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Model Engineer

IN THIS ISSUE:

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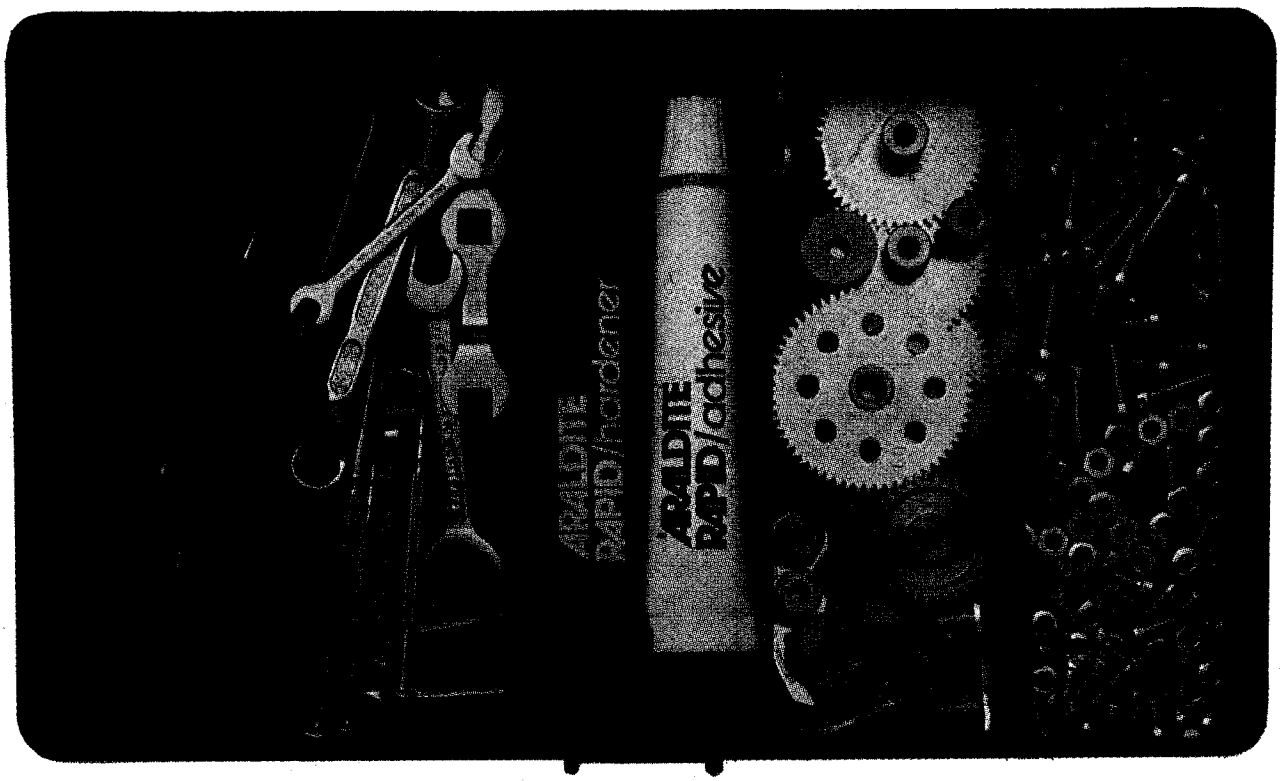

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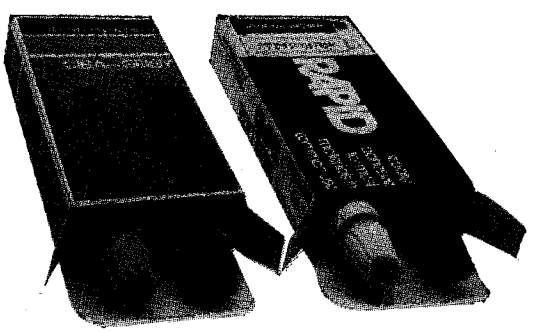

Model Engineer

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Incorporating Mechanics, English Mechanics, and Ships and Ship Models

Volume 142 Number 3548

5 November 1976

CONTENTS

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COVER PICTURE

Lionel Woodhead's G.W.R. "Bulldog" 4-4-0 locomotive at Beech Hurst. Colour photograph by G. C. Lavis.

NEXT ISSUE

Thread milling: The Centaur gas engine.

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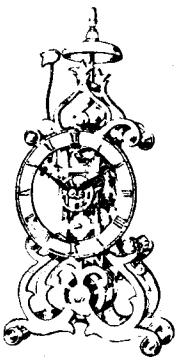

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Forthcoming Book Productions include:

Christopher Pinchbeck and his Family
by RITA SHENTON

Though already well known in horological circles, this is Mrs Shenton's first book. It contains a fascinating account of the Pinchbeck family of clockmakers, as well as details of many of the clocks and watches attributed to them. There are many excellent full-sized illustrations.

***How to make a Congreve Rolling Ball Clock**
by JOHN WILDING

This will need little introduction, except to say that the end product is a beautiful and fascinating clock, and that the book is complete in itself. At the end of 1975 a limited edition of Congreve clocks was offered for sale at £1,980 each—a pointer to their value.

