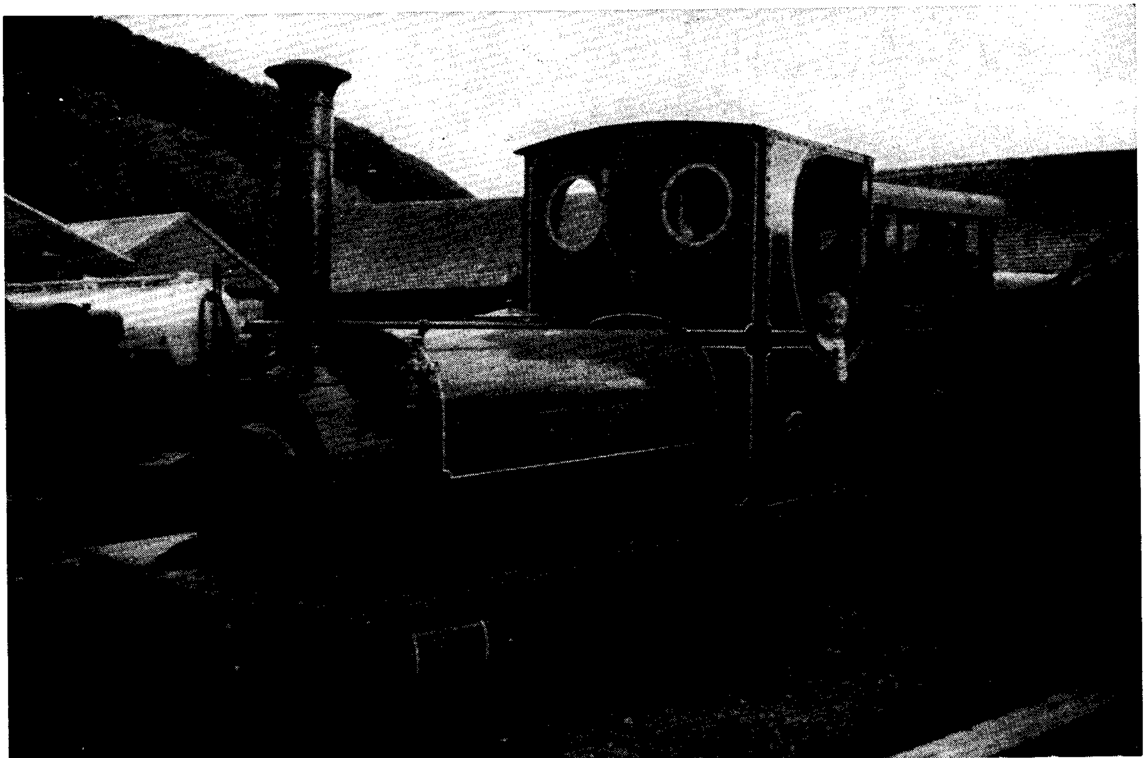
The pictures are by my good friend Mr. C. H. A. Walker who is always ready to oblige and I am most grateful to him.

My Introduction to the Two-foot Gauge

by Albert Sell

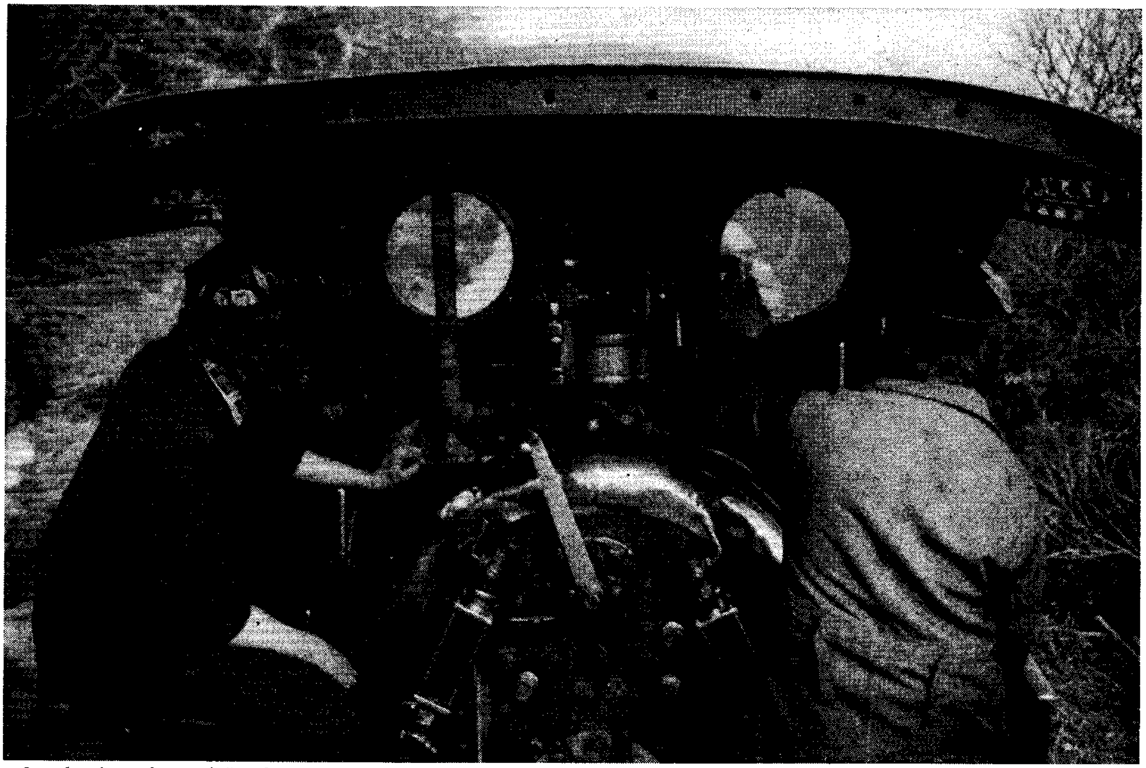
I HAVE ALWAYS had an interest in Welsh narrow gauge engines. This interest started about ten years ago when I took a family holiday in North Wales. It was on this holiday that I had a ride on British Rail's two-foot line from Aberystwyth to Devil's Bridge. This line fascinated me as such a small locomotive (compared with Jubilees, class 5s etc.) could pull so much up such a steep hill so well. (First sight of narrow gauge at work.) I went home that night, to a tent in a field, with some wonderful memories of a tiny steam locomotive working far too hard for far too long.

Little did I know that a few days later I would be standing on Towyn station of the Tal-y-Llyn Railway when an even smaller locomotive, although on a larger gauge of 2 ft. 3 in., came trundling under the road bridge into the station. This was *Edward Thomas,* an 0-4-2 saddle tank, very small, with a large flat chimney to the design of Dr. Geisl. I sat in the first compartment next to the engine listening to it hissing rather than puffing through its Geisl ejector, whilst the fireman shovelled coal on to the fire with a shovel not much larger than the one that I used at home for the fire. A note was made of several more small locomotives outside the railway works at Pendre (for future reference). The fireman at intervals passed out a coloured stick to a man at the lineside who in turn passed him a stick of another colour. These I found out later were electric train staffs used to ensure that two trains could not be in the same section of single line track at the same time.

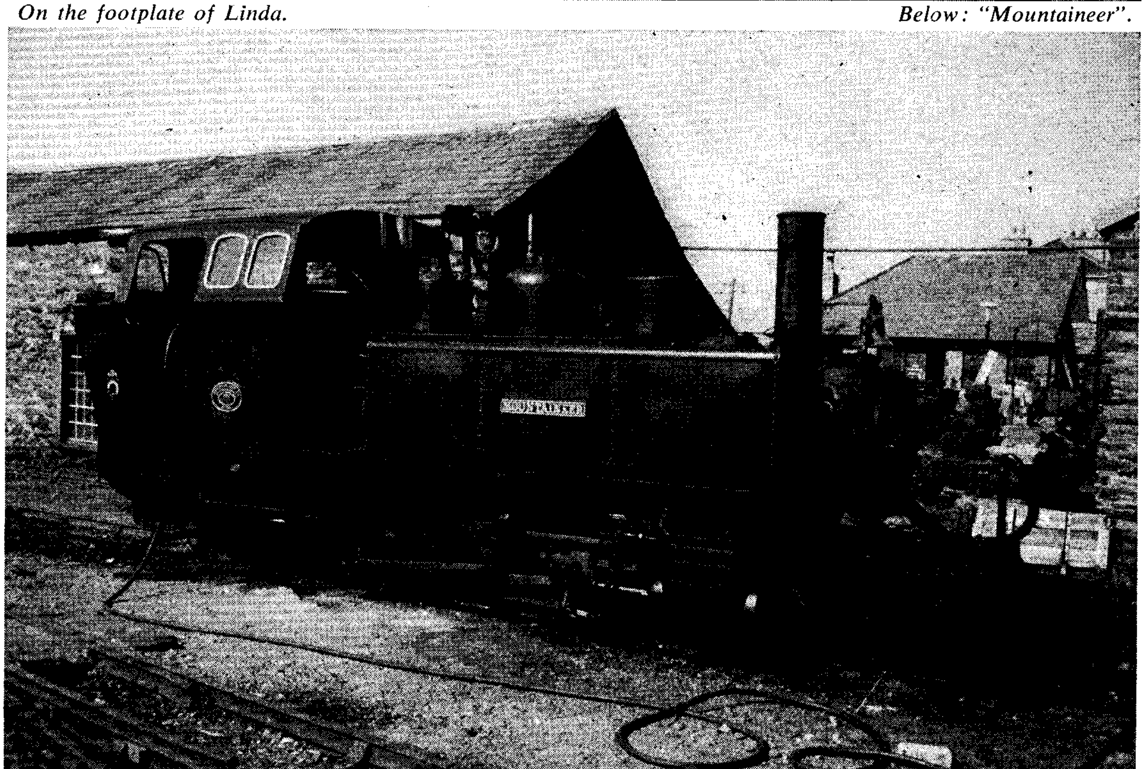


"Britomart" at Boston Lodge.

Below: "Linda" running round at Ddouallt.



On the footplate of Linda. *Below: "Mountaineer".*



Next morning, before breakfast, I was enquiring if I could have a look around the works of the T.R. Co. Permission was granted and I went into a shed where about ten people of all ages were busy, some with tins of Brasso, some with tins of car polish, and a few with barrows of coal and sticks. I spent at least two hours watching these people going about their duties, asking the odd question or two, taking in a lot of detail about the engines and thinking what a difference between this locomotive shed and Hasland shed with its dirty engines and thick covering of oil and grime on the floor.

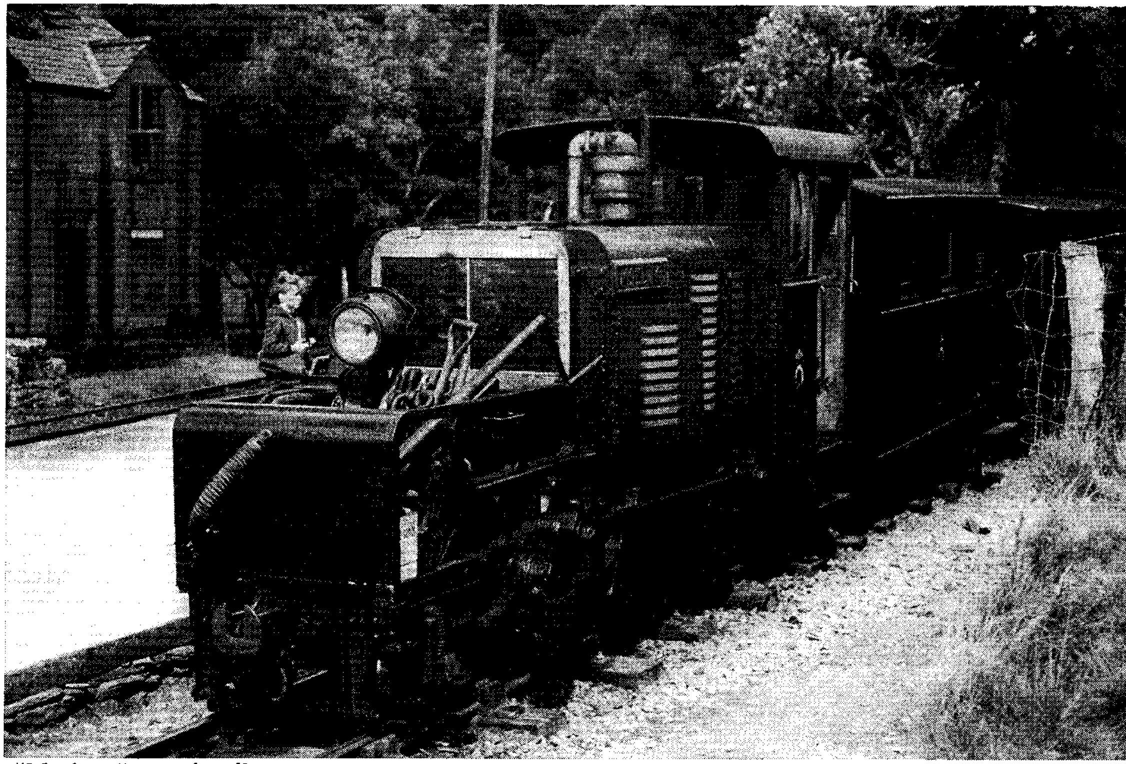
I spent as much time as I could of my holiday admiring this lovely railway and its engines, where no-one was in any hurry, where the trains were more or less on time and where everybody seemed to be "playing trains". It was whilst here that I purchased a line drawing of *Edward Thomas* from which I eventually drew out and built my own 5 in. version.

A couple of years later I visited North Wales again, but this time I was living in a field near Portmadoc where another little train of Wales runs, namely, the Festiniog Railway. Here trains of much larger size run on a smaller gauge, some engines with one chimney and some which don't know which way to run and so someone fitted a chimney to both ends; a very weird thing which fascinated me even more than the other engines of two years before.

Whilst looking around the shop at Portmadoc station I noted that if I joined the Festiniog Railway Society, for I think the equivalent of £1.50 per year, I could have as many rides as I liked on the F.R. and T.R. plus four copies of the F.R. Society magazine each year. I joined there and then and little did I know how involved in this railway I would become in the years ahead.

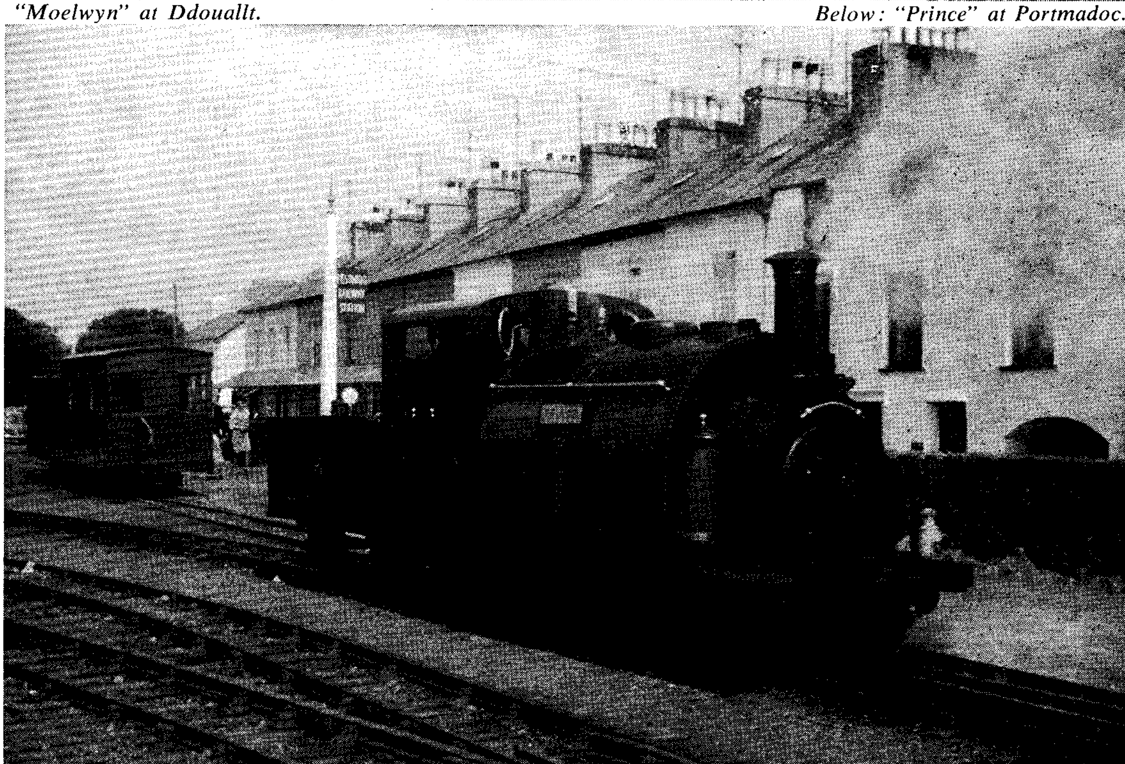
My first ride on this line was the only ride I had behind the little England locomotive *Prince,* an 0-4-0 saddle tank with an additional tender. This is the smallest steam locomotive on the railway and I enjoyed every minute of hearing this small locomotive pull I think it was five coaches up to Ddouallt with the very well known L.N.E.R. top link driver Bill Hoole in full charge. This line had everything in scenery you could want; the first mile is next to the sea on one side with a view of Snowdon in the distance on the other. Past the works at Boston Lodge where the line turns through ninety degrees inland, through cemetery cutting and through fields of cattle and sheep to Minffordd Station. This is an exchange station with the Cambrian Coast British Rail Line which passes under the F.R. at right angles. Out of Minffordd

"Linda" passing over the iron bridge.



"Moelwyn" at Ddouallt.

Below: "Prince" at Portmadoc.



and on to an embankment, through more fields and on to a ledge cut in the rock which takes us through Penrhyn between the houses and so to Penrhyn Station. After a level crossing the line proceeds almost all the rest of its journey on a ledge up the Vale of Maentwrog. The fields eventually change to a heavily wooded area where, if the sun is out, you will note that for a time you will actually travel in a direction which takes you back to Portmadoc. This is due to the line following the side of the valley.

At Tan-y-Bwlch Station trains pass each other and the up train takes water. This is a busy station with car park, shop and refreshment area, which reminds me that you can purchase on all trains refreshments—crisps, pop, beer and some shorts at any time of the day whilst the train is in motion, even on Sundays when the pubs in this area of Wales are dry.