The Clockmakers of Cumberland
by DR. JOHN PENFOLD

This work of great scholarship has involved Dr. Penfold in 40 years of research, and draws on the findings of his father before him. It covers all the known clockmakers and clockmaking centres of the county, and is lavishly illustrated and comprehensively indexed. It will undoubtedly become a must for collectors.

***How to make Galileo's Escapement**
by JOHN WILDING

Step-by-step instructions to make this interesting conversation piece, and its relatively simple design, make this an ideal book for amateur constructors of moderate advancement.

Mercer Chronometers
Radical Tom Mercer and the house he founded
by TONY MERCER

This is a fascinating and highly readable account of Thomas Mercer and Co., today the only marine chronometer manufacturers in the Western world. Mr. Mercer has been able to draw on his Company's highly detailed records over the past 150 years. The work has very many illustrations, including 8 pages in full colour. It contains a complete list of Mercer chronometer numbers.

***How to make a Bracket Clock**
by JOHN E. TYLER *of California*

This contains fully detailed instructions to make a most attractive English style bracket clock, including the cabinet.

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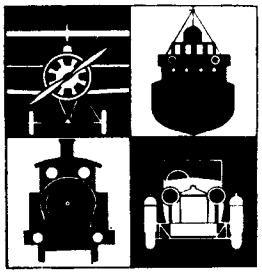


46th Model Engineer Exhibition

4–15 JANUARY 1977

(not open Sunday)

At Wembley Conference & Exhibition Centre

LOCOMOTIVES, BOATS, AIRCRAFT, TRACTION ENGINES, MILITARIA, WOODWORK, CRAFTS

WHERE?

The Model Engineer Exhibition is moving to Wembley, and will be the first public exhibition to be held at the superb new Wembley Conference and Display Centre. If you've been through Wembley recently, this is the huge circular building on Empire Way, between the Empire Pool and the Squash Centre on one side, and York House and the London Esso Hotel on the other, all within a stone's throw of the famous Stadium.

As we have previously mentioned, the display area occupies two floors; these are at the rear of the Centre, reached through the main front entrance or, at extra busy times, through a second entrance at upper floor level, reached via a pedestrian walkway. Automatic ticket desks are expected to be in use at the main entrance, which should reduce queueing time to a minimum; any brief wait would be under cover.

WHEN?

The opening dates are Tuesday, January 4th to Saturday, January 15th, 10 am–8 pm daily, except the last day, when the Exhibition closes at 7 pm. It is not open on Sunday the 9th.

HOW . . .

Much to go in? Admission at the door for adults will be 50p, children over 5 and still at school 30p, prices inclusive of VAT. Under 5s not yet at school are not charged.

Pre-booking tickets are available and avoid waiting. Single price for small parties of up to 10, adult 45p, child 25p. Parties of more than 10 adult 40p, child 20p. Teachers in charge of parties free in ratio of one per 10 in party. Family tickets are also available (in advance only) at £1.25 for two adults and two children plus 20p per extra child.

Visitors arriving after 7 pm will be entitled to entry at 30p. Season tickets are not normally available but the Exhibition Manager may be prepared to make specific arrangements in special circumstances.

TRAVEL

Rail travel to Wembley is available from Euston and Marylebone, but most travellers by public transport will probably use the Underground service; both Bakerloo and Metropolitan lines (via Baker Street) serve Wembley Park Station, which is five minutes' walk away, along the same road. Wembley Central Station is a little further away and has a limited Underground train service, but is an alighting point for some Birmingham/Euston main line trains.

By road, Wembley is easily reachable, lying only a minute or two west of the North Circular Road. Local permanent signposting to the Wembley complex exists over quite a wide radius, and although peak-hour traffic on the main roads in the vicinity can be quite heavy at times, it really is quite simple for drivers unfamiliar with London to reach the Exhibition without driving through the more confusing parts of the city.

There are extensive car parks adjacent to the Centre, and most people are glad to pay the modest charge for the convenience of parking close and without the worry of meter time running out. Coaches coming to the Exhibition only should make this clear, preferably by displaying a poster in the front window, otherwise they may be directed to the Ice Show coach park, which could mean that the coach could not be driven out until the end of the current performance.

CATERING

Wembley has extensive new catering facilities in the Centre itself, ranging from a tea/coffee bar and alcohol bar on the Exhibition upper floor to a snack and light refreshment bar and an attractive restaurant on the next floor. Prices and quality will, we believe, prove attractive, and group or party arrangements can be made in advance by writing to the Catering Manager, Wembley Conference Centre, Wembley, HA9 0DW.

COMBINATION TICKETS

Details are given elsewhere of facilities available for combination rail and accommodation 'packages' offering two nights in a choice of hotels plus rail fare and Exhibition entrance. These represent good value and offer an opportunity of, in effect, a three-day trip which could be used to take in that long-promised visit to, say, the Maritime or Science Museum etc, as well as a West End theatre or even the Oxford Street sales.