On up the line through Garnedd tunnel and a view on the opposite valley side of the nuclear power station at Trawsfynydd; this is indirectly the cause of the line terminating at this time at Ddouallt. As we pull into Ddouallt we pass under Rhosllyn bridge which carries the new line, brought round in a spiral, over itself and on up into the hills towards its destination at Blaenau Ffestiniog. The reason for the new line being built is that the Central Electricity Generating Board built a pumped storage scheme reservoir across the line whilst this part was derelict in the early 1960s. The new line, a little over two miles in length, which includes a 300 yd. long tunnel through granite rock, is being built by a small number of full-time employees assisted by a large number of volunteers.

Now back to the day after my trip behind Prince. I again went works visiting, asked if I might look around and was given permission. This works is very different to the T.R. where they seem to play trains whereas the F.R. runs as a business concern. The buildings are the originals built over 100 years ago. All the outside yards are rough, no concrete or tarmac, heaps of coal and sand, all sorts of material in heaps all over the place. Everything seemed everywhere but as I was to find out later someone knew where everything was.

Whilst in the works I was approached by Arwel, the works chargehand, who had a lengthy chat about my interests and I was invited to bring my overalls next time I came. The works is capable of doing all its own maintenance to coaches, locomotives and track and does do outside work for other railways especially the turning of wheel treads.

I paid a number of visits to the works over the next two years to look around and then due to an industrial dispute I was to be on strike for at least two weeks and so to Boston Lodge I went with overalls and boots in hand. I was greeted with a cup of "den sludge" which was appreciated at the time as it was a cold, damp February morning. I was introduced to the works manager, Paul Dukes; we had a chat and he decided I might help Evan Davies, who drives the double engine, to fibreglass and clead the boiler for a new double engine which even now is still being built. I learnt a lot over the next few days about a locomotive with one boiler, two fires, two sets of tubes and smokeboxes, two regulators and two power bogies, in fact two of about everything except the boiler, reverser, driver and, as I was to eventually discover to my delight, only one fireman with two fires to look after.

In all I spent the next six weeks in Boston Lodge with only long weekends off. During this time we completed two outside contracts: first was for the F.R. new works department which was the construction of the handrails for the new Rhosllyn Bridge, second was the construction of six four-seat wagons for transporting people into the Llechwedd slate caverns at Blaenau Ffestiniog.

My next job of any significance was to repack all the glands on the double engine *Merddin Emrys*. This took me a day and a half of struggling inside the Stephenson valve gear on one hand to the comparative ease of the gauge glasses and steam valves in the cab. Next day I had to fill the boiler with water and light the fires. Steam was raised from cold in about three hours. We took the locomotive as light engine back and forth the 1½ miles from Portmadoc to Lotties crossing near Minffordd, checking all the rod glands which, when correctly adjusted, should just leak otherwise the piston or valve rod can overheat and seize into the gland; the other glands should be tight enough just not to leak. During this time I was being given information on how to keep the two fires producing maximum heat, how to, and where to and when to fire. On arrival back at the works the driver and works manager consulted each other about the engine, and apparently about the fireman, with the result that the locomotive roster for the following day showed me to fire *Merddin Emrys* for three trips. This was to be my first trip on the F.R. footplate.

This was my final conversion to the narrow gauge. I was to learn more on my three trips in one day than I have ever learnt in any other single day in my life. I was to learn how to fire a locomotive whilst on the run and not only fire when the fires needed it, but because on *Merddin Emrys* the fire holes are on the side of the boiler; if one fires whilst passing through cuttings or past close walls and fences you stand a good chance of rattling your hands on the passing scenery.

Continued on page 513

"GREENE KING"

A new locomotive for 3½ in. gauge based on the Southern Railway S.15 class

by Martin Evans

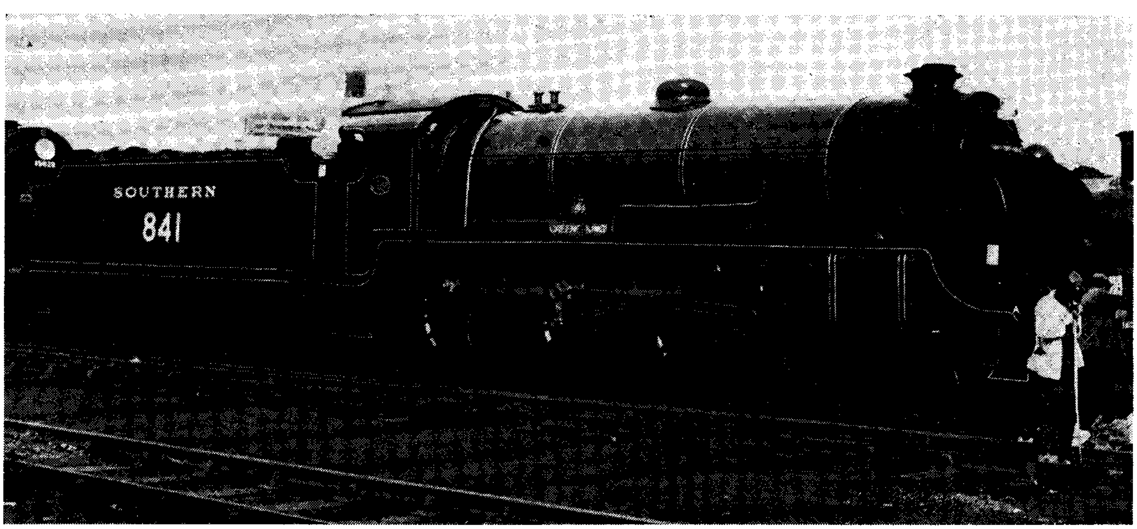
ENTHUSIASTS for the 3½ in. gauge may have been thinking that we have neglected their favourite scale during the last year or two, so I hope that my new locomotive *Greene King* will redress the balance. The original locomotive has fortunately been preserved and was at the recent Stockton & Darlington celebrations, where I was able to obtain a few photographs of it.

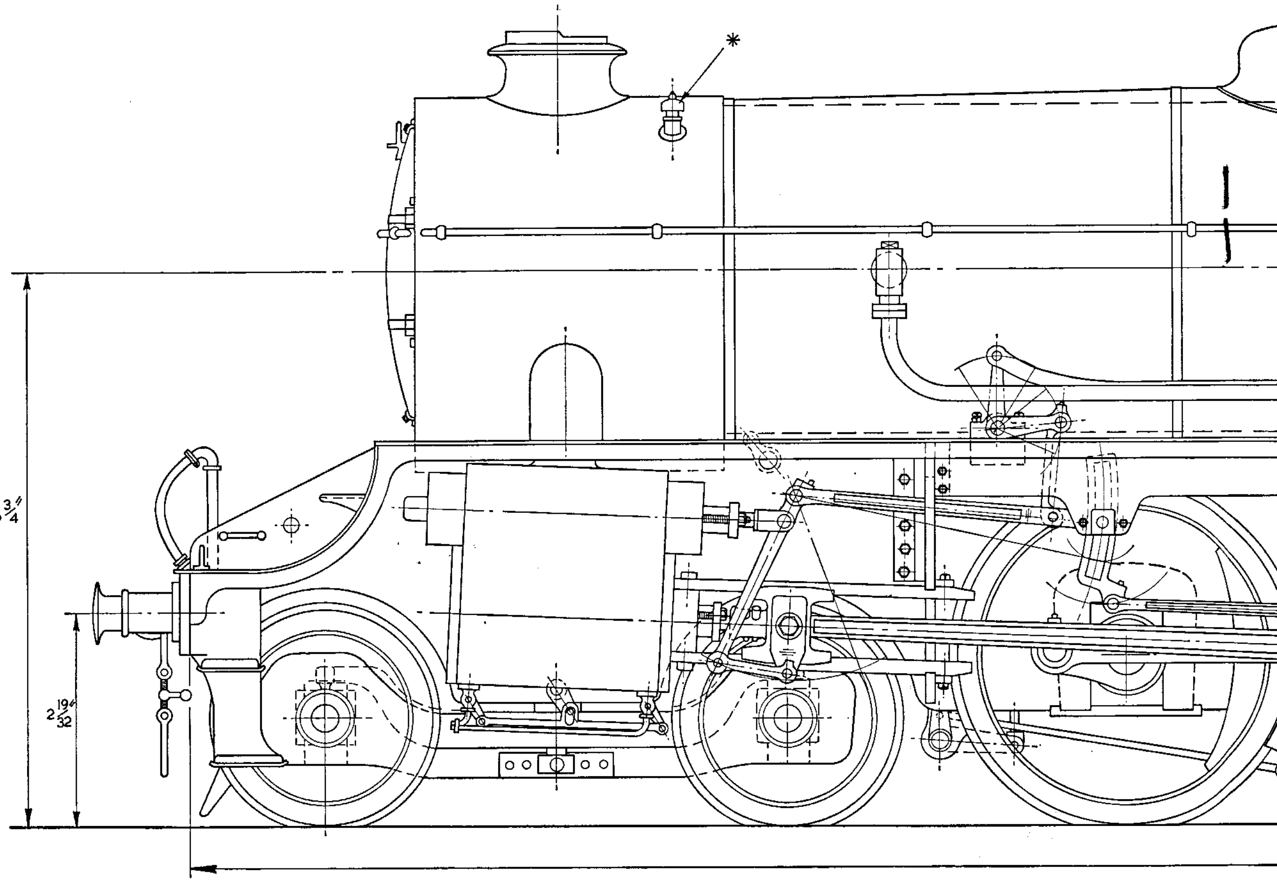
Greene King is one of the ex-Southern Railway S.15 class mixed-traffic engines, built during the Maunsell regime, though based on the earlier design by Urie for the London & South Western Railway.

Robert Urie produced his express passenger and mixed traffic classes of 4-6-0 from 1918 onwards, the well-known N.15 and H.15 classes, which were a radical departure from the previous and unsuccessful Drummond 4-6-0s. Urie's third and final 4-6-0 design was the S.15, based closely on the N.15s but with much smaller wheels, and with the boiler lower pitched. The essential dimensions were as follows: outside cylinders 21 in. x 28 in., driving and coupled wheels 5 ft. 7 in., bogie wheels 3 ft. 7 in., boiler diameter 5 ft. 1½ in. at the front, with a taper part to 5 ft. 5¾ in., heating surfaces—tubes 1252 sq. ft., flues 464 sq. ft., firebox 162 sq. ft., and superheater 308 sq. ft., giving a total of 2186 sq. ft. The working pressure was 180 p.s.i., and the grate area 30 sq. ft. Weight in working order was 135 tons 1 cwt. (including the tender). In common with all Urie designs, very generous bearing surfaces were provided, with coupled axle journals 9 in. x 12 in., and bogie 6½ in. x 11 in. The whole engine was robust and the high running plate, which had a raised part over the cylinders, gave excellent accessibility. Standard Urie 5000-gallon bogie tenders were originally fitted.

One of the class, No. 515, was converted to oil firing in 1921, but this change did not last long, as it was found that with the price of coal and oil at the time, coal firing was considerably more economical. Originally painted in the normal L.S.W.R. style, they were repainted black by the Southern Railway at grouping, but as they were later employed on passenger duties, they were repainted again, in green livery, around 1928. During the period 1927-32, the original Eastleigh type of superheater was replaced by the Maunsell pattern, giving slightly greater heating surface.

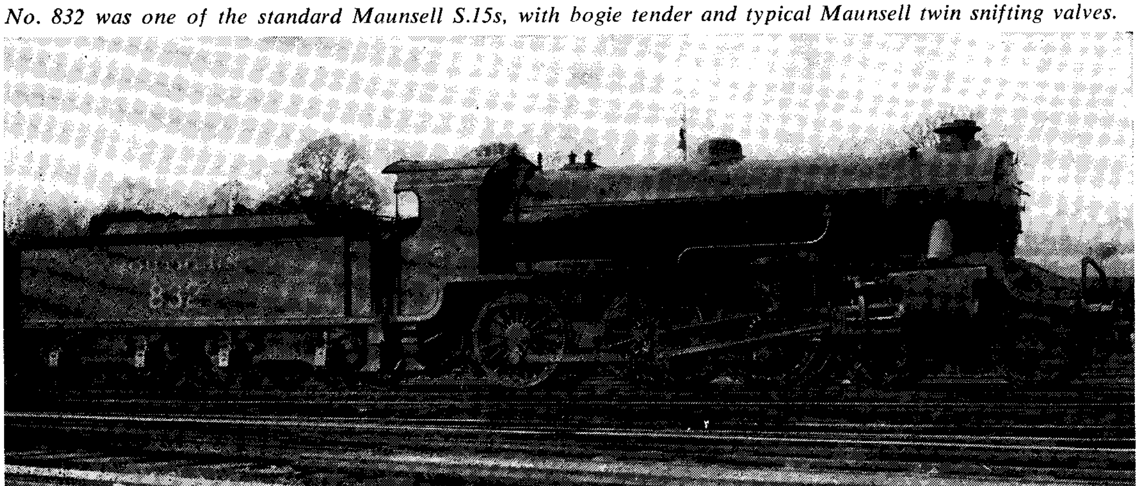
When additional heavy goods locomotives became necessary on the Western section of the Southern Railway around 1926, fifteen more S.15s were ordered from Eastleigh Works to the modified design of Maunsell. These new engines, of which our prototype *Greene King* was one, were fitted with new cylinders 20½ in. x 28 in., 11 in. dia. piston valves with longer travel, outside steam pipes, and boilers pressed to 200 p.s.i.

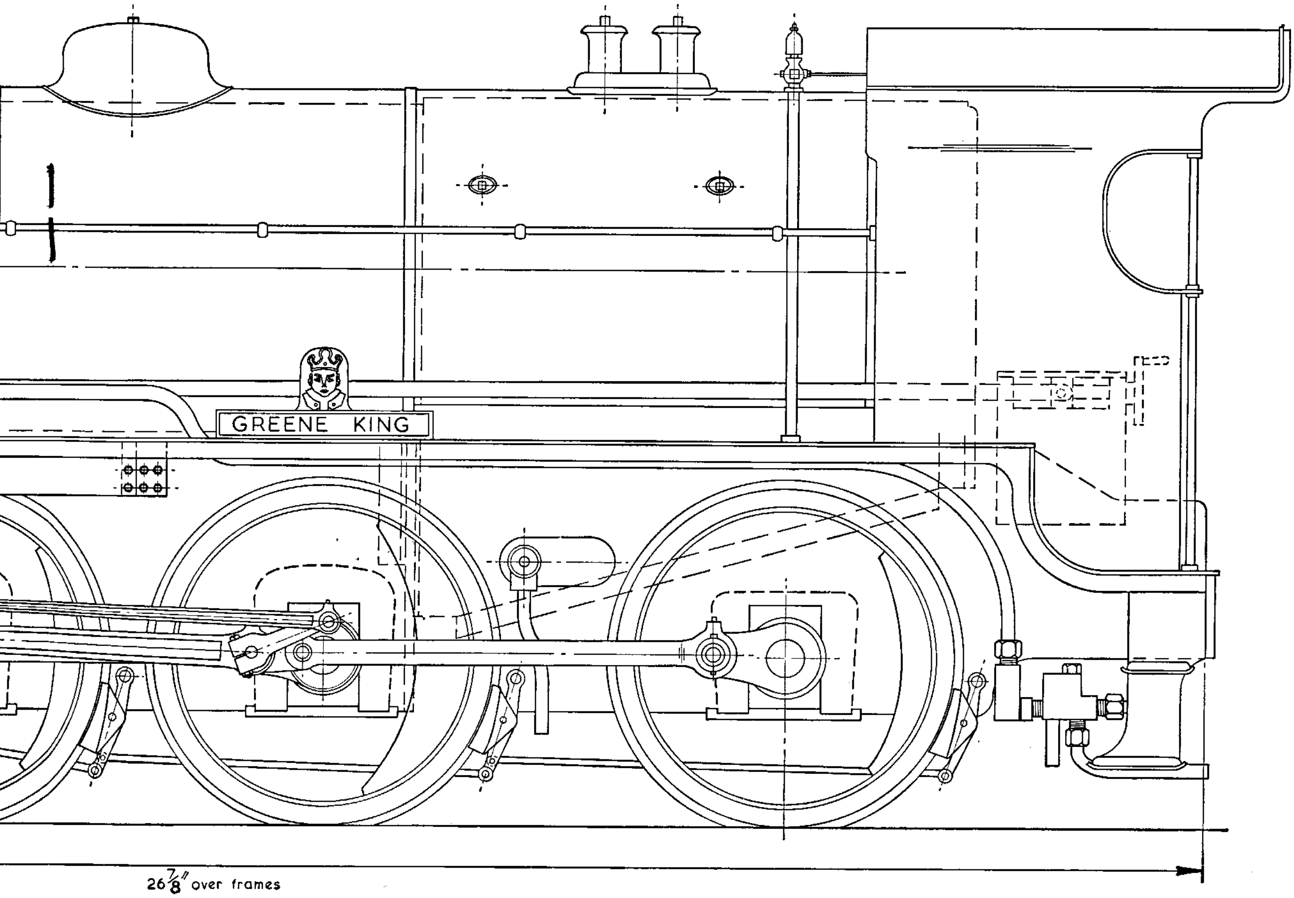




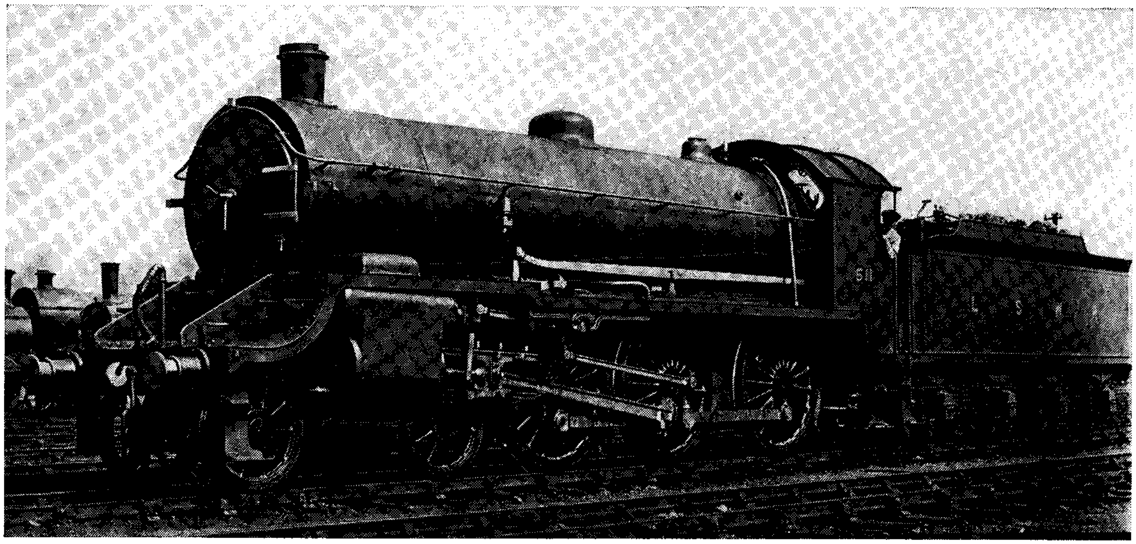
* *Snifting valve not now fitted on "Greene King".*

No. 832 was one of the standard Maunsell S.15s, with bogie tender and typical Maunsell twin snifting valves.





This is one of the original Urie S.15s, with taller, small diameter chimney and raised footplating. It is seen in L.S.W.R. livery.



Maunsell type cabs and superheaters were also fitted. The grate area was slightly less, at 28 sq. ft., due to the water space at the throatplate being increased. The more handsome Maunsell chimney was fitted, and they were turned out in goods black, though this livery gave way to the more attractive passenger green quite soon.

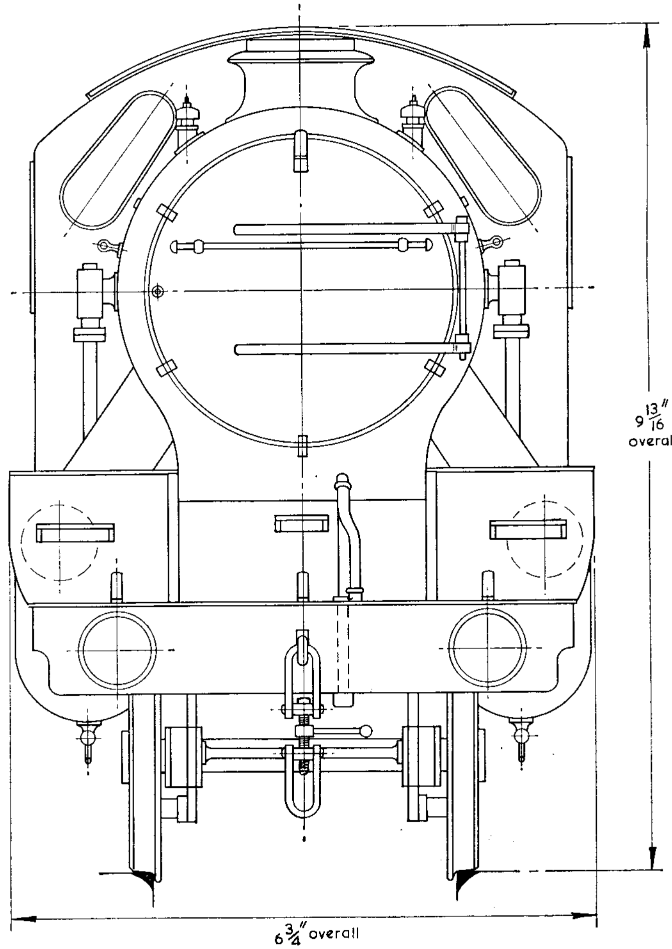
The Maunsell S.15s were most successful engines, having plenty of power and capable of an easy 70 m.p.h., so that they were able to take any type of train, from express passenger to slow goods.

The tenders originally fitted to the Maunsell S.15s were later transferred to "Lord Nelson" 4-6-0s, the S.15s receiving tenders from "King Arthurs". Further tender exchanges took place around 1936-7, when S.15s Nos. 833-837 were transferred to the Central section, and received six-wheel tenders off "King Arthurs".

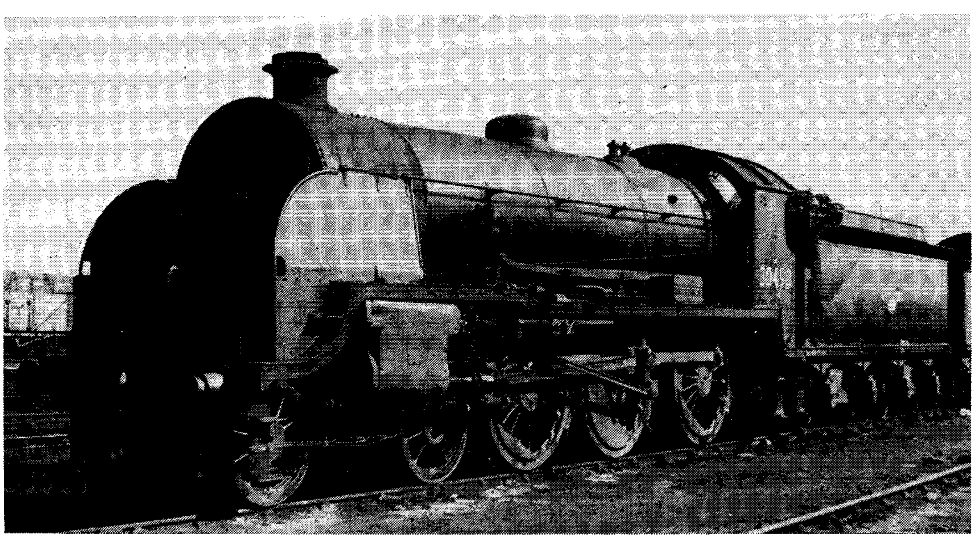
Ten further S.15s were built at Eastleigh in 1936, of which Nos. 838-842 were sent to the Eastern section for main line goods work from Hither Green, while Nos. 843-6 were sent to Feltham and No. 847 to Exmouth Junction. This batch was generally similar to the earlier series, though slightly lighter. All were attached to 5000-gallon tenders with flat sides.

The Bulleid livery changes did not affect the S.15s very much; up to June 1939, all locomotives left the shops painted in the standard Maunsell green with black and white lining, though one or two received black and yellow lining. At the outbreak of war, those engines in the class that required repainting were finished in plain unlined dark green. After February 1941, all repaints were carried out in unlined black.

During the 1939-45 war, the S.15s proved a most useful class, handling an immense tonnage of



Front elevation of the 3½ in. gauge model.



A Urie S.15 with new chimney and high-sided bogie tender, in British Railways livery.

goods in addition to the working of troop trains and various specials; requiring only the minimum of maintenance, the class proved most successful, and averaged 131,000 miles between general repairs.

Withdrawal of the S.15s commenced with No. 30826 (B.R. numbering) in December 1962, and the last to go, apart from *Greene King,* were Nos. 30824, 30837, 30838 and 30839.

The Model

Coming now to our model, we can have a choice of 5000-gallon bogie tender or six-wheel tender, and I expect most builders will plump for the latter, as it is always rather difficult for the driver to reach over a long bogie tender, and the extra capacity for coal and water of the bogie tender matters little in $\frac{3}{4}$ in. scale.

From examination of photographs of *Greene King,* it seems that several modifications have been carried out since Southern Railway days. For instance, the big ends of the connecting rods are now of the plain circular bush type, instead of the well-known "gib and cotter" type usual on the L.S.W.R. The twin Maunsell snifting valves have also been removed (my general arrangement drawing shows these as originally fitted), and of course smoke deflectors are now standard, which in my opinion rather spoils the appearance of these fine locomotives.

My model will have the correct piston valve cylinders, though these will be just a shade under the "scale" dimensions, at 1 3/16 in. x $1\frac{3}{4}$ in. Working pressure 90 p.s.i., as anything higher than this would only lead to excessive slipping with this size of cylinders. The Walschaerts valve gear will follow the prototype closely; the full gear valve travel will work out as rather more than on the full-size engine ($6\frac{1}{8}$ in., with $\frac{1}{4}$ in. lead).

Water feed will be taken care of by two injectors, feeding through the usual side clacks. Those who prefer axle-driven feed pumps will find plenty of room between the frames, with the eccentrics on the driving axle and the pump bodies between this axle and the leading coupled axle.

The bogie will be of the full "Adams" type, which I think was always used on the L.S.W.R. Adams of course was one of the early C.M.E.s of that railway, though he invented the bogie that bears his name while on the North London Railway.

Here then is *Greene King,* and I hope that it (or should I say "he"?) meets with readers' approval.

To be continued

Introduction to the two-foot

From page 508

During my six years on the F.R. I have had personal experience of three mechanical breakdowns of the steam locomotives. My first was during, of all times, a train organised for the training of staff and volunteers. A series of simulated happenings and accidents was to take place. I was on the 2-4-0 S.T. *Linda.* We were going up Gwyndy Bank when there was one almighty bang, followed by a fairly loud knock. Upon inspection we found the right-hand piston rod had broken and the piston had been pushed through the front cylinder cover. The second occurred on *Blanche.* We were approaching Minffordd when the link pin which coupled the tender to its drawbar broke and allowed the tender to part from the locomotive by about 10 in., the safety chains taking the strain. It is fortunate we (the crew) noticed the failure, which happened in complete silence as the drawbar runs from under the locomotive drawbar right through the tender to the rear coupling; the tender is only pulled along, its chassis does not transmit any pull. If we had stepped back a very serious accident could have occurred.

My third was on my last visit. Whilst pulling out of Tany-y-Bwlch with the double engine and seven fully-loaded coaches there was a bang from the bottom engine and live steam up the chimney. The driver, thinking a drive pin to the valve had broken (an occasional occurrence with this engine), closed the bottom end regulator and we carried on with top end engine only. Upon inspection at Ddouallt we found the valve gear very badly bent.

The greatest thrill for me on the F.R. is when the driver turns to me and says "You drive this one". This means, after quite a few driving trips, doing everything the driver does, oiling round, checking for hot bearings and keeping an eye on the fireman. That's not as funny as it may seem, they occasionally forget to carry out their duty to check if I am awake. One also has to remember all the speed limits, where to stop in stations so that all the coaches are in the platform. Know how much steam pressure to put in the steam chest to keep a constant speed over the longer stretches, know not to accelerate or brake too sharply or the pints of beer in the buffet car will spill over. The most difficult stop is at Tan-y-Bwlch where two feet short or overrun and the fireman has great difficulty in reaching the water valve; the most difficult speed restriction is at Garnedd tunnel where there must be a speed check from 15 m.p.h. to 8 m.p.h. without fully closing the regulator, otherwise the fireman has problems with his oil settings in the tunnel.

I have found the last six years on the F.R. very interesting and I have learnt a lot about the running and maintenance of steam locomotives and am looking forward to many more sessions on the footplate and in the works.

MINIATURE VACUUM BRAKE COUPLINGS

by Brian Hughes

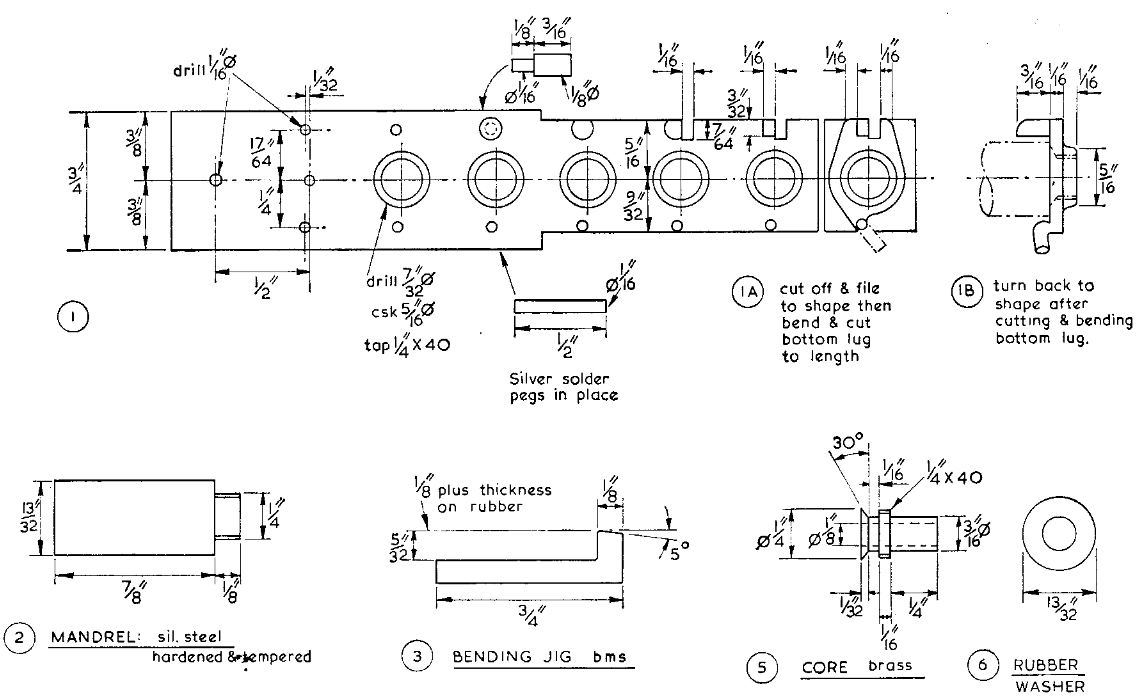
ONE OF THE ADVANTAGES claimed for the vacuum brake on our small trains is the simplicity of coupling the brake line with a bit of rubber tubing slipped over the ends of the train pipe on adjoining vehicles. Little bits of rubber do however get themselves lost and in any case big trains do have separate hoses on each vehicle with those interestingly shaped couplings which slip together in a trice, so why not follow suit?

Bill Carter has described his own method of making the fiddling little things in *Model Engineer* and while these are perfectly O.K. the method didn't really appeal to me. I puzzled over several schemes and none seemed quite right, especially as I needed a dozen. Eventually a drawing of the G.W.R. $1\frac{1}{2}$ in. dia. hose couplers as used on the Vale of Rheidol and the Welshpool and Llanfair lines came my way and this proved the simplest answer of the lot. Two bits screwed together! O.K. they did use castings, but a simple fabrication and a bit of turning would do for the little ones.

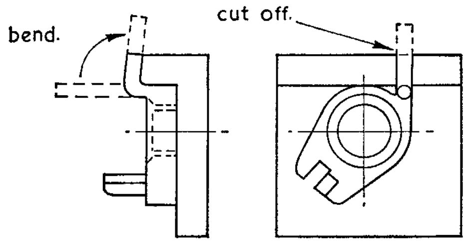
The couplings described are $\frac{1}{8}$ full size of $1\frac{1}{2}$ in. dia. pipe couplings, but these would not be far out for 5 in. gauge main line types of locomotive as these used 2 in. dia. pipes on full size.

Assuming a small batch is required, start off with a strip of $\frac{3}{4}$ in. x $\frac{1}{8}$ in. mild steel, allowing about $\frac{1}{2}$ in. length for each coupling. Scribe a line along the full length of the strip straight down the middle, and across the strip at $\frac{1}{2}$ in. intervals. The intersection of these lines marks the centre of the couplers (Fig. 1); drill through each 1/16 in. dia. Next, using the side of the holes as a guide, scribe another set of lines across the strip 1/32 in. to the left of the centre of the holes. Then mark two more lines along the length of the strip, 17/64 in. above and $\frac{1}{4}$ in. below the centre of the holes. Centre punch and drill through at each intersection with a 1/16 in. drill. This completes the marking out and accuracy at this stage ensures that each coupling will mate with any of the others (fingers crossed).

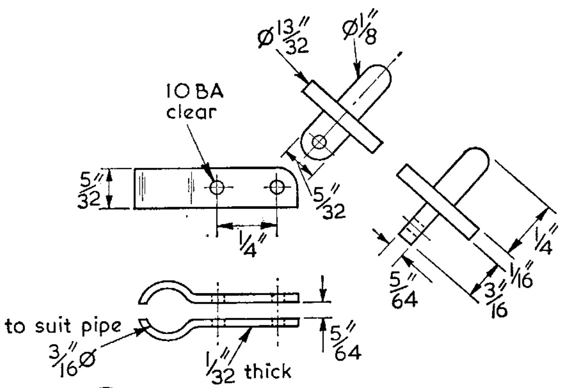
Open out the centre holes to 7/32 in. dia., countersink with a normal drill (118 deg. angle point) to 5/16 in. dia. then tap $\frac{1}{4}$ in. x 40 t.p.i. Cut off one $\frac{1}{2}$ in. length of 1/16 in. dia. mild steel for each coupling and insert into the lower holes, then cut off one 5/16 in. length of $\frac{1}{8}$ in. dia. mild steel for each coupling, turn down $\frac{1}{8}$ in. length on one end to 1/16 in. dia. and insert into the upper holes.



VACUUM BRAKE HOSE COUPLINGS



4 BENDING THE BOTTOM LUGS



7 DUMMY & BRACKET

Flux up and silver-solder into place. (The pins should be an easy fit in the holes so that the silver-solder can sweat right through). Pickle and clean.

Clamp the strip in the vice, using a bit of packing between the pins, with the bottom edge uppermost and file the edge till flush with the 1/16 in. pins. Turn over and file the upper edge cutting into the $\frac{1}{8}$ in. dia. pins by 1/64 in. leaving a flat just over 1/16 in. wide on each pin (.083 in. if you want to be more accurate than necessary).

The next operation is to cut the slot into the top of each coupling, using the pin as a guide. The first cut should take 1/32 in. off the side of the pin and extend down to level with the bottom of the pin (7/64 in. deep), then open out to a touch over 1/16 in. wide, away from the pin. Reset the strip in the vice with the pins uppermost and file the top pins on the remaining faces, finishing at 1/16 in. x 1/32 in., and finally file the radius on the end as shown in the sketch.

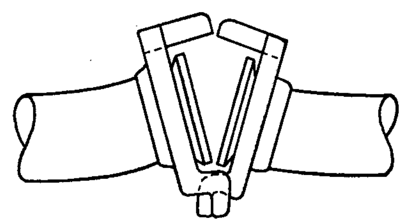
Before proceeding any further, a small screwed mandrel is required. This should be silver steel, hardened and tempered as it doubles as a filing jig (Fig. 2). Saw the strip into separate blanks, screw the mandrel into the first from the front, clamp in the vice and file to shape using the mandrel as a guide. Repeat on the remaining blanks (Fig. 1A).