Clubs and families may like to know that details are being finalised for combination tickets covering the Exhibition and the adjacent Ice Show; this year it is 'Sleeping Beauty on Ice' and these Wembley spectaculars have a well-deserved reputation for quality and entertainment value. Unfortunately, it will not be possible to offer reduced combination tickets for Saturdays, but there are three Saturday performances of the show if the families want to go there while the modellers spend the time in the Exhibition.

OTHER ATTRACTIONS

With cinema and theatre facilities available in the Centre, film shows, talks and demonstrations of interest to Exhibition visitors are being arranged. What is on, and when, will be displayed on a board at the MAP stand and tickets will be available (at nominal cost only) to ensure that enthusiasts can reserve a seat at the feature of their choice without wasting time in queues. Full details are still to be finalised, but it is expected that talks and demonstrations on such subjects as lost wax casting, woodworking, boiler-making and the like will be taking place plus railway and aviation films. These are in addition to the many demonstrations which will be taking place on some of the 132 stands, including lathework, brazing, milling, and other workshop practices, lapidary, enamelling, wargames, miniature weapon-making, cart making, wood turning and machining, boat-building – a real feast of how to do it.

There is this year a special Woodworker 'show within a show' where expert advice on hand and power tools, and all aspects of carving, machining etc, will be displayed. This time, too, the demonstration area for electric flying models is at floor level, and this will permit the operation of R/C vehicles from time to time.

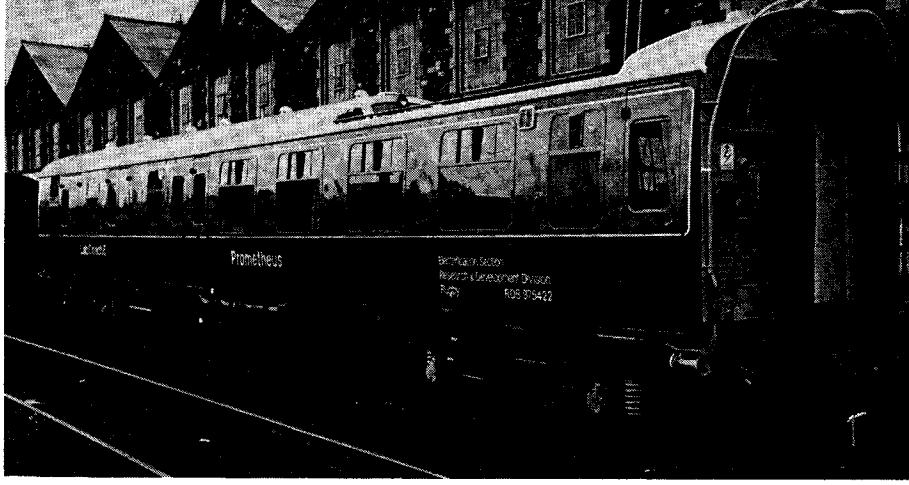
Many standholders have booked space for the first time, adding to the variety and choice of tools etc; they include model retailers, small gauge model railway suppliers, small lathes, specialist tool merchants, and so on.

Lots to see, lots to learn, lots to buy – you just can't afford to miss this 46th Exhibition!

Advance bookings and details from the Exhibition Manager, M.A.P. Ltd., P.O. Box 35, Hemel Hempstead, Herts. HP1 1EE

SMOKE RINGS

A Commentary by the Editor



British Rail Engineering's new test vehicle "Prometheus", at Swindon Works. Photograph R. C. H. Nash.

De-furring Boilers

Readers who operate steam models in areas where the water supply is very hard usually have trouble with their boilers and boiler fittings "furring-up", unless of course they are able to use rain water.

According to one of our New Zealand readers, the "hardness" deposits in model boilers can be washed out after treatment with phosphoric acid or "Jenolite", which he says does not attack the copper. Perhaps one of our chemist readers could give us his advice on whether this is the best method.

Locomotive Tenders

In the August Newsletter of the Guildford Society, the Editor comments on the difficulty in driving 5 in. gauge tender locomotives when the tender is large and with high sides or coal rails. The biggest offenders in this respect are probably the eight-wheel tenders fitted to the L.N.E.R. "Pacifics", and the Stanier 4000-gallon tenders fitted to Rebuilt "Royal Scots", Class 5s, "Pacifics", 2-8-0s, etc., where the sides slope inwards at the top.

The eight-wheel tenders fitted to S.R. "Lord Nelsons", "Arthurs", etc. are not quite so bad, being considerably lower.

The six-wheel L.N.E.R. standard tenders as fitted to "Springboks", J.39s, "Moguls", etc. are quite good in this respect, while the G.W.R. 3000- and 3500-gallon standard tenders are best of all from the point of view of the 5 in. gauge driver.