The next step is to bend the bottom pegs to shape and another simple jig is required. This can be cut from an odd piece of $\frac{1}{8}$ in. thick angle. Clamp each blank in turn to the jig, bend as shown in the sketch and cut to length (Figs. 3 and 4).

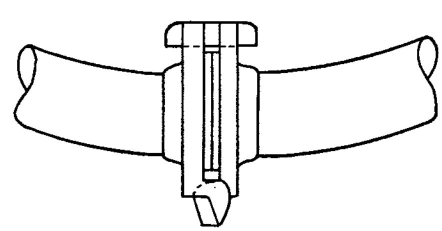
Finally mount the mandrel in the lathe, screw each blank on in turn, and turn up the backs to shape, remove and put aside (Fig. 1B). Not too bad, was it?

The cores are a simple turning job that needs no detailing (Fig. 5) and the rubber washers are straightforward, being cut from a piece of sheet rubber about 1/32 in. thick. I use a bit of old bicycle inner tube. Check the thickness of your rubber before you start on the bending jig to avoid problems in getting the ends to mate properly (Fig. 6). To couple up, remove pipes from their dummies (Fig. 7), lift until the ends are above horizontal, engage the bent horns on the bottoms of the couplings, then gently lower allowing the top lugs to engage the slots of the mating coupling. The natural tendency for the pipes to straighten will hold the joints closed (Fig. 8).

Well, that's it. A bit fiddly to make, perhaps, but not too difficult and you will probably spend less time making them than the time you spend playing with them afterwards.



To couple: engage bottom lugs and lower allowing upper lugs to engage in mating slots.



To uncouple: lift couplings and disengage bottom lugs.

8

Modifications to a Rear Tool-post

by S. U. Belsey

THE "DUPLEX" REAR TOOL-POST, a description of which appeared in *Model Engineer* in 1948, works so well that it simply begs for a chance to do better. Incidentally, a booklet giving details of the construction of the device can still be had from public libraries. Here is an account of some modifications which I have made to mine which extend its usefulness and make the job of setting it up on the lathe cross-slide much easier.

The first job was to alter the hand clamping nut so that its handle (1), Figs. 1 and 2, projected upward at an angle of 30 deg. from the horizontal. The washer between the turret and the nut was made to a thickness such that the handle pointed away from the chuck when the nut was fully tightened down. And then came a minor exasperation. The head of the securing tee-bolt had a habit of getting fixed cross-wise across the end of the cross-slide tee-slots, and when I had aligned it to enter the slot it was an even chance that the clamping handle would be pointing directly at the chuck instead of away from it, according to which way round the bolt head had entered the slot.

The tee-bolt head was modified so that it stayed correctly aligned by first assembling the tool-post upside down, with the tee-bolt clamping-handle pointing in the correct direction. A No. 34 hole was drilled, centred 5/16 in. from the centre of the tee-bolt, through the bolt-head and into the tool-post body to a depth of ½ in.

The hole in the bolt-head was tapped out 4 BA and carefully countersunk so that a 4 BA countersunk screw would just screw down flush. A 4 BA screw was turned down so that it would neatly enter the hole in the tool-post body when screwed into the tee-bolt head. The front tee-head bolt, which locks the post securely, was treated in the same manner (Fig. 4).

Anyone who has an attachment fitted to the rear end of his cross-slide, such as the power cross-feed described some years ago, will find that the register-pins which align the tool-post will prevent the unit from being slid into place. The following modification avoids this difficulty. First a piece of ⅜ in. mild-steel square strip was cut off 1½ in. long, and closely fitted into the second tee-slot from the rear of the cross-slide. The tool-post was assembled to, or rather over it, and aligned in the operating position, but without the front tee-bolt. The hand clamping nut was then tightened securely, and two No. 34 holes were drilled 3/16 in. from each long edge of the tool-post body and on the tee-slot centre-line. The holes were drilled right through the tool-post body and into the ⅜ in. square steel strip, being careful not to drill into the cross-slide. The post and strip were removed from the cross-slide and the holes in the body were opened-out to 9/64 in. and countersunk to take 4 BA screws. The holes in the strip were drilled right through and tapped out 4 BA.

A recess was turned in the strip, 13/16 in. long by ¼ in. deep, to take the head of the front tee-bolt. The strip was assembled into position upon the tool-post as shown at (2) in Figs. 1 and 2, and was drilled through 5/16 in. to take the front tee-bolt, using the existing bolt-hole in the body as a guide. The hole in the bolt-head for the aligning-screw was used as a guide for a No. 34. With this arrangement, both tee-bolts are kept correctly aligned in the tool-post body, and the square steel strip keeps the post in exact alignment on the cross-slide. The device can be slid straight into position literally in seconds, ready for immediate action.

The turret part of the device works extremely well and as surfacing was done almost as often as cylindrical turning it was decided that this should be added to its functions. This was done by adapting it to take a 3/16 in. or ¼ in. section "Eclipse"

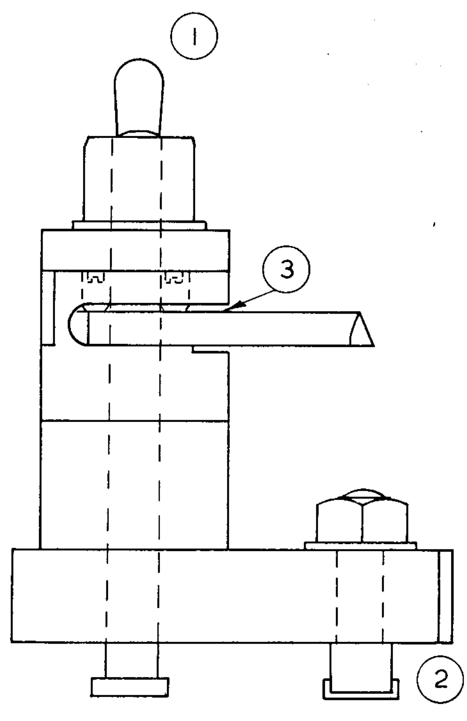


Fig. 1

boring-bar tool-bit, cut down to fit. So a groove was milled in one of the unoccupied faces of the turret, $\frac{7}{8}$ in. long by $\frac{1}{4}$ in. deep, opening into the groove carrying the knife tool-bit and ending 3/16 in. from the face carrying the parting-tool. The groove was placed $\frac{1}{2}$ in. from the bottom of the turret face, slightly below the lathe centre-line height, so that the boring-bar tool bit can be shimmed-up until its tip is at centre-height. This arrangement was used because, as the facing-tool in a back tool-post is upside-down, sharpening the tool raises its line of action. Therefore allowance must be available for lowering the tool-shank. Two No. 26 holes were drilled, $\frac{5}{8}$ in. apart, $\frac{1}{8}$ in. from the turret face, from the top of the turret face right down into the tool groove, and tapped out 2 BA, to take two Allen grub-screws (3), Figs. 1 and 2.

A minor disadvantage of the original set-up was the fact that the parting-tool blade was secured in place by a square keep-plate, which covered the heads of the fixing-screws which held the other tool-bits. Therefore the keep-plate had to be removed to get at these screws to free the tool-bits for sharpening. As is well-known among amateurs, a well-aligned parting-tool blade is worth its weight in rubies. Therefore, in order to avoid disturbing a good set-up, the keep-plate was modified to the shape shown in Fig. 3.

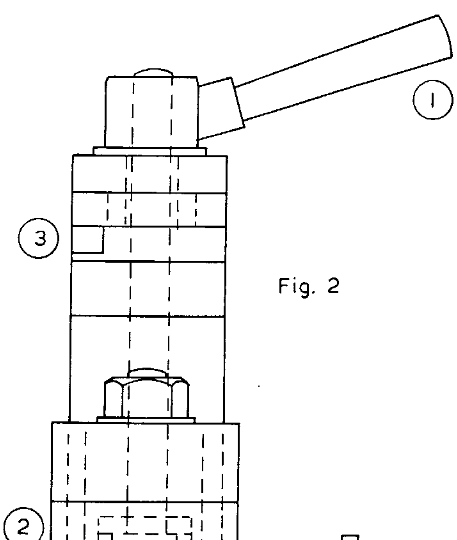


Fig. 2

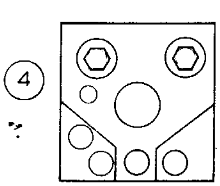


Fig. 3

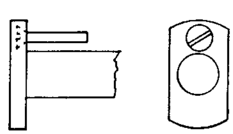


Fig. 4

The sides of the plate were cut away to leave a nose 5/16 in. long by $\frac{1}{4}$ in. wide, and a No. 26 hole was drilled $\frac{1}{8}$ in. from the tip and on its centre-line. This hole was tapped out 2 BA to take a single Allen grub-screw. Adjusting this screw enables the existing cap-head screws to be tightened to bring the keep-plate down squarely upon the parting-tool blade. Only one extra hole need be drilled into the keep-plate. This is shown at (4), Fig. 3, and it is made just large enough to allow an Allen key to be inserted to engage the inner facing-tool clamping grub-screw. It will be seen from Fig. 3 that the cut-away flanks of the keep-plate clear the knife-tool clamping-screw heads. By the above-described modifications, any of the tool-bits can be removed and replaced without disturbing the others.

All the above-described modifications were made to reduce the time spent in setting-up the lathe before work can begin. Clearly, the larger the proportion of our scanty leisure time that can be spent in actually cutting metal, the better use we are making of it.

JEYNES' CORNER

E. H. Jeynes on good old lathes

I READ Geo. H. Thomas's remarks concerning the Pratt and Whitney lathe, in his letter to "Postbag", 4 March; these made me wonder if he had ever had the good fortune to work on an old Hendy Norton lathe. Recalled from France in 1915, to work in the Toolroom of the Coventry Ordnance Works, I was lucky enough to be put on an 18 in. of this make, and though I had worked on many makes of lathes before this, and have done so since, I have never found any lathe so handy to work upon as the Hendy Norton.

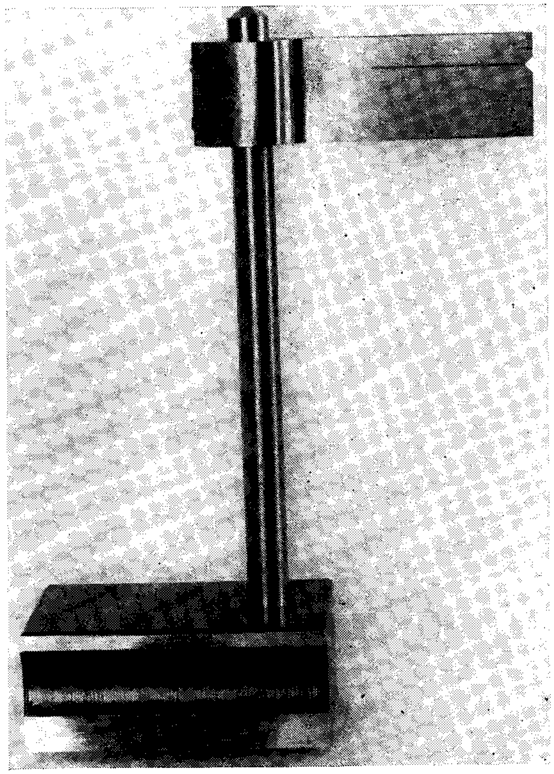
There were three Hendy Nortons in this Toolroom, two 18 in. (9 in. centres) and a 14 in., the latter being used solely for production of hand and machine taps. These lathes were about 1906 vintage and I believe had been in some Exhibition, and each had a full equipment, including taper turning attachment, fixed and travelling steadies, and two clutches on the belt-driven countershaft, one forward, and one for the fast reverse; I used this latter quite a lot in screwcutting, hardly ever opening the nut on short threads. There was a three-speed gearbox in the gear train, and a 127-tooth wheel to be inserted in the train for cutting metric threads; finally the drive to the leadscrew was through a 12-speed gearbox, thus allowing 36 feed speeds, or the facility of cutting 36 threads without having to alter a single wheel, unless the thread to be cut was a metric pitch.

The wide bed had two separate sets of vees, the inner for the tailstock and fixed steady, the outer for the saddle; the latter had horns each side which embraced the headstock and tailstock, when the centres were brought together. Each lathe was equipped with a 12 in. 4-jaw independent chuck, a 12 in. self-centring

Continued on page 521

Modifications to a Tool Height Gauge

by Ian Bradley



Top right, Fig. 1: The original tool height gauge.

SOME YEARS AGO "Duplex", a partnership of which I am the surviving member, published a design for a simple gauge that might be used to set tools at the correct height when carrying out turning operations in the lathe.

The device consisted of a base carrying an upright standard on which was set a blade with set screws somewhat resembling the "board" of a railway signal. The blade had a line incised upon it parallel with the base member. Once the tube had been set at the lathe centre height, with the base member resting on the lathe bed, or cross-slide, the point of the turning tool could be adjusted for height by packing the tool shank until the tool point and the incised line coincided.

Setting the incised line to centre height, was simply a matter of adjusting the blade on the upright standard with reference to a lathe centre, placed for preference in the headstock.

A simple device of this nature presents no difficulty where it is employed on the only lathe in the

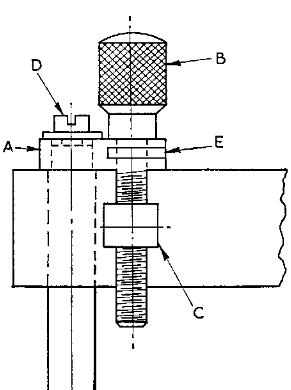
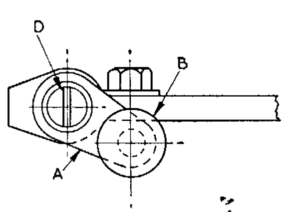
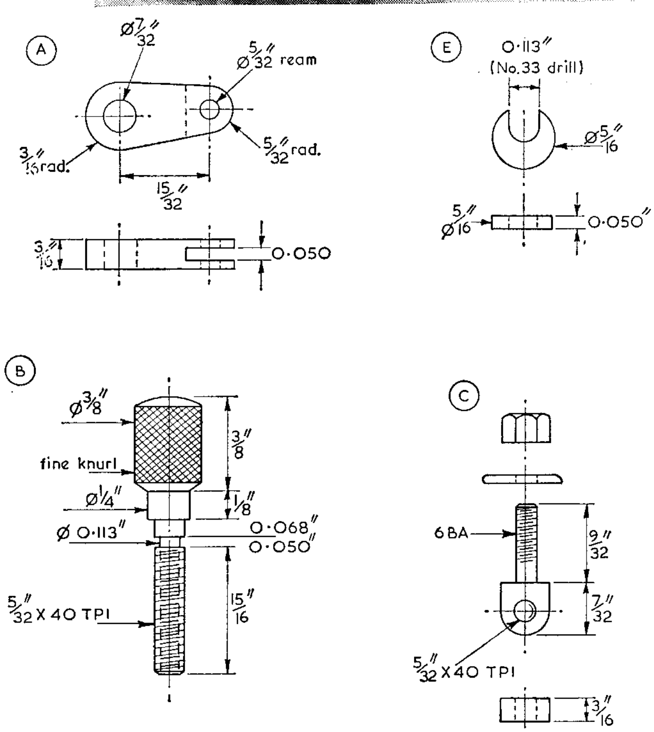


Fig. 2



MODIFICATIONS TO A HEIGHT GAUGE



MODIFICATIONS TO A HEIGHT GAUGE

Fig. 4

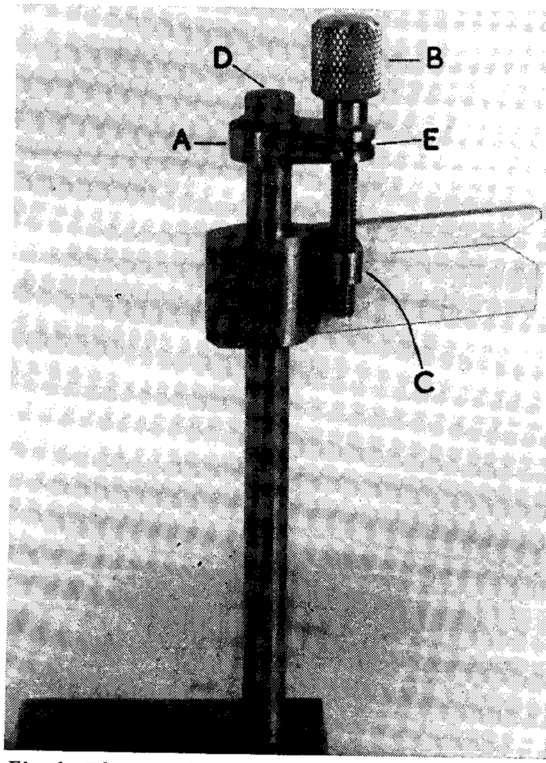


Fig. 3: The modified tool height gauge.

shop. However, when the lathes in the shop are duplicated or even triplicated and have different centre heights, it is advisable to provide means of adjusting the blade with greater rapidity and with enhanced sensitivity. Add to this that by cutting a notch in the blade and setting this to centre height the device can be employed to adjust a vertical milling attachment so that saws or gear cutters mounted in it will cut truly on the axis of the lathe itself; then the need for some modification to enable setting to be carried out expeditiously will be apparent.

The height gauge in its original form is seen in Fig. 1 and as modified in Fig. 2 and Fig. 3. The modification comprises a bracket A supporting an adjusting screw B. The latter engages a nut C set in the blade of the height gauge itself so that when the adjusting screw is turned the blade is raised or lowered as required. In order to do so, however, a circlip E must be set in the bracket A to locate the adjusting screw. The bracket by the way is held in place by the 4 BA hex-head screw seen in the illustrations.

Making the necessary parts is a straightforward matter, but two matters need further mention. In the first place the length of the threaded position of the adjusting screw as given in the drawings, is suitable for the two lathes in the author's workshop. These have centre heights $3\frac{1}{2}$ in. and 4 in. respectively.

The second comment concerns the nut C. This should not be drilled and tapped for the adjusting screw until it has been assembled on the blade. To this end the bracket A must be set in place at the top of the column and a drill bush inserted in the 5/32 in. hole formed in the bracket itself. The drill bush needs to be machined so that it fits the bracket closely, whilst it is drilled and reamed to accept a standard $\frac{1}{8}$ in. centre drill. When carrying out the drilling and tapping operation, the blade should be set at the top of the column as shown in the general arrangement drawing.

It will be appreciated that care must be taken over this operation or the smoothness with which the adjusting device operates will be impaired.

The circlip E is made from a piece of 5/16 in. dia. mild steel drilled so that it is just a clearance over the undercut in the adjusting screw B. It is parted off from the parent material so that the part has a width equal to that of the slot in the bracket A, in my case 0.046 in. The circlip is then sawn and filed so that it will just spring over the adjusting screw. Details of the additional parts are given in Fig. 4.

Electric Ships

SIR,—I feel that Mr. Gowan in "Postbag" of 18 February draws too fine a distinction in referring to installations such as the *Monarch of Bermuda* and *Queen of Bermuda* as electrical torque convertors. Both were 20,000 s.h.p., each utilising two G.E.C. AC synchronous motors energised from a pair of G.E.C. turbo-alternators capable of being run singly, separately, or paralleled over a range of frequency. The outstanding advantage of such an arrangement was the flexibility of control, particularly during manoeuvring, and the ability to run the generating plant at optimum efficiency at all times; the disadvantage overall weight and capital cost.

However these two ships, as those equipped by B.T.H. for P. & O., were truly electric ships, just as were many smaller vessels (tugs were a particularly attractive proposition) with DC drive. It is surely irrelevant whether an electrically-driven vessel is powered from a generating plant aboard or from batteries charged from a shoreside station? But, if the latter interpretation is insisted upon, then quite clearly the prime example of "straight electric drive" occurs in the case of a conventional (i.e. non-nuclear) submarine which is entirely dependent upon battery power when submerged below snorkel depth. As long as 20 years ago the French "Narval" class had 5000 s.h.p. available submerged, yielding 18 knots, and this may well be more commonplace today although endurance at high speeds would obviously be limited.

There would appear to be renewed interest in marine electric drive in view of published reports on superconducting motor developments and one can well visualise the attraction, where gas turbo-generators are involved, of placing the turbines in an upper-deck position where machinery changes would be simple and the need for vast, space-consuming intake and exhaust ducts obviated.

Malta. T. V. Lavarack, C.Eng.M.I.E.E.

LATHEWORK FOR BEGINNERS

Part V

by the Editor

From page 285

IN MY LAST ARTICLE, I gave brief instructions on making a simple flanged bush in brass (page 285, 4 March), and suggested that after turning the outside, it should be reversed in the chuck for drilling. This unfortunately was not the best way to go about it, as this procedure would not ensure that the bore was concentric with the outside. A better way therefore would be to carry out the drilling operation before reversing the bush in the chuck. As even large diameter drills tend to wander, to ensure that the bore of the bush is really concentric, it is worth while to finish with a boring tool, the last drill used being say 1/32 in. under the finished diameter.

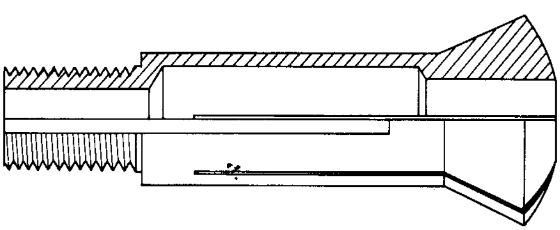
Work Between Centres

Where long workpieces which are too large in diameter to pass through the spindle of the lathe have to be dealt with, they are turned between centres. Lathes are normally supplied with two centres, one hard and one soft. The soft centre is used in the spindle, as it revolves with the work, while the hard centre is used in the tailstock, as this one is stationary.

The first thing to do here is to centre the work at each end. It may be centred merely by scribing lines at 90 deg. across the ends, which are previously filed approximately square, using surface plate (or its equivalent) vee blocks and scribing block. Another method is the use of a "bell" punch. Neither of these methods however are particularly accurate, and a better method is to use a fixed steady on the lathe. The bar to be centred is held at one end in the self-centring chuck or collet, while the outer end is supported by the fixed steady. While mounted in this way, the end can be faced off accurately and the work centred by a "Slocumbe" or centre drill, held in the tailstock chuck.

Where even greater accuracy is required, the end of the work can be centred by the use of a fine-pointed lathe tool, presented to the end of the bar at about 30 deg. The centre drill is then used afterwards. Incidentally, it is a mistake to centre work too deeply, as this can easily spoil the appearance of the finished job. The centre should only be deep enough to ensure proper support for the job in hand.

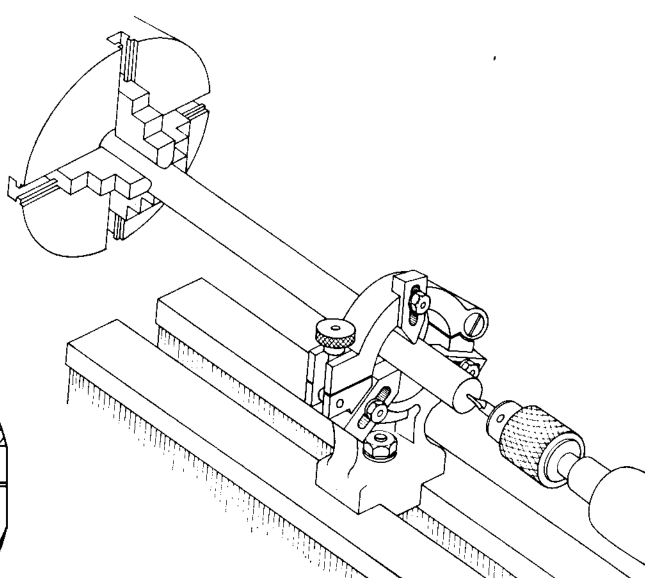
A typical lathe collet, for use with a "draw-in" spindle.



To drive work between centres, it is usual to employ a driver or "catch" plate, which is screwed on to the spindle of the lathe. A pin is provided in the catch plate, and a carrier or "dog" is fitted on the work by means of its grub screw. The pin in the catch plate engages the tail of the carrier, thus driving it around. It is a good plan to keep the two closely engaged by means of a strong rubber band. If no catch plate is available, the lathe faceplate makes a good substitute.

To turn a parallel shaft between centres to a good degree of accuracy, it is first necessary to ensure that the tailstock is truly aligned. Very few of the smaller and cheaper lathes can be relied upon to keep exact alignment between the headstock and tailstock for any length of time, so it is likely that the tailstock will have to be adjusted before accurate "between centre" work can be carried out. One way of doing this is to obtain a length of silver steel about $\frac{3}{4}$ in. dia. Silver steel

Centring the work, using a fixed steady.



comes in 13 in. (or longer) lengths, and this length will do nicely. This is now centred at both ends as accurately as possible, as just described. The silver-steel bar is put between centres and a dial test indicator set up on the toolpost with its plunger bearing on the bar. The saddle is then wound along the lathe bed from end to end and any variation in the D.T.I. noted. The tailstock is then set over in the required direction until no movement can be detected in the "clock" reading. The job can now be set up between centres and a light trial cut taken, when any small variation in diameter between the ends can be corrected.

Another method is really a question of trial and error, and may be used where a micrometer is available, but not a dial test indicator. The material is set up between centres and a light cut taken over the whole length of the material, using the finest feed. Each end is then measured with the micrometer and the difference noted. The tailstock is then set over by *half* the amount of the difference.

It is important, when turning between centres, to adjust the tailstock for end pressure against the workpiece. When turning tough materials, the workpiece will rapidly heat up and will therefore expand quite appreciably, and if the tailstock is not eased to allow for this, its centre will rapidly become overheated and spoilt. Needless to say, the tailstock centre must be kept well lubricated and it is not a bad plan, when dealing with tough materials and heavy workpieces, to lubricate this centre with one of the "high-pressure" greases used in the motor trade.

Turning between centres is never an easy operation, and requires continual watchfulness on the part of the operator, especially when dealing with long slender shafts. A great help in turning long slender work is the fixed steady, mentioned in connection with centring the end of the work. The fixed steady bolts down on the lathe bed, and has three (sometimes more) supporting "fingers" which can be quickly adjusted to support the work. The upper "finger" is generally arranged in a hinged top bar, which can be swung open so that the work can be released without having to move the steady.

The travelling steady is somewhat similar to the fixed steady, but usually has only two "fingers", and it is clamped to the cross-slide or some other part of the saddle, according to the design of the lathe. It is normally arranged behind the work and of course travels with the lathe tool, giving close support to the tool. Although I am fortunate enough to have both a fixed steady and a travelling steady for my own Myford lathe, my travelling steady has not been used for many years, while the fixed steady is in constant use.

In my next article in this series, I hope to say a few words about faceplate work.

JEYNES' CORNER

From page 517

chuck with two sets of jaws, and a "Little Giant" $\frac{3}{4}$ in. capacity drill chuck, while saddle lock, toolpost and taper turning attachment were all operated by the same spanner; the tailstock was lever clamped and the tumbler gear was operated by a lever on the apron.

The only thing I found fault with was the splined leadscrew which was rather inclined to snatch at our dust coats. The ease of manipulation of this lathe was reflected in the fact that when on bonus, an extra pound could be earned without any undue exertion, compared with some of the other lathes in the shop, especially when on one-off jobs. The backgear and gear train were enclosed in cast-iron quick removable covers, and a depth of cut adjustable stop was fitted on the cross-slide, very convenient when screw cutting, feeding in at $27\frac{1}{2}$ deg.

I have never worked on a lathe fitted with a device for withdrawing the tool at the end of the thread being cut, and candidly, I cannot see much advantage, as it would be of no earthly use when cutting internal threads; quickness of the hand and eye take some beating when screwcutting.

I have often noticed people starting a hole (when tailstock drilling) using an ordinary centre drill which has an included angle of 60 deg., which is really nothing like the included angle of a standard drill point, and if the drill is badly ground, so that one lip starts cutting before the other, the hole will run out of true, unless the lathe tool is brought up against the drill to stop its wandering; this is not very good practice really. I always prepared special centre drills having the same included angle as the drill point, and ground the drills to a line scribed on a chalked surface, fulcrumed either in a punch hole, or on a hardened point, according to whether the drill had a centre hole in the end or was pointed.

In the days gone by, the Armstrong holder was used with taper shank drills and reamers; this saved the bores of the tailstock centre taper being scored by drill shanks turning within it. I haven't seen one in use for years; neither have I seen a chasing bar in use for hand finishing threads for a very long time, though I expect Mr. Thomas has both these items in regular use.

Tender Buffers

SIR,—The recent issues regarding the fitting of locomotive buffers, where the buffer comes in line with the frame, one cannot fit the usual nut retaining, due to the frame. Various ways have been shown in *M.E.*, all successful, apart from one error.

When buffers are fitted with no retaining nut, a groove or flat must be machined on the buffer shank, but of course not run right out. The buffer stocks drilled and tapped underneath and a small retaining stud fitted to protrude in the slot in the buffer. This allows the buffer to slide, yet cannot fly out. This has been mentioned in *M.E.* time and again, I can only conclude it is an oversight on *M.E.* but it has not been mentioned recently.

Darlington, Co. Durham. J. H. Gladden

NINTH INTERNATIONAL MODEL LOCOMOTIVE EFFICIENCY COMPETITION

FOR STEAM LOCOMOTIVES OF $3\frac{1}{2}$ in. AND 5 in. GAUGES

THE COMPETITION WILL BE HELD ON THE CHINGFORD TRACK OF THE CHINGFORD & DISTRICT MODEL ENGINEERING CLUB

(By kind permission of the Committee of the Society)

ON SATURDAY JUNE 25th

Commencing at 9 a.m.

The Prizes will be as follows:

The Winner — Martin Evans Challenge Trophy and Cheque for £35
Second — Cheque for £12
Third — Cheque for £8
Fourth — One year's subscription to "Model Engineer"

The winner will also receive an engraved "replica" trophy for permanent retention

ADMISSION FOR SPECTATORS WILL BE BY TICKET ONLY OBTAINABLE FROM "MODEL ENGINEER"

ADMISSION 20p per person. Car parking free

Please make cheques and postal orders payable to "Evans Locomotive Fund"

COMPETITION RULES AND ORGANISATION

1. The Competition will be open to $3\frac{1}{2}$ in. and 5 in. gauge coal-fired steam locomotives.
2. Entry will be restricted to owners who have basically built the engine they enter. (Parts bought "outside" such as pressure gauges, boiler fittings, lubricators etc. will not disqualify). Overseas competitors however may enter any suitable locomotive.
3. No competitor may enter more than one locomotive.
4. Competitors who have entered a locomotive in TWO previous I.M.L.E.C.s will not be permitted to enter the same locomotive, but they may enter another locomotive.
5. There will be 15 entries, accepted on a "first-come first-served" basis. Closing date for entries 15 May.
6. The owner may nominate a driver if unable to drive the locomotive himself, any prizes won would go to the owner, not the driver.
7. Locomotives entered must carry a current boiler test certificate. This (or a Xerox copy) should be sent to the Secretary of the Chingford Society before the event.
8. Coal to be used will be provided by the Host Society in weighed 2 lb. bags, in two grades (of size).

9. As much charcoal, paraffin, meths, or wood as requested by the competitor will be provided and this will be used to raise steam to a working pressure of approximately 60 p.s.i. After exceeding this pressure, and while waiting to go on to the track, the coal supplied may, at the discretion of the driver, be fed to the fire.
10. The train with Dynamometer car will be prepared for the competitor who may choose the size of his load. The duration of the run will be not less than 30 minutes, starting at the station. The timekeepers will keep competitors informed of their progress and will indicate when they are on their last lap.
    The run must finish at the station to unload the passengers. Should drivers stop due to shortage of steam, water or coal before reaching the station, even though they have been running for the full 30 minutes, they must "blow up" and complete their run to the station.
11. No time allowance will be made for stops except in case of derailments.
12. At the end of the run, engines will be taken back to the steaming bays, all unused coal will be collected and weighed in the presence of the driver. No allowance will be made for unburnt coal left in the firebox.
13. The results will be calculated by the Society's officials and displayed on the notice board as soon as possible after the run.
14. The Society's speed limits must be observed. The official observer will warn drivers if speed limits are exceeded. Two warnings will be given, but if a third warning is necessary, this will result in disqualification.
15. Drivers must not lean on their locomotives so as to gain adhesion; they must not apply the brakes in order to increase drawbar pull, although they may of course do so to reduce *excessive* speed or in emergencies. Disqualification may follow disregard of this rule as outlined in 14.
16. Sanding the rails will be permitted at the start only, at the discretion of the Officials. Drivers who have locomotives fitted with working sanding gear are at liberty to use it at any time.
17. The Society will appoint a Panel of Judges, whose decision on all matters appertaining to the Competition will be final.

THE SYDNEY STEAM TRAM

by R. Atkins

In *Model Engineer* 1 August 1975, Mr. Jeynes (p. 768) suggests that a tramway locomotive would make an interesting prototype for a model and concludes by saying that in all his travels he has never seen such a model.

Some years back the late Robert (Bob) Cutcher, a founder member and driving force in the Hornsby and District Model Engineers' Society, made a beautiful model of a 0-4-0 steam tramway locomotive together with single deck and double deck trailer cars and a ballast wagon for $3\frac{1}{2}$ in. gauge. The model tram set (less ballast car) is illustrated in the photographs.

The other photograph is of a full-size Baldwin locomotive and shows Bob on the driving platform. This particular locomotive has been preserved by the "Parramatta Park Steam Tramway", a volunteer preservation society, and is used by them for public running in Parramatta Park (15 miles west of Sydney) on one Sunday in each month. This particular locomotive is claimed to be the only one of its type operating in the world.

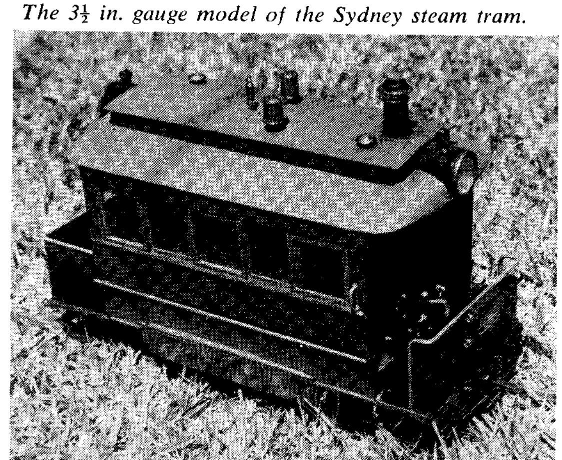
The following information may be of interest, it is based on notes given to me by Bob Cutcher just prior to his untimely death: The first steam tram ran in Sydney in 1879 on a single track about $1\frac{1}{2}$ miles long between Hunter Street in the City and Redfern Station in connection with the International Exhibition 1879/80.

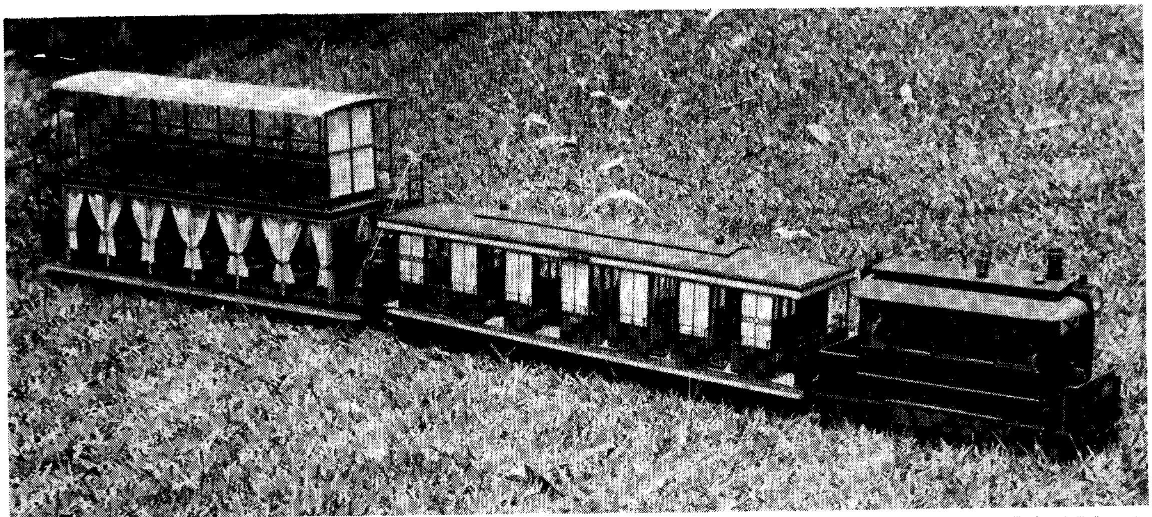
The early locomotives, referred to as "motors", were supplied by Baldwin's of Philadelphia; they were designed for two-man operation and were saddle tank 0-4-0s having two outside cylinders 11 in. dia. x 16 in. stroke. The "motor" was 17 ft. 2 in. long over the aprons, 8 ft. 6 in. wide and weighed 14 tons. Boiler pressure was 120 p.s.i.