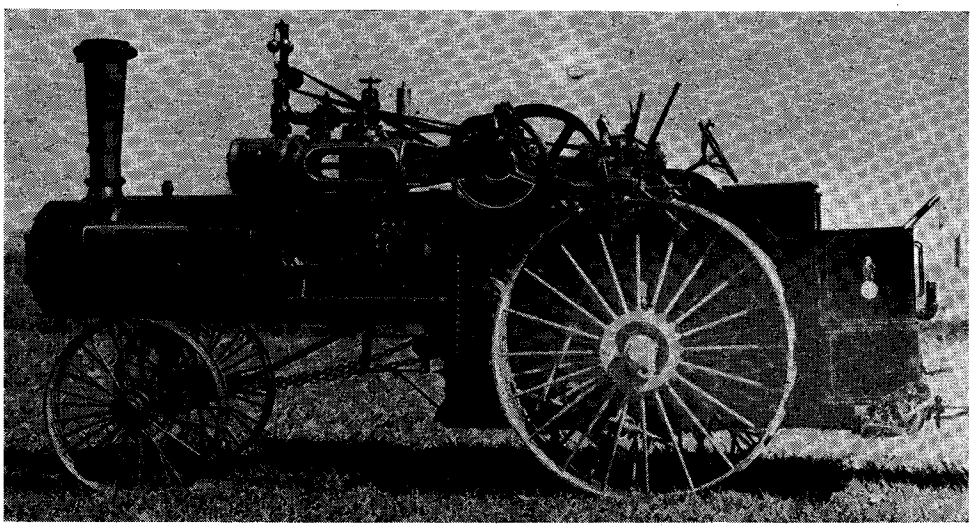
As the writer remarks, do prospective builders of 5 in. gauge locomotives appreciate this problem before it is too late?

Talyllyn Railway Cards

Christmas is once again approaching, and I have received samples of some very nice Christmas cards from the Talyllyn Railway Preservation Society. They depict locomotive *Douglas* at Abergynolwyn Station, and can be obtained from the Wharf Station Shop, Talyllyn Railway, Towyn, Merioneth.

Small "O" Rings

My note in the 17 September issue has brought a further reminder — from "Locosteam" of West Mersea, Colchester. This company stocks "O" rings in "Viton" from 1/16 in. internal diameter up to $1\frac{5}{8}$ in. i.d.



A fine 3 in. scale Case traction engine built by Mr. E. Ohlenkamp of Chicago. It has an all-copper boiler.

WALSCHAERTS VALVE GEAR

by Martin Evans

AT FIRST I hesitated at mentioning the subject of Walschaerts valve gear yet again, but Dr. Burrows' recent article on the backset of the expansion link has brought in several letters from readers, and it is evident that there is still considerable interest in this subject.

Walschaerts valve gear is not easy to understand, in fact most valve gears are more involved than they at first appear. The great G. J. Churchward is alleged to have said that it took him twenty years to fully master valve gear design, so lesser mortals may be excused if they find the subject difficult. One reason for my returning to the subject is that I have been strongly criticised in some quarters for adhering to the so-called "Greenly" method of designing Walschaerts gear, some readers having referred to the process as sloppy. Other readers want to know why I cannot explain the *correct* way to design the gear.

Perhaps I should mention that Mr. D. L. Ashton of Manchester has produced a booklet which explains the Walschaerts gear in a very clear manner, but briefly the process is as follows:

As I mentioned in my article in the 19 March issue, the first things to be decided are the proportions of the valves and ports and the full gear cut-off required, and the lap and lead required, as mentioned in my original article. The total travel of the valve in full gear will be the amount of the lap and the port opening multiplied by two. (Note that the steam port does not necessarily have to be opened fully even in full gear.)

The proportions of the combination lever are next determined exactly as described before. That is to say for slide valves

$$\frac{A}{B} = \frac{2\ (\text{Lap plus lead})}{\text{Stroke}}$$

For inside admission piston valves

$$\frac{C}{D} = \frac{2\ (\text{Lap plus lead})}{\text{Stroke}}$$

This far, we are still with Greenly.

Now the movement of the valve is determined partly by the movement obtained from the return crank or eccentric, and partly by the movement obtained from the crosshead, and the latter is 90 deg. out of phase from the former. Therefore in the diagram Fig. 2

L = lap plus lead
R = half total valve travel
X = half return crank-derived component
$= \sqrt{R^2 - L^2}$

To find the pitch circle diameter of the return crank, we now refer to Fig. 3, where for inside admission

$$PCD = \frac{2X \times E \times D}{F \times G}$$

and for outside admission

$$PCD = \frac{2X \times E \times B}{F \times H}$$

Coming now to the question of the backset of the link tailpin, difficulty can easily arise here owing to the fact that there seems no established definition of what backset really is. The definition which I prefer is that it is the perpendicular distance from the tailpin to the tangent to the arc of the curved centre-line of the link, or in other words, to the tangent through the trunnion centre.

The purpose of backset is to obtain equal angles of swing of the link on each side of its central position, i.e. the position with the crank on dead centre. If the reader applies dividers to the drawing Fig. 4, he will find that without backset, it is impossible to get equal angles of swing. Fig. 5 shows the correct amount of backset.