Altogether 122 "motors" were supplied, 100 from Baldwin's, the rest being made locally. During their life they changed from two-man to one-man operation, had copper fireboxes and tubes fitted, and gas lamps replaced the oil ones.

The last public tram with a steam "motor" ran in Sydney in 1937 and the last privately owned one in Parramatta in 1943, this latter being No. 1034 as shown in the photograph. Electric traction took over the tramway system in Sydney and the last electric unit was withdrawn in 1961. A few of

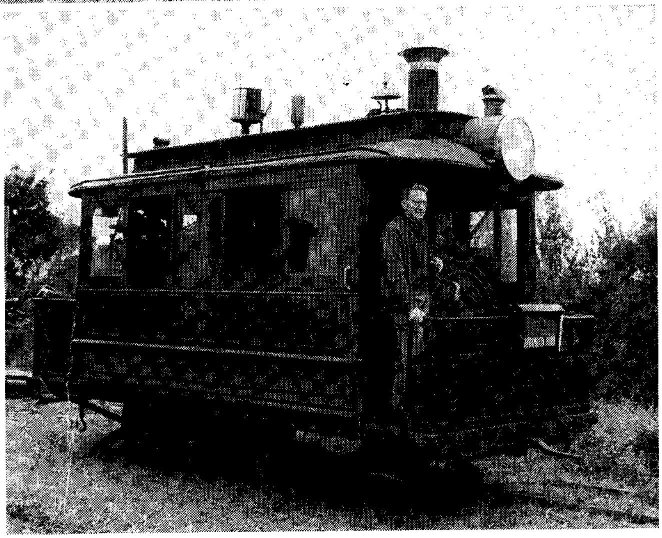
The $3\frac{1}{2}$ in. gauge model of the Sydney steam tram.





The 3½ in. gauge model Sydney steam tram set.

Picture on right shows Bob Cutcher on the footplate of the full-size tram. Photograph by Col Bullard, Melba Studios.



the latter have been preserved and now run at Loftus (15 miles south of Sydney) in a special park belonging to the South Pacific Electric Railway Co-op Society, a group of enthusiastic volunteers.

The original double deck cars had accommodation for 90 passengers seated and were provided with canvas blinds to the lower deck for protection against the weather. At sports meetings it is said that up to 200 persons would be on each car of a four-car set, and as the Sydney terrain is anything but flat, grades up to 1-25, the more energetic passengers often had to get out and push up the steep grades. Later in 1898 the top decks were removed to make way for the change to electric traction with overhead wires; even so, agile youths still made use of the roofs of trailer cars. The vast majority of cars were made locally to local designs.

As regards the model which Bob declared took him about two years to complete, occupying a pleasant hour of his spare time every day, the following details may be of interest: outside cylinders 11/16 in. bore, 1½ in. stroke; Stephenson valve gear; wheels 2¼ in. dia.; boiler 3 in. dia.

The boiler is rated at 60 p.s.i. but Bob usually steamed it at 30 p.s.i. as he found that this was adequate to pull one person up a 1-100 grade without slipping. Bob suggested that with the cab removed the unit was very similar to *Tich*.

The cab is in timber with a clerestory roof in metal as per the original, the metal being used to combat heat problems. The double deck car is all timber, finished in clear lacquer and complete with canvas side blinds. The single deck car incorporates a water feed tank under the floor. The ballast car is a flat topped one as used on construction and maintenance. The complete model of four units is some 7 ft. 6 in. overall and when running free is most realistic.

Hobson Lathe

SIR,—I find one of the more interesting features of *Model Engineer* is the continuing correspondence about older lathes and workshop methods.

I would like to take advantage of your reader's fund of knowledge on these matters to enquire for any information as to instruction manuals or fittings for a "Hobson" 3½ in. machine number 7/220 lathe made by Victa Engineering, Maidenhead.

I have traced the current owners of this firm to Poole in Dorset but they were unable to provide anything. I would gladly purchase any manual that may be for sale, or refund any costs for the short loan for copying of any available information.

Geoffrey Goodship
28 London Road, Merstham, Surrey.

CLUB NEWS

S.M.E.E.

Professor D. H. Chaddock gave a most interesting talk on "scale", with the title "You can't scale Nature, she scales herself", to members of the Society of Model and Experimental Engineers last November. His talk covered linear scales, static structures, heat flow by conduction, stresses in boilers, centrifugal forces, spring design and many other interesting subjects. Items seen on the table included a first attempt at photo-etching by Mr. C. W. Tidy, a Greenly Uniflow engine under construction by Mr. T. W. Pinnock, some collets by Mr. L. Joyce, and a bench type hold-fast by Mr. D. G. Gordon.

Fifty-seven members attended the Annual General Meeting held at the Caxton Hall on 29 January with President Lord Gretton in the chair.

Secretary: A. A. Smith, Marshall House, 28 Wanless Road, London S.E.24.

Worthing and District S.M.E.

This Society continues to grow, with over 80 members to date. The portable track is proving very popular and negotiations are in hand with the local council for land for a permanent track and model engineering centre. For the bi-annual exhibition, two new cups have been presented to the Society. One from Mr. and Mrs. Tanner—the Salvington Cup—to be awarded for the best locomotive or steam prime mover and the Dodd Cup presented by Mr. Ray Dodd for the best marine exhibit, these cups to be contested by members of the Society.

Secretary: J. A. Rea, 80 Goldsmith Road, Worthing, Sussex.

News from Wimborne

A fairly recent Society is the Wimborne and District Society of Model Engineers. This Society meets on the last Thursday of each month at the Flight Refuelling Sports and Social Club, Merley, near Wimborne, at 7.30 p.m. So far there are 35 members and between them there are some twelve 5 in. gauge locomotives under construction. Planning permission has just been received for a ground level 3½/5 in. gauge track to be laid at the above Club ground. New members will be most welcome.

Secretary: T. D. Hargreaves, 13 Churchmoor Road. Wimborne, Dorset.

CLUB DIARY

Dates should be sent at least five weeks before the event to ensure publication. Please state venue and time. While every care is taken, we cannot accept responsibility for errors.

MAY

6 Stockport & District S.M.E. Bits and Pieces. The Parish Hall, Church Road, Cheadle, Cheshire. 8 p.m.

6 Rochdale S.M.E.E. General Meeting. Springfield Park, Rochdale. 8 p.m.

6 Romford M.E.C. Competition Night. Ardleigh House Community Centre, Ardleigh Green Road, Hornchurch, Essex. 8 p.m.

6 Brighton & Hove S.M.L.E. Eric's Film Show by Eric Masters. Elm Grove School, Elm Grove, Brighton. 8 p.m.

7/8 Ascot Locomotive Club. Portable track event at Silver Jubilee Transport Rally. Ascot Racecourse, Berks.

7/8 Birmingham S.M.E.E. BSME 'Jubilee' Exhibition at Alderlea School, Shard End.

7/8 Sunderland M.E.S. Exhibition as part of the "Perth Green Jubilee Festival Exhibition". Portable track, exhibition and other activities. Jarrow Perth Green School, Inverness Road, Perth Green, Jarrow, Tyne and Wear.

8 Bristol S.M.E.E. Public running. Track at Ashton Court, Bristol. 11 a.m.–6 p.m.

8 King's Lynn & District S.M.E. Society Boat Competitions–British Industrial Sands Ltd. Lake at Leziate. 10 a.m.

8 Bracknell R.S. Public operation of Jocks Lane track, Bracknell, Berks. 3 p.m.–6 p.m.

8 Brighton & Hove S.M.L.E. Portable track and display, Horsted Keynes, Bluebell Railway.

9 Bedford M.E.S. Building Model of "SS Caernarvon Castle" by Mr. P. Lambert. Clubhouse, Wilstead.

9 King's Lynn & District S.M.E. Monthly Meeting. St. James School, London Road, King's Lynn. 7.45 p.m.

9 Fareham & District S.M.E. Society meeting. "Royal Oak", West Street, Fareham. 7.30 p.m.

10 Guildford M.E.S. Executive Committee Meeting.

11 Southampton & District S.M.E. General Meeting. Atherley Bowling Club, Hill Lane, Southampton. 8 p.m.

11 Sutton Coldfield Railway Society. Annual General Meeting. Wylde Green Library, Emscote Drive, Little Green Lanes, off Birmingham Road, Sutton Coldfield. 7.30 for 8.15 p.m.

12 Leyland, Preston and District S.M.E. Meeting. Roebuck Hotel, Leyland.

13 Melbourne S.M.E.E. Film Night. A.R.E. tour of U.S.A.—W. Chalmers. 92 Wills Street, Glen Iris. 8 p.m.

13 Polegate M.E.C. "Articulated Locomotives" by Mr. B. Jackson.

14 S.M.E.E. Talk—The Doble: Last of the Great am Cars—Mr. R. O. Bell.

14 orth London S.M.E.E. Society visit to the Bluebell Line.

14 Gauge "1" Model Railway Assoc. Get Together. St. John's School, M.R.C. Leatherhead, Surrey.

14/15 Milton Keynes M.S. Portable live steam track. Stacey Hill, Wolverton, Milton Keynes. 11 a.m. onwards.

14/15 Tyneside S.M.E.E. Open Day. All welcome.

15 Guildford M.E.S. First Public Open Afternoon. Headquarters, Stoke Park. 2 p.m.–6 p.m.

15 Furness Model Railway Club. Open Day with the Barrow Ship Model Society. Public Park, Park Drive, Barrow-in-Furness. 11 a.m.

15 King's Lynn & District S.M.E. Public running. Walks Track, London Road, King's Lynn. 2–5 p.m.

15 Worcester and District S.M.E. Public running day. 3½" and 5" elevated and 3½", 5" and 7¼" ground level tracks. Waverley St. Diglis. 2.30 p.m.

15 Cannock Chase M.E.S. "Steam Up" Cannock Park. 2 p.m.

15 Cambridge & District M.E.S. Locomotive Rally. Fulbrooke Road, Cambridge. (2½", 3½", 5" gauges). 10 a.m.

17 Milton Keynes M.S. Visit by Buckaneers M.C. Royal Engineer, Stratford Road, Wolverton, Milton Keynes. 8 p.m

17 Chesterfield and District M.E.S. Guns and Gunsmithing by Mr. F. Hall. Bryan Donkin Co. Ltd., Derby Road, Chesterfield. 7.30 p.m.

18 Guildford M.E.S. Final Bits and Pieces evening. Headquarters, Stoke Park. 7.45 p.m.

18 Bristol S.M.E.E. Great Western in Action. Slides by Hugh Ballantyne. B.R. Staff Association Club, Temple Meads at 7.30 p.m.

18 Sutton Coldfield Railway Society. Sight and Sound by David Beardmore. Wylde Green Library, Emscote Drive, Little Green Lanes, off Birmingham Road, Sutton Coldfield. 7.30 for 8.15 p.m.

18 Cannock Chase M.E.S. "Metal Casting" —Mr. K. Knowels. Lea Hall Club, Sandy Lane, Rugeley. 7.30 p.m.

19 Nottingham S.M.E.E. Hot Air Engines—Professor D. H. Chaddock. The Friends' Meeting House, Clarendon Street, Nottingham. 7.30 p.m.

19 Hull Society of M.E. Rummage Sale of unwanted items of equipment. Trades & Labour Club (Room 3), Beverley Road, Hull. 7.45 p.m.

20 Stockport & District S.M.E. Mr. Kay—7¼" Gauge Locomotives. The Parish Hall, Church Road, Cheadle, Cheshire. 8 p.m.

20 Rochdale S.M.E.E. General Meeting. Springfield Park, Rochdale. 8 p.m.

20 Romford M.E.C. Track Night. Ardleigh House Community Centre, Ardleigh Green Road, Hornchurch, Essex. 8 p.m.

20 Brighton & Hove S.M.L.E. Workshop. Elm Grove School, Elm Grove, Brighton. 8 p.m.

21 King's Lynn & District S.M.E. Dereham School Fete—Portable track in operation.

21 North London S.M.E.E. Southern Federation Rally—Blenheim.

21 Ilford & West Essex M.R.C. welcomes members and prospective members of Model Railway Clubs, Model Engineering Clubs and Preservation Societies, to their open day. Clubhouse adjacent to Chadwell Heath B.R. Station. 10 a.m.–6 p.m.

21 Chesterfield and District M.E.S. "Efficiency Trials". Hady Track. From 1.30 p.m.

21 Wigan & District M.E.S. Meeting at Co-operative Guild Room, Thompson Street, Whelley, at 7.15 p.m.

21 Southern Federation Rally. Blenheim.

21 Polegate M.E.C. Open Day. Martelo Beach Caravan Park, Pevensey Bay, Sussex. (Boiler certificates must be shown).

21 The White Horse M.R.C. Model Railway Exhibition, Memorial Hall, off Station Road, Wootton Bassett, Swindon, Wilts. 11 working model railway layouts in all popular gauges. Light refreshments available. 10.30 a.m.–8.30 p.m. Details from Reg and Audrey Palk, 5 Bradene Close, Wootton Bassett, Swindon, Wilts. SN4 8DG.

21/22 Southend Round Table. Steam Engine Rally. Hullbridge, Essex. Free car parking. Proceeds donated to Charity.

21/22 Cambridge Museum of Technology. Special event—"Craft and Steam". Cheddar Lane, Cambridge. 11 a.m.–6 p.m.

22 Bristol S.M.E.E. Public running. Track at Ashton Court, Bristol. 11 a.m.–6 p.m.

22 Ardeer Recreation Club. Monthly meeting—Ardeer Track. 2½", 3½" and 5" gauge. 12 noon–6 p.m.

23 Bedford M.E.S. Informal Meeting. Clubhouse, Wilstead.

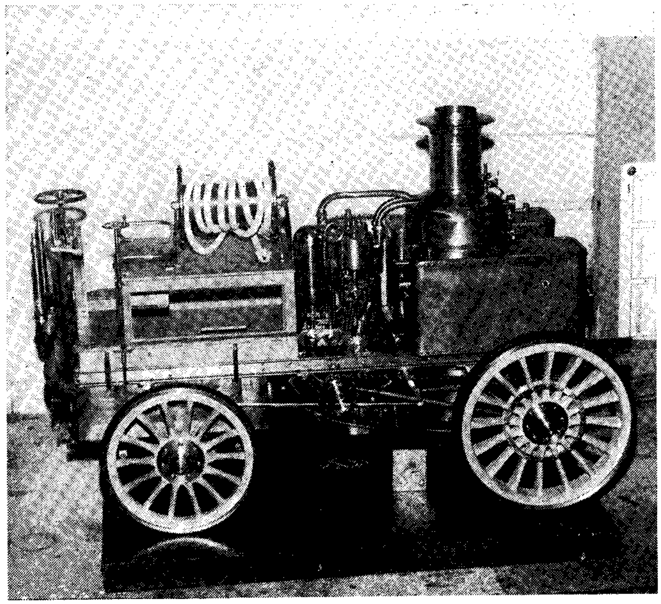
25 Sutton Coldfield Railway Society. Zaire Railways by Peter Johnson (slides). Wylde Green Library, Emscote Drive, Little Green Lanes, off Birmingham Road, Sutton Coldfield. 7.30 for 8.15 p.m.

26 Leyland, Preston and District S.M.E. Meeting. Roebuck Hotel, Leyland.

27 Hereford Live Steamers. Monthly meeting. White Swan, Aylestone Hill, Hereford.

Two Model Fire Engines

by G. D. McLeman



LIKE MANY READERS, I suspect, there is a model one always intends to build, and yet somehow never gets beyond the drawing board stage. In my own case it was a "Merryweather steam self-propelled fire engine". For many years I had gathered information intending to build a "Fire King", but for one reason or another that was as far as I had reached, until I was asked by a client to build two "Fire Kings", a heavy duty version, followed by the lighter type. So at last I was able to get down to the actual building.

As the full-size engines were built to individual customers' requirements, no two engines were exactly alike, so I had first to decide on a type, and I picked the engine as used by the Cardiff Fire Brigade, from 1905 to 1916.

Whilst building my models I like to build up a picture of the prototype when it was in use, and the comments of the period varied from, and I quote from the *Fireman* of 1908: "These engines equalled, if not exceeded the most sanguine hopes of their supporters".

To another view in a much later publication: "The engine was a most capricious beast on the road!" So I imagine that the truth lay somewhere in the middle.

One of the sad facts is that not even one of these engines has survived to the present day. This also meant that I couldn't measure a full-size version, as I usually like to do, although I have learnt the hard way never to accept the fact that all restored engines are correct as originally built. One of the problems of earning a living doing model engineering is that one has to satisfy the customer besides oneself. So I have learned to get information from all sources possible and then build up drawings, cross checking all the time. One can always rub out a few lines on a drawing!

A scale of $1\frac{1}{2}$ in. to 1 ft. was required, so all was settled now, just building from here on. As both engines were built in a similar manner, I will only describe the first model.

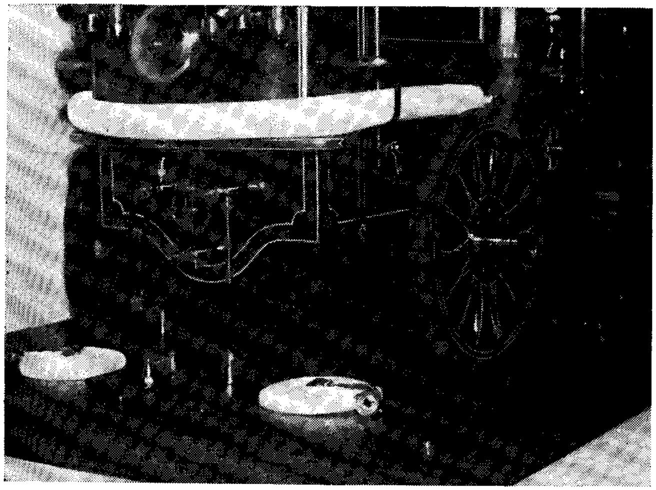
The two main chassis members are 18 in. long, $\frac{1}{2}$ in. x 5/16 in. steel channel section, and onto these is riveted the front trough, built up from sheet steel, having flanged plates front and rear; this is 6 in. long, 5 in. wide, and $3\frac{1}{4}$ in. deep. Riveted onto the trough are the spring hanger brackets and a small bracket to support the steering bell crank.