The important thing to notice is that using the above definition of backset, the backset will vary according to whether the eccentric rod connection is inclined at an angle to the cylinder centre-line or not.

In most British locomotives, the eccentric rod connection was inclined, and the greater the angle of inclination, the less the backset will be. In my drawing Fig. 6, I have shown the typically "all-square" eccentric rod connection, and I have superimposed on this, an inclined eccentric rod connection, and to save showing two drawings, the eccentric rod connection is left horizontal, while the cylinder centre-line and the radius rod centre-

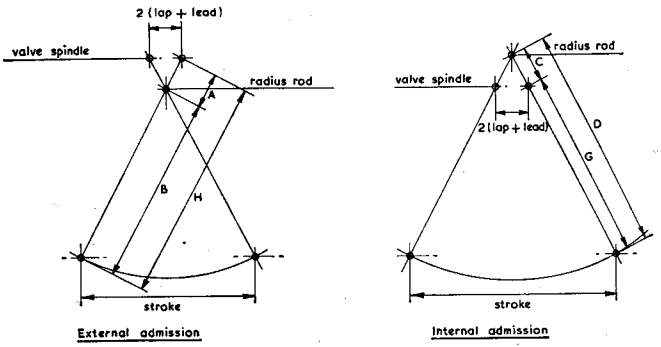


FIG. 1 THE COMBINATION LEVER

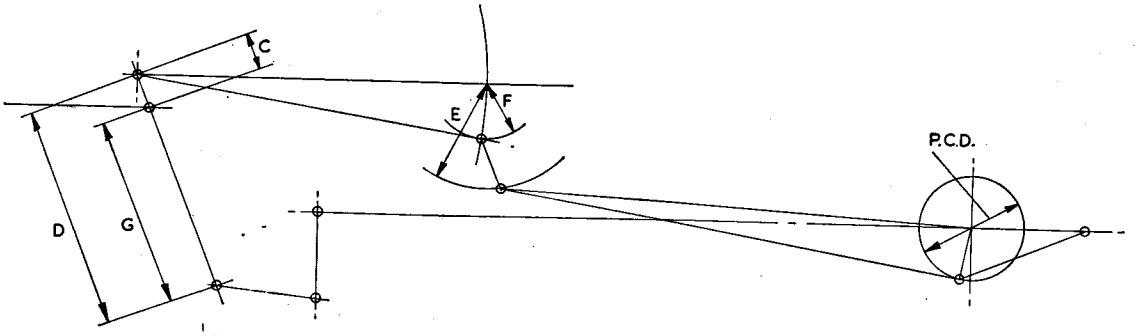


FIG. 3

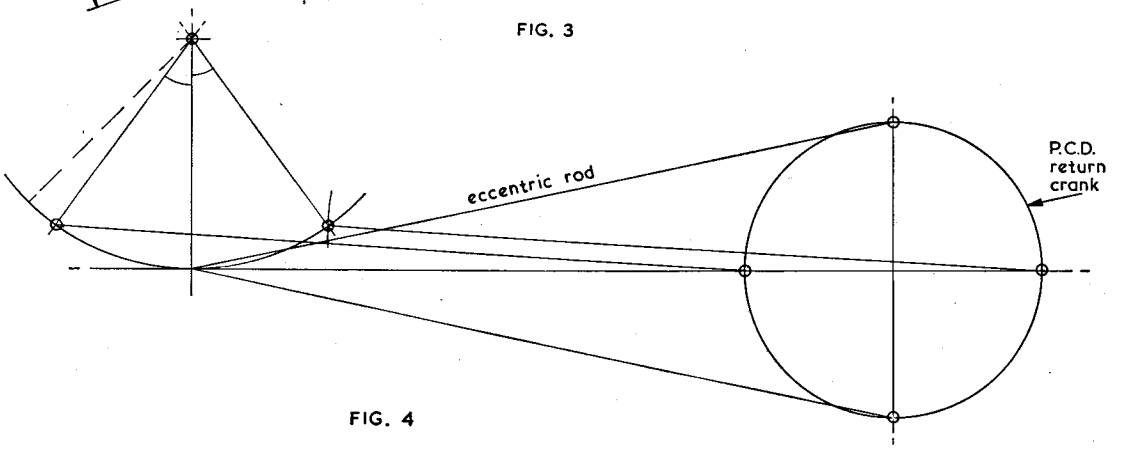


FIG. 4

line (the radius rod being in mid-gear position) have been inclined instead, which comes to the same thing. Note how the backset is now considerably less.

However, there may be yet another complication. The radius rod itself may be inclined, i.e. not parallel to the cylinder centre-line, in which case the backset will be greater than in the last case.