Attached to the front of the engine is the apron, also built from steel, 5 in. wide and $3\frac{7}{8}$ in. high. This carries the driver's controls, branch nozzles, bell and lamps. The controls are three long hand levers, being throttle, reversing lever, and a brake on the differential, of the contracting band type. The rear wheel brakes are expanding type in the rear brake drums, operated from a hand-wheel on the nearside, fitted onto the hosebox. Pressure gauges, and a small hand lever to the cylinder drain cocks of the steam pump, are also fitted to the apron.

The steering mechanism is quite complicated, by turning the wood-covered steering wheel, $1\frac{3}{4}$ in. dia., a left-handed die block moves two vertical rods at the front of the apron, operating a bellcrank, which in turn operates a rod to another bellcrank on the front axle, from this bellcrank by track rods to the stub axles. I hope that can be understood! On the lighter engine the second bellcrank is omitted.

The front axle is cut from $\frac{1}{4}$ in. steel plate, being lowered at the centre to clear the front trough. Front springs are $\frac{1}{4}$ in. wide, $3\frac{5}{8}$ in. long and consist of 10 leaves, having curved ends. Hanger plates provide movement.

Before leaving the front trough I will mention the "Kemic". This is a copper cylinder 2 in. dia. having domed ends, in all $4\frac{1}{2}$ in. long, carried inside the trough, with operating valves at the front. This device is a quick-acting method to control small fires. The "Kemic" is partially filled with a mixture of water and soda. In use a small bottle of acid is broken and the resulting interaction pressurises the mixture. The delivery is through



the hose reel on top of the hosebox. The main pumps can be connected to the hose reel, if needed, via the bottom valve. Naturally the cylinder can be flushed through this valve also. The centre handwheel operates the striker mechanism, and also works a paddle to thoroughly mix the contents. The top left-hand valve is delivery, and top right the overflow. Inside the hosebox is a fitting for the acid bottle, and here too is fitted a safety valve. The hose reel is 2¾ in. dia. by 3 in. long having ⅛ in. dia. brass tube handles, and brass spokes. The hose is 5/32 in. dia. rubber. A rotating gland is fitted at the rear to enable the hose to be run out. The unit is supported on steel stanchions.

The hosebox is of wood having hinged doors at the sides, and a hinged door under the driver to provide access to a small toolbox. The brass handrail is ⅛ in. dia., as are the two small handrails on the sides of the apron. Attached to the hosebox, which is 5½ in. long by 2¾ in. high, are the hinged footboards, having a metal covering with a raised pattern to provide grip. These footboards are hinged to allow removal and storage of the suction hose. Footboards are also of wood, being 7 in. long and 1½ in. wide.

The water tanks on either side of the boiler are of brass, having flanged plates top and bottom, the whole assembly is riveted together, and a ⅛ in. half round beading fitted onto the top edge. These tanks are attached to the mainframes by small brackets. The inner faces of the water tanks are curved to correspond with the boiler. They are 5½ in. long.

Various tank fittings are filler caps, delivery from main pump, injector on the offside, air vent and a balance pipe at the rear. A water level gauge is fitted at the nearside rear, and at the rear end of both tanks there are brass handrails for the stoker. Suspended from the mainframes at the rear is the footplate for the stoker, formed of steel strips on edge and carrying a small toolbox either side. This footplate is 5½ in. wide by 2¾ in. deep, supported by rods at the sides, and steel strips connected to the boiler extension.

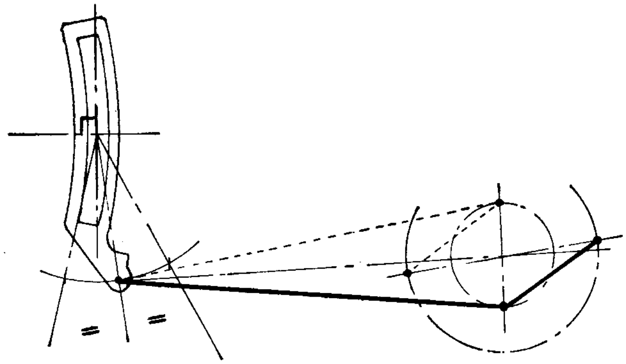
The rear axle is of ¼ in. square steel, having 3/16 in. dia. turned ends, and bent to clear the boiler. Road springs are again ¼ in. wide, and have 16 leaves. The movement of the rear springs is allowed for by sliding brackets at the ends, moving along fixed plates on the mainframes. A tension bar from the rear axle to the driving sprocket bearings maintains correct driving chain tension.

The rear wheels are built from wood, having the root of the spokes tapered to fit around the metal hub caps. A steel strengthening ring is fitted to support the driving sprockets and brake drums. The rim of the wheel has metal rings to hold the solid rubber tyres, double at the rear and single at the front. Wheel diameters are 4¾ in. front and 5¾ in. at the rear, 14 spokes for the front wheels and 16 on the rear. Hub caps of brass, outside, and steel inside 1 7/16 in. dia. are bolted together having the spokes sandwiched between the two. The hub nuts are octagonal and of brass.

The boiler is of the now familiar cylindrical type common to most fire engines, and on this model is of copper with horizontal water tubes and J type vertical tubes. For reasons of necessity I only fitted 50 tubes. The full-size boiler had over 200, but I felt that this would create more problems than necessary. The boiler has proved satisfactory as built, so nothing was lost. The outer shell is 3¼ in. dia. 16 g., and the flared lower skirt 4¼ in. dia., 2 in. long. The firebox is 3 in. dia. and matches the outside shape leaving a small water space between. A gunmetal ring provides a means of dismantling the boiler, and has 50 bolts for assembly. This ring proved a source of leaks for a while until after a couple of pressure tests and tightening of the bolts it finally gave in.

To be continued

Walschaerts valve gear—see letter by D. L. Ashton on next page.



The Editor welcomes letters for these columns. He will give a Book Voucher for £3.00 for the letter which, in his opinion, is the most interesting published each month. Pictures, especially of models, are also welcomed. Letters may be condensed or edited.

Walschaerts Valve Gear

SIR,—If Dr. Burrows' letter (Vol. 143, No. 3556) concerning Walschaerts' valve gear seeks to demolish the "extraordinary and unsubstantiated" criticism I made of his hypothesis it is unfortunate that it serves only to confirm his preoccupation with a self-designed "geometric constraint" *at the expense of the prime criteria.* Mathematical exactitude is useless if the *sine qua non* of the expansion link/return crank mechanism cannot be satisfied. The timing link between this mechanism and the piston is through the main crankpin, which is absent from all Dr. Burrows' illustrations save Fig. 1 on page 856, in which, incidentally, it is wrongly placed.

Readers who have made and set up Walschaerts' gear will recognise the following essential elements in their setting procedure. This is *the* twofold prerequisite for the quadrature component:

1) When the main crankpin is on each dead centre in turn the expansion link must be at 90 deg. to the radius rod centreline in midgear, and

2) This position shall be the centre of the link's angular excursions.

The importance of condition 1) is paramount, whilst condition 2), within fairly fine tolerances, is an ideal. These elements are expressed visually in the accompanying diagram.

The consequence of ignoring condition 1) is to interfere with the excellent equality of admission points inherent in a properly designed Walschaerts' gear. Because lead is a small "event" dimensionally even a slight gear error could easily cause its total obliteration, or an inequality of well over 100% in the points of admission between front and back ports. Moreover, the connecting rod's angularity effect is only zero at dead centre crank positions, so there are only *two* stroke positions which are exactly 180 deg. apart. Where we have two points in the cyclic path of the gear with the same 180 deg. spacing requirement it is logical to make rigid constraint with the crankpin in these positions, as we do via the return crank. However accurately condition 2) is portrayed the result is modified by connecting rod angularity, hence its secondary importance relative to condition 1).

Therefore it is the *"upper and lower"* pitch circle points which must be 180 deg. apart, like the dead centres, and equidistant from the expansion link tailpin when that link is positioned as in condition 1), even if condition 2) is closely but not exactly met. My template method of finding backset ensures this within fine limits and avoids the error shown in Dr. Burrows' Fig. 2L.

Dr. Burrows' scheme ingeniously achieves equal expansion link excursions for equal quantities of wheel revolution (the basis of his thesis), but as this does not constitute *equal distances of piston travel* the timing of events is not equal. Furthermore, a momentary reflection will reveal that his scheme shifts the cyclic errors from their most innocuous points to those very places (dead centres) where it is imperative that no error should exist. I'm afraid his tone of contempt for what he calls "workable arrangements" is misplaced. Their superiority over most others throughout the history of the steam locomotive is proven, and while I am not averse to progress, this is rarely achieved by violating first principles.

Incidentally, the view that the analysis of valve gears is easy is not shared by me or my many contacts interested in valve gears, nor by my 70-odd colleagues in the local M.E.S. According to the mass of literature produced and the cases of blatant error even on full-size designs, the professionals would not agree either. G. J. Churchward said as much.

Manchester. D. L. Ashton

Walschaerts Gear

SIR,—Further to my last letter on this subject, where such strongly held convictions exist on both sides in a discussion of this kind, one has to look for a deeper reason than an obstinate refusal to see the other man's point of view. In the present case, I think it is the adoption of two distinct and conflicting sets of criteria. Dr. Burrows has chosen to set the limits of total link swing to coincide with points on the return crank pitch circle diameter 180° apart and accept that the points on the P.C.D. corresponding to the central position of the link are not 90° from those corresponding to the limits of link swing. On the other hand, the traditionalists with their dividers, adjustable geometric models, or other pet methods, of whom I am one, strive to obtain a *central position of the link* coinciding with points on the return crank P.C.D. 180° apart, in conjunction with equiangular swing of the link related to positions on the P.C.D. 90° from those corresponding to the central position of the link, and accept (or are happily unaware of) the fact that this may involve some measure of overswing at other points on the P.C.D. As the error which Dr. Burrows accepts is in a highly critical part of the cycle and the error we traditionalists accept is not in a critical part of the cycle, I for my part opt to remain with the devil I am on slightly more familiar terms with! Furthermore, as Dr. Burrows has already observed in reference to the article by you, Sir (Vol. 142, No. 3548), the error is so small as to be difficult to detect with dividers. On the other hand, there must be few of us who would be content to accept a situation where movement of the die-block up and down the length of the link slot produced movement of the valve when the main crank is on either dead centre.

Hampton Hill. H. W. Holmes

Locomotive Variable Blastpipes

SIR,—With regard to Mr. Riddington's article under the above heading (*M.E.* 3557), I do not know who was the first to fit a variable blast nozzle to a steam locomotive but, reproduced in D. K. Clark's *Railway Machinery* of 1855, is a very fine engraving of a Sharp Bros. 0-6-0 goods engine, "Sphynx", showing such a device, worked from the footplate. This machine, which was ordered by Richard Peacock, Locomotive Superintendent of the Manchester, Sheffield and Lincolnshire Railway and designed by Charles Frederick Beyer, the builder's chief draughtsman and later manager, was delivered in July, 1850, and was a modified version of the "Actos" class of 0-6-0 goods engine, introduced in May, 1846, some of which were also fitted with variable blastpipes by Peacock. It is an interesting point that Beyer, Peacock and Henry Robertson founded the firm of Beyer, Peacock & Co. Ltd. in 1854, whose locomotives were second to none and were known all over the world.

As the result of numerous tests, made in 1850, with blastpipes of different sizes and heights, Peacock adopted the practice of placing the exhaust nozzle lower than had hitherto been customary. Full accounts of these tests were published by Clark as were results of similar tests made by Camille Polonceau, Locomotive Engineer of the Paris-Orleans Railway, at about the same time.

Many different forms of variable blastpipe were tried in this country over the years, such as the movable cone, which both Thomas Whitelegg and H. A. Ivatt coupled to the reversing gear so that the blast nozzle was reduced as the valve travel was shortened, the macallan top cap, Jones back hole type, N.E.R. sliding type and Churchward jumper. Just one hundred years ago, in 1877, the London, Chatham and Dover Railway fitted twelve of their engines with the Polonceau rectangular blastpipe, with two sides of the orifice hinged at the bottom, which could be opened or closed from the footplate. Most of these devices were eventually discarded because of the difficulties in maintaining them in working order.

As to the concentric double tube superheater element, this is almost as old as the firetube superheater and, as early as 1904, F. J. Cole, one-time Motive Power Superintendent of the New York Central and Hudson River Railroad and later Chief Engineer of the American Locomotive Company, had designed a superheater with straight concentric or field tube elements. Many locomotives in America were fitted with this superheater and G. J. Churchward fitted one to his "Star" class 4-cylinder 4-6-0, 4010 *Western Star*, when it was built at Swindon in May, 1907. Churchward adopted this type of element in the first Swindon superheater, as fitted to his Pacific *The Great Bear* in 1908, but later changed to a return bend, keeping it single pass, as distinct from the Schmidt and Robinson elements which were double pass.

I was interested to see Mr. Piddington's remarks regarding LBSC's *Jeanie Deans*. I was fortunate enough to be able to drive this little compound many times, over a period of almost thirty years, from when she was brand new on "Curly's" track, just after the war, until shortly before she was stolen from the late Reggie Hanks' home in Oxford in January, 1976. It was through this machine that I met LBSC. She was a fascinating engine to drive, a great favourite of mine, and I often wonder where she is now.

New Romney, Kent. George Barlow

"Firefly"

SIR,—I have now completed your delightful 3½ in. gauge Prairie Tank, *Firefly*.

It is modelled on 4588 which survives and is running on the Dart Valley Railway, Paignton to Kingswear, here in Devon.

I have been able to get all around the original taking numerous photographs with the result that a good bit of detail has been incorporated.

Rebuilding over the years 4588 has created a number of differences from its original form.

The present engine has no rivets in vertical lines on the side tanks; the replacement tanks have been welded, I have therefore left them out on the model. The model also has sliding wind guards on the cab sides, a coal lamp guard on the back of the tender, etc.

I have taken a series of photographs of various details during the process of building which will no doubt be of interest in a future article on the model if you are interested.

The enclosed couple of photographs show the model up quite well, proving that the proportions in your drawings are accurate!

The model has been painted, Reeves transfers and etched brass plates fixed on so that the appearance is quite attractive. Rear sand boxes, which are quite a feature on the original, have also been fitted.

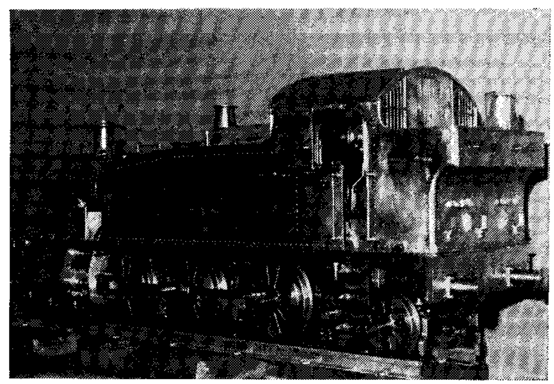
We had a steam test last Sunday and apart from blowing out a gauge glass, it was a great success.

I started the model on 7 January last year and with the experience gained from this and the previous effort, *P. V. Baker*, my next project, *Evening Star*, 9F, should not take too long.

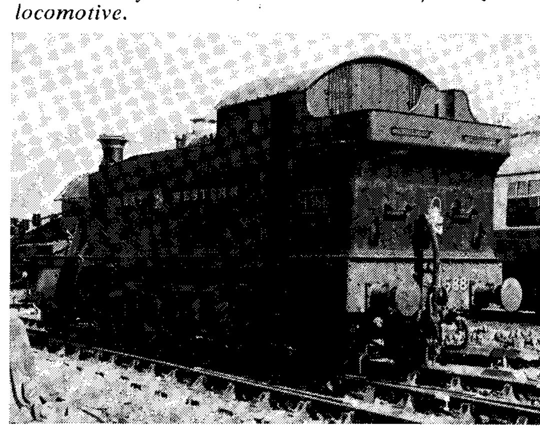
I have written to Dave Piddington at Reeves for outline drawings and I hope to go to York later in the year to get some photographs in the Museum. The service I have had from Reeves is really first class; they are most helpful with nearly everything the model engineer can need.

Wishing you all success with *M.E.*

St. Leonards, Exeter EX2 4LP. Kenneth D. Hornsby



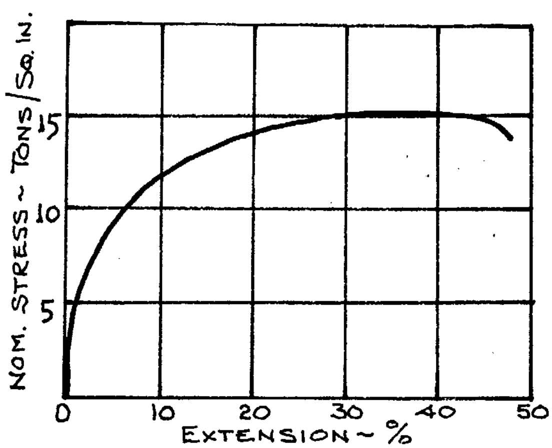
Mr. Hornsby's 2-6-2T, and below—the full-size locomotive.



Strength of Copper

SIR,—I find myself a little confused! On page 341 of the 18 March issue, Mr. Wilson tells me I cannot strengthen copper by stressing it because the material has *no* Yield Point; whilst on page 351 Dr. Phillips tells me that I can't do it because I didn't stress it *above* the Yield Point; this confusion being confounded by the fact that my experience shows that the procedure I suggested (page 19, 7 January) *does* work-harden the shell of a boiler!

To deal with Mr. Wilson first. It is true that copper has no Yield Point as defined by B.S.I. It behaves in a plastic manner—that is, deformation is not proportional to stress and the stress/strain curve *is* a curve, and not a straight line over most of its length as in the case of steel. (Other materials, aluminium, for example, have similar properties.) In place of the "Yield Point" designers use the "Proof Stress"—that is, the stress at which the material takes a stated deviation from the straight line under load. Often 0.1%, but other figures can be used according to the duty. The sketch attached shows a curve of this sort—for annealed copper, as it happens.