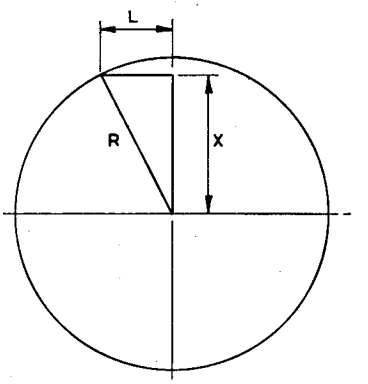


FIG. 2

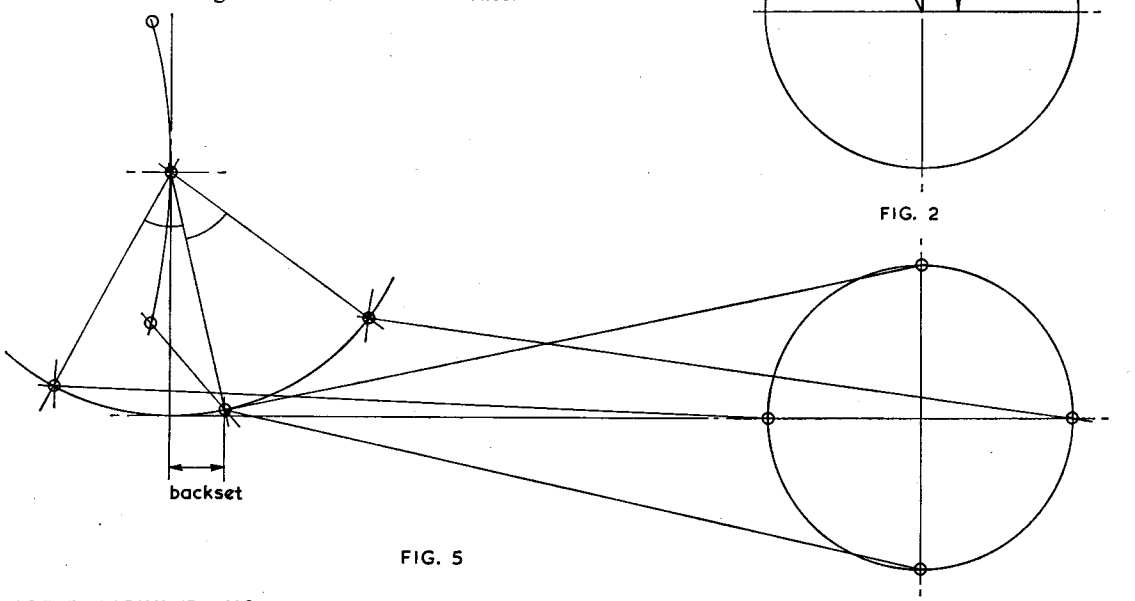


FIG. 5

To sum up: With the (American) "all-square" layout, especially if the eccentric rod is short, the backset will be large. With radius rod parallel to the cylinder centre-line (when in mid-gear position) and inclined eccentric rod connection, the backset will be small (other things being equal of course) while with both inclined radius rod and inclined eccentric rod connections, backset will be large.

A position could even arise where the backset is a negative quantity, or as some call it, a "frontset". This could happen where the radius rod is parallel to the cylinder centre-line, but the eccentric rod is steeply inclined, and is most likely on inside cylinders. I have it on good authority that the G.W.R. "Kings" have such an arrangement.

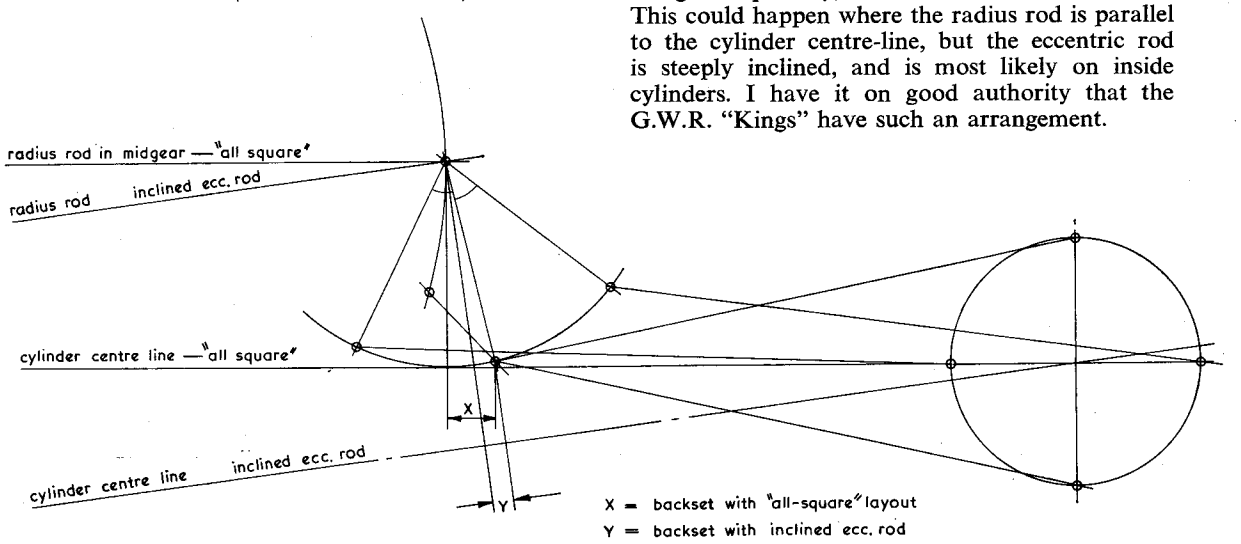


FIG. 6

A VERTICAL COLUMNAR ENGINE

"Tubal Cain" describes how to build a model of the "Williamson" engine

Part VII

From page 1009

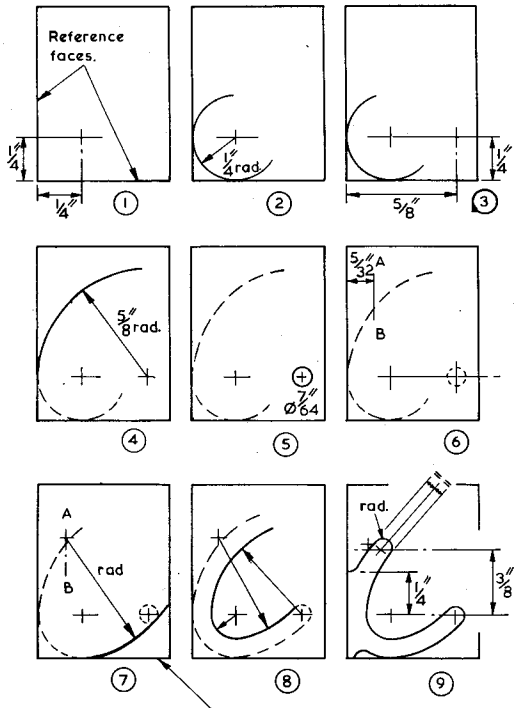
Governor Drive Arms, Part DD

File one edge of the sheet material provided to straight and cut the piece into four equal parts. Solder these together to make a thick lump and then file two edges square to each other. These are the reference faces for the marking out, which is done as shown in Fig. 19. This should be done very carefully, as this part of the engine is prominent. Once marked out, drill the No. 60 holes; pop lightly, examine, deepen the pop and examine again, then drill. If the holes then do not appear to be in the centre of the section, adjust the latter to make them so. Put a 7/32 in. drill through at the centre from which the $\frac{1}{4}$ in. radius is struck if you like, to ease the cutting out of the shape.

Remove burrs and take off all surplus solder with a coarse file, and then bring the outside to shape. Holding is not always easy, and Fig. 20 shows one way of doing it. Work right up to the line—don't leave a witness but don't go beyond. Having formed the outside, cut down to the drilled hole in the middle with a couple of saw cuts to get rid of most of the material and then finish with a file. As you get towards the line keep an eye on the shape and appearance. This is more important than true dimensional accuracy—the only ones that matter are the No. 60 holes and you have these in place already. Once you are satisfied, unsolder and remove all the solder from the faces of the arms. See Fig. 22. Set aside where they won't get lost.

Carrier, Part DE

Grip the pulley boss in the 4-jaw, chucking piece outwards, and true up the latter. Change to the 3-jaw and hold by the machined chucking piece, pulling the outer end till it runs true, and centre it. Bring up the tailstock and take a cut over the edges of the vanes or ears. Bring this to any convenient dimension, so long as it is parallel. Rough out the pulley to a shade over diameter and machine the accessible face. Withdraw the tailstock and very carefully drill 2.4 mm. or No. 41. Go easy and clear chips frequently. Take from the chuck and file the length of the ears (not the diameter yet) to dimension. Put a little centre in the drilled hole each end with a Slocumbe held in the fingers and

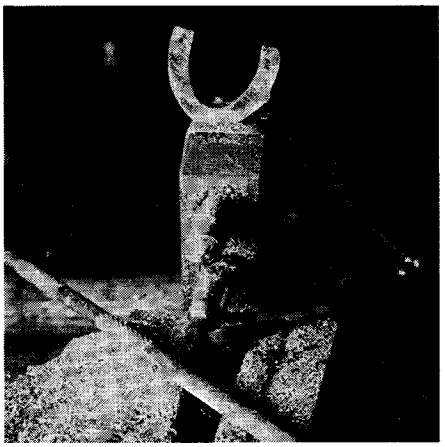


STEPS IN MARKING OUT GOVERNOR DRIVE ARMS

Fig. 19

then set the work between centres—you will have to improvise a bit to get a carrier on. Turn the cylindrical shank to 0.187 in. dia. by micrometer—another reference dimension—and finish the pulley and the boss at each end. Part off the chucking piece, thus also facing the pulley boss.

Set up the vertical-slide and vice facing the headstock and grip the work by the machined edges of the ears—the face of these vertical and the drilled hole horizontal across the machine. Put a piece of



Left: Fig. 20. Using an instrument vice for holding small work.