It is *not* true that work-hardened copper is "very little" stronger than annealed; the Ultimate Tensile strength of annealed copper is about 14 tons/sq. in., that of 90% cold worked being 29 tons/sq. in. The corresponding 0.1% proof stresses being 4 tons and 25 tons/sq. in. Quite a difference! (For "half-hard" copper the figures are about 19 and 16 tons/sq. in.—the considerable improvement in proof stress being the important thing.)

Now for Dr. Phillips. First, copper only obeys Hooke's law over a very small part of the stress-strain curve. (He has, I think, been confused because many American textbooks refer to "Proof Stress" as "Yield Point", thus suggesting that the stress-strain curve is linear.) The sketch already referred to makes this clear. The "limit of proportionality" for annealed copper—that is, the point at which the curve can be detected as parting from a straight line—is just under 2200 lb./sq. in. (150 Bar—if you *must* use S.I!), not 9000 as he suggests; the latter figure is the *proof* stress. My test pressure was some 25% above the limit of proportionality, so that some workhardening does take place. It is, of course, rather more complicated than this, as a Ph.D. will readily appreciate, for we are applying a repeated stress to a material that behaves in a plastic manner and after each application of stress the properties of the material have been changed. Further, the simple stress calculation (that stress = PD/2t, P being pressure, D diameter, t thickness) applies only to the shell. The flue and the endplates are more highly stressed by the test pressure and hence more considerably affected; which is as is desired.

I am afraid that his comments on temperature effects may be similarly influenced by his misunderstanding of the use of elastic limit, though I quite agree with the conclusions he draws. At a working pressure of 100 lb./sq. in. (gauge) the steam temperature will be 338°F., and the outer shell will be at or about this temperature. Heat transmission surfaces may be as much as 50°F. higher, though; and in superheater elements higher still. The allowable *working* stress in copper shell tubes (internally pressed) at 400°F. is 2500 lb./sq. in., corresponding to a factor of safety of 4 on the creep strength of copper at this temperature. (Creep? No—not you, Mr. Editor! Creep strength is the stress at which the material will stretch slowly to 0.01% of its length in 1000 hours under continuous load.) The recommended working stress at 350° is about 5000 lb./sq. in. for half-hard sheet.

Note, now! Both of these figures are above the limit of proportionality for the fully annealed copper and, as the "authorities" state, "... test pressure may well cause plastic overstrain, with consequent strengthening of the copper ... ". It is fortunate for model engineers that copper *does* behave in this way, otherwise our boilers would be monstrously heavy—bad enough as it is, the price being almost prohibitive!

For the record, I use the following figures for most of my work, they being taken from a reasonably modern table of properties of copper:

State	Limit of proportionality	0.1% proof stress	Ultimate strength
Annealed	2,200	9,000	30,000
10% worked	15,000	27,000	38,000
Half-hard	21,000	36,000	44,000
Hard (60% worked)	27,000	47,000	56,000

The figures being lb./sq. in. in each case.

Incidentally, it is perhaps worth mentioning that it is difficult to anneal very hard-worked copper and it is best to ask for "soft" or "half-hard" tempers.

Kendal. "Tubal Cain"

In Reply to Mr. L. G. Eldridge, Shoreham-by-Sea

SIR,—Whilst the content of Mr. L. G. Eldridge's contribution in 4 March issue is substantially correct, we do not think it can be aimed at suppliers who cater generally for the model engineer. Our Far Eastern counterparts and other overseas suppliers do little to relieve our frustration on low demand specialised products, and it is all very well quoting the supply of 10,000 small repetition parts, and it would be interesting to know how many British firms were approached. In our own field of trading such quantities could not even be considered.

The item promoting Mr. Eldridge's letter is a very well-known product, and is one of many accessories offered by a reputable manufacturer who is constantly aware of the supply and demand position. Every item of their merchandise is produced to a standard known to model engineers, and the only guide they have to demand is previous production and sales information; should a sudden high number of sales develop on one particular accessory it cannot be corrected by further production overnight, and several months precede any production schedule. It is not from choice that either the manufacturer or the supplier is unable to meet his customers' needs, both are only interested in concluding a sale in order to make profit and remain in business.

The non-availability of a popular make of tool does not mean there is apathy within the organisation, and I assure you we as a major supplier to the model engineer are continually increasing our stocks in an effort to satisfy the customer and reduce the work involved in balance orders. It is a fact that even standard items of furniture, office equipment, and many others cannot be obtained off the shelf, and to criticise makers and stockists through failing to realise certain items are not freely available is due to a lack of forward planning on the part of the customer.

W. D. B. Crisp

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The Barker Lathe

SIR,—In "Postbag", 18 March, Mr. Lachlan MacLeod asks for information about the "Barker" lathe. This lathe was described and illustrated in *Model Engineer,* volume 101, page 60, on 14 July 1949, and again, in rather more detail, in *Mechanics,* volume XLVII, pages 320 and 321, on 17 February 1950. Apparently the machine was first marketed around the date of the earlier article. *Mechanics* was of course later amalgamated with *Model Engineer.*

Although around this time I used to visit the London tool and machinery dealers quite frequently, and also occasionally attended exhibitions, I never saw a "Barker" lathe, and I have never seen one since, so I do not think that many of them were made. In the articles referred to it appears to be completely accepted that the three-bar bed is a deliberate and important design feature; there is no suggestion that it was in any way an expedient to overcome a shortage of castings, and indeed I do not think that this can have been the case. At the time quite a number of small lathes were on the market—far more than at the present time—and Myfords had just reduced the price of the ML7 because of increased production, to quote their advertisements, so there can hardly have been a shortage of cast iron.

I wonder why the lathe was not more successful? Both of the articles mentioned spoke highly of it, that in *Mechanics* being specially enthusiastic: it was headlined in part "Critics, confounded, have now admitted that the unorthodox sometimes pays off". Were the critics right after all? Or was it simply a question of price and failure correctly to identify the market? It seems to have been a fairly elaborate and expensive machine; the price with standard equipment was £135, or with extras, £240. By contrast, the reduced price of the ML7 was just under £40, which makes the "Barker" worth well over a thousand pounds at today's values.

What intrigued me, however, and set me burrowing among my back numbers, was Mr. MacLeod's statement that his lathe was "in remarkable condition" after what may well be close on thirty years of work. It occurred to me that the three-barbed idea, if it has stood the test of time, might have possibilities for the present-day amateur who, despairing of being able to afford his own lathe, decides to try to build one. It would not be easy, but the job *could* be managed with the aid only of another lathe—no elaborate patternmaking and no large flat surface or long slideways to finish. The details could of course be simplified or made in more conventional fashion. A good photograph of the "Barker" lathe might well interest many readers.

Bury St. Edmunds. E. L. Dellow

Tools at the Exhibition

SIR,—I was very interested in your opening remarks in "Smoke Rings" in 18 March issue of *M.E.* re H.R.H. The Duke of Edinburgh inspecting some of the tools etc. as shown on the cover of 6 November 1952 issue of *M.E.*

I value this cover very much, as it looks as if he was looking at *my* twist drill grinding jig, as the twist drill on the vee block is plainly visible (awarded Commended diploma).

I might add this was a very elaborate and adaptable tool to make, and, at that time, the only machine tool I had to machine slides, vee blocks, etc. was a treadle 1909 flat bed Drummond lathe, which was also my drilling machine when too much was required of the breast drill.

Also, in this last issue on page 318 Mr. Walshaw's Rotary Gnome Engine was very much of interest to me, as in 1916-17 I made many parts for these engines in works at Caversham, Reading, on a big Warner & Swasey capstan lathe, turning long noses, i.e. crankcase to prop boss, prop bosses, pistons and rings, thrust blocks, which were in effect big end bearings and many small parts.

On the next machine to mine, the cylinders were bored and turned. These were steel forgings, and the cooling fins were roughed out and formed two at a time and finished one at a time with a single tool. Cylinders were bored out to take a cast iron liner.

These engines were completed there, run and tested.

Wimborne. R. S. Shute

Screwcutting in the Pittler Lathe

SIR,—Thanks to Martin Cleeve in his article of 18 December, page 334, which suggested the modification necessary to give instant pick-up for all thread pitches. In the case of the Pittler lathe it is only necessary to remove four dogs from the existing five-dog clutch and the conversion is complete.

The lathe mentioned by E. H. Jeynes on 17 December 1976, page 1291, used by Miss Cherry Hinds is a Pittler and has a trapeze shaped bed.

Hereford. George Gay

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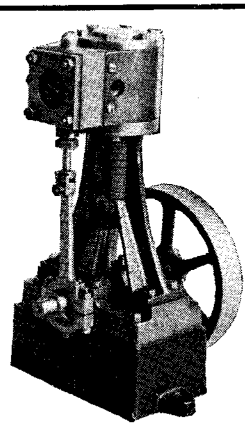

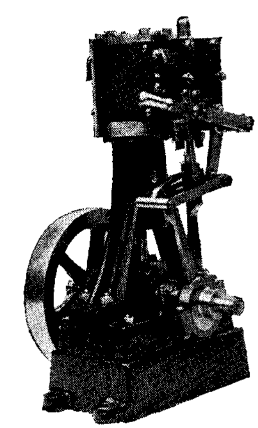

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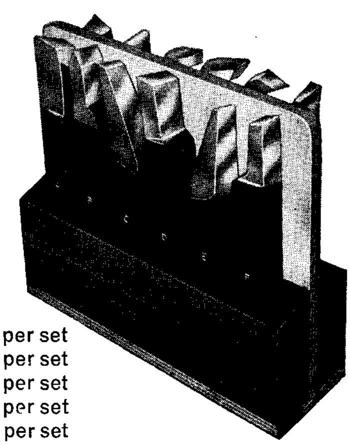

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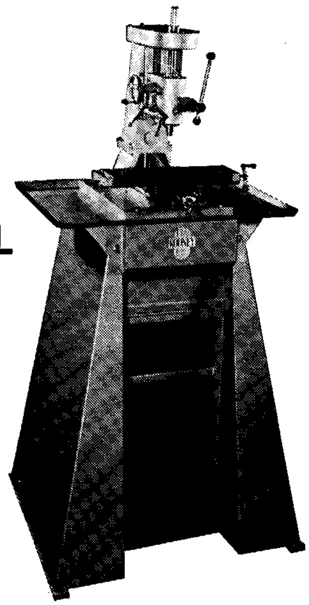

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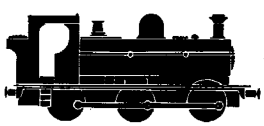

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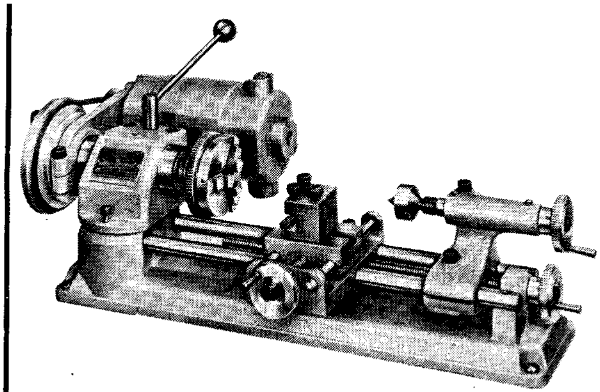

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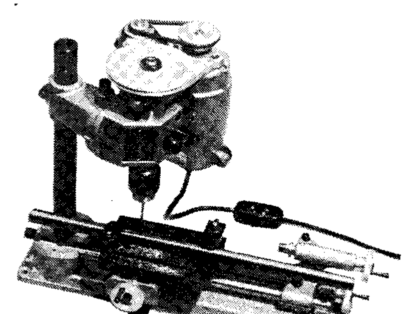

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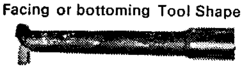
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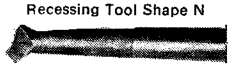
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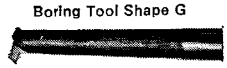
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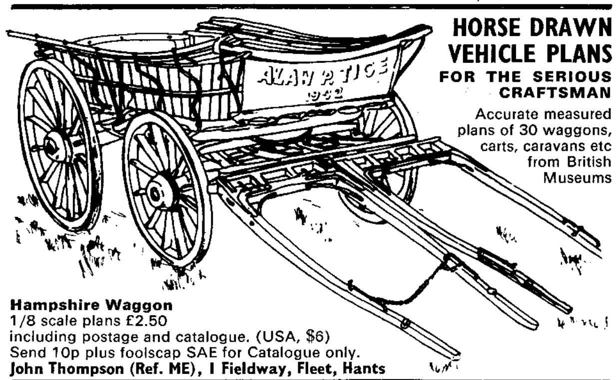

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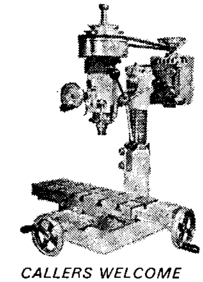

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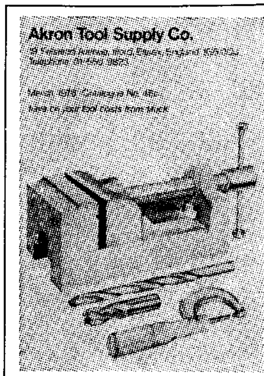

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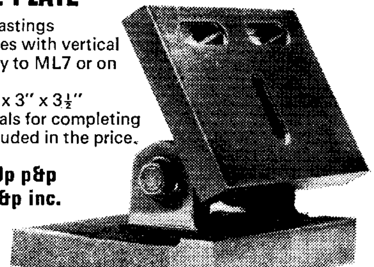

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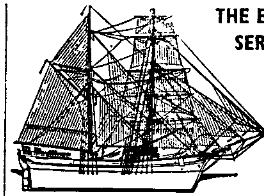

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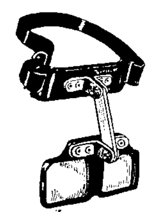

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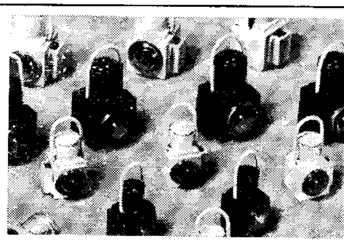

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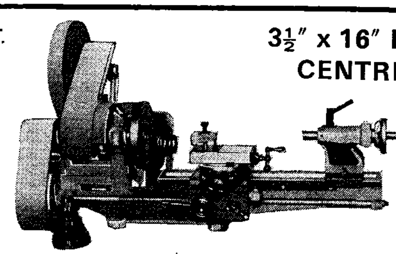

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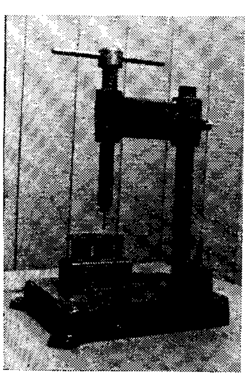

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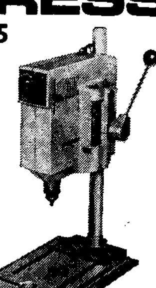

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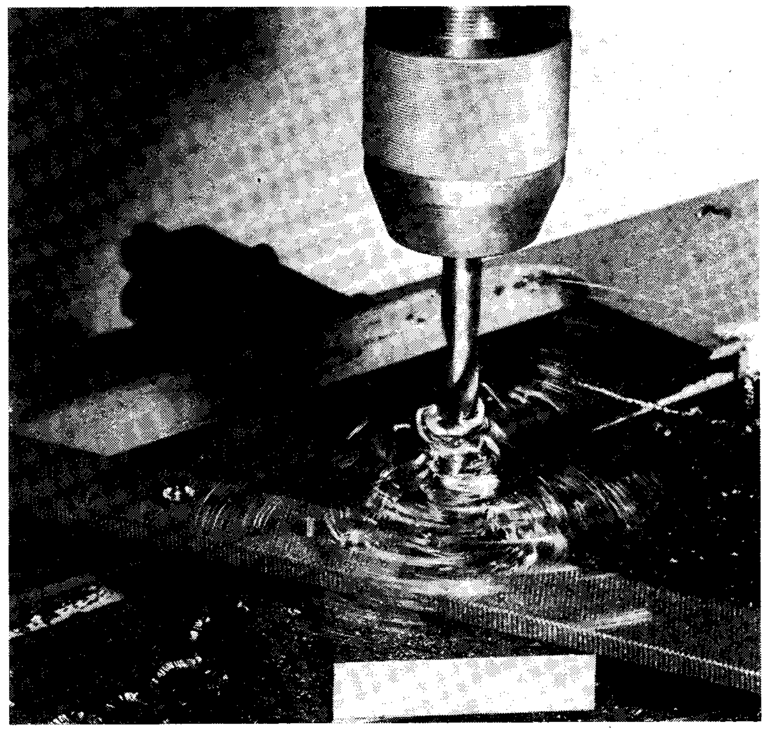

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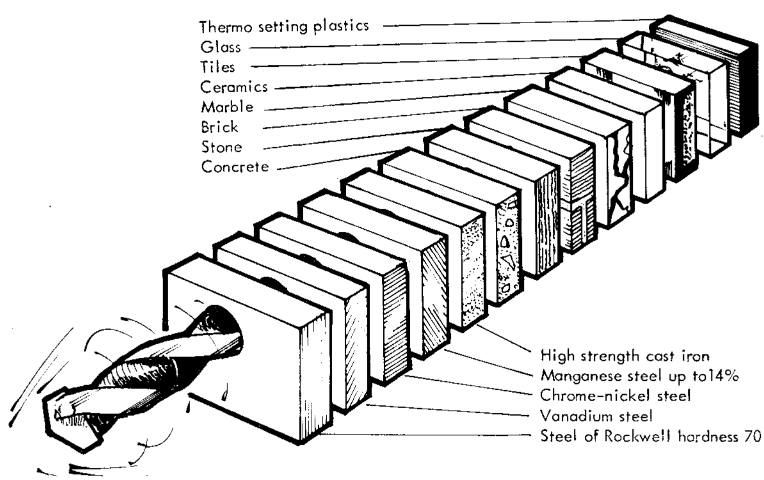

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