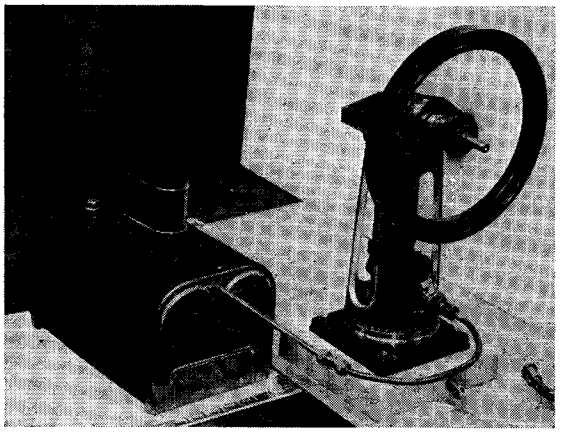
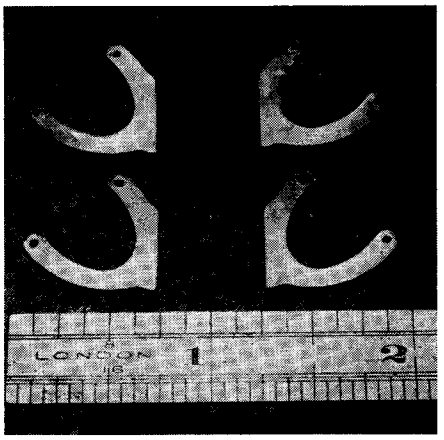


Fig. 21: The engine under steam at 600 r.p.m.

3/32 in. silver steel through the hole and wangle the casting till it is truly square across the machine and the ears vertical. Set a 3/16 in. or ¼ in. endmill—no larger—in the chuck and then engage the leadscrew handwheel and advance the saddle till the cutter just traps a piece of paper against the 3/16 in. dia. machined shank. Note the index reading. Raise the vertical-slide and advance the saddle, then adjust the former till the side of the endmill traps paper against the 3/16 in. dia.—note the reading. Repeat for the cutter touching the opposite diameter, underneath. You now have three "zeros" to enable you to set the cutter when machining the ears. Set the vertical-slide to one of these zeros and advance the saddle to the leadscrew handwheel zero. Then, using the latter to put on say 5 to 10 thou. cut at a time, machine across the ear till you have advanced by 1/16 in.—.063 in. Repeat at the other vertical-slide zero, and the machined edge must be exactly 3/16 in. wide and 1/32 in. from the carrier centre. Take from the vice and saw off the unmachined part of the ear, and remove burrs. Now hold the carrier by the machined shoulder and tap it back to the vice jaws.

Right: Fig. 22. Finished governor drive arms.



Repeat the procedure of setting and machining as before, and the job is as true as possible. Take from the vice, file off any surplus metal from the ears after the weight-carriers are soldered on, and remove burrs.

Weight and Arm, Parts DF and DG

The weight arm comes as a strip over-width and length. Centrepop for the holes—work as one piece—and scribe a circle therefrom to give the correct width. Drill and then file to width. Cut to the correct length, and then file the shoulders, taking care that both pieces are alike. Remove burrs and polish. Grip each ball in turn in the 3-jaw, centre and drill No. 48. Try the arm in the hole, and ensure that it is an easy but not sloppy fit. Mix some Araldite according to the instructions, and after degreasing, smear some on the peg and put a little down the hole. Push in the peg (make sure it doesn't push itself out again) and set aside to cure. Any surplus Araldite may be cut off after about 5 hours, thereafter leave as long as you can in a warm place.

Governor Bracket, Part DH

File the base first, and then the front face square to it—it's not worth machining either. Clean up the top of the boss to dimension and mark out and centrepop for the hole. Drill No. 42 and then enlarge to fit the material provided for the spindle—a slide fit. Put the last drill right down to make a centre, and drill the base 7 BA tapping size; tap this from the top. Turn the job upside down and mark out and drill for the holding-down bolts. Elongate these as shown and then trim the casting for paint. I don't think I need say anything about either the spindle or the nut except to say that the former should be brought to a high polish and the tops of the threads reduced to pass easily through the carrier, part DE.

Jockey Bracket, Pulleys and Spindle Parts EA, EB and EC

File the base flat and mark out for the three holes. I suggest you drill the two outer ones No. 35, not 37, to allow for slight adjustment on erection. Spotface or file the nut seatings. The position of the cross-hole in the boss is moderately important, but I suggest you centre it to the boss and bend the casting afterwards—on assembly—to suit. File the ends to a smooth finish and to the correct width of boss.

The little pulleys call for no comment except to emphasise that the profile of the groove should be half-round, not a vee. The pulleys should be an easy running fit on the spindle and you should lightly countersink the ends of the holes. The spindle length is taken from the job—assemble the pulleys and washers, cut to length, and allow a bit for riveting or soldering. Leave a little side clearance for the pulleys—not much. Don't assemble till you have tried it on the engine as the bracket may need bending a little.

Drive Pulley, Part ED

A straight turning job, but there isn't much room where the pulley fits so pay some attention to the OD. The groove must be the narrow vee shown or the cord won't grip, so you will have to grind a tool to 45 deg. included angle. I recommend that you bore the hole a good fit to the crank rather than ream. The grub screws must not project more than half a thread when assembled.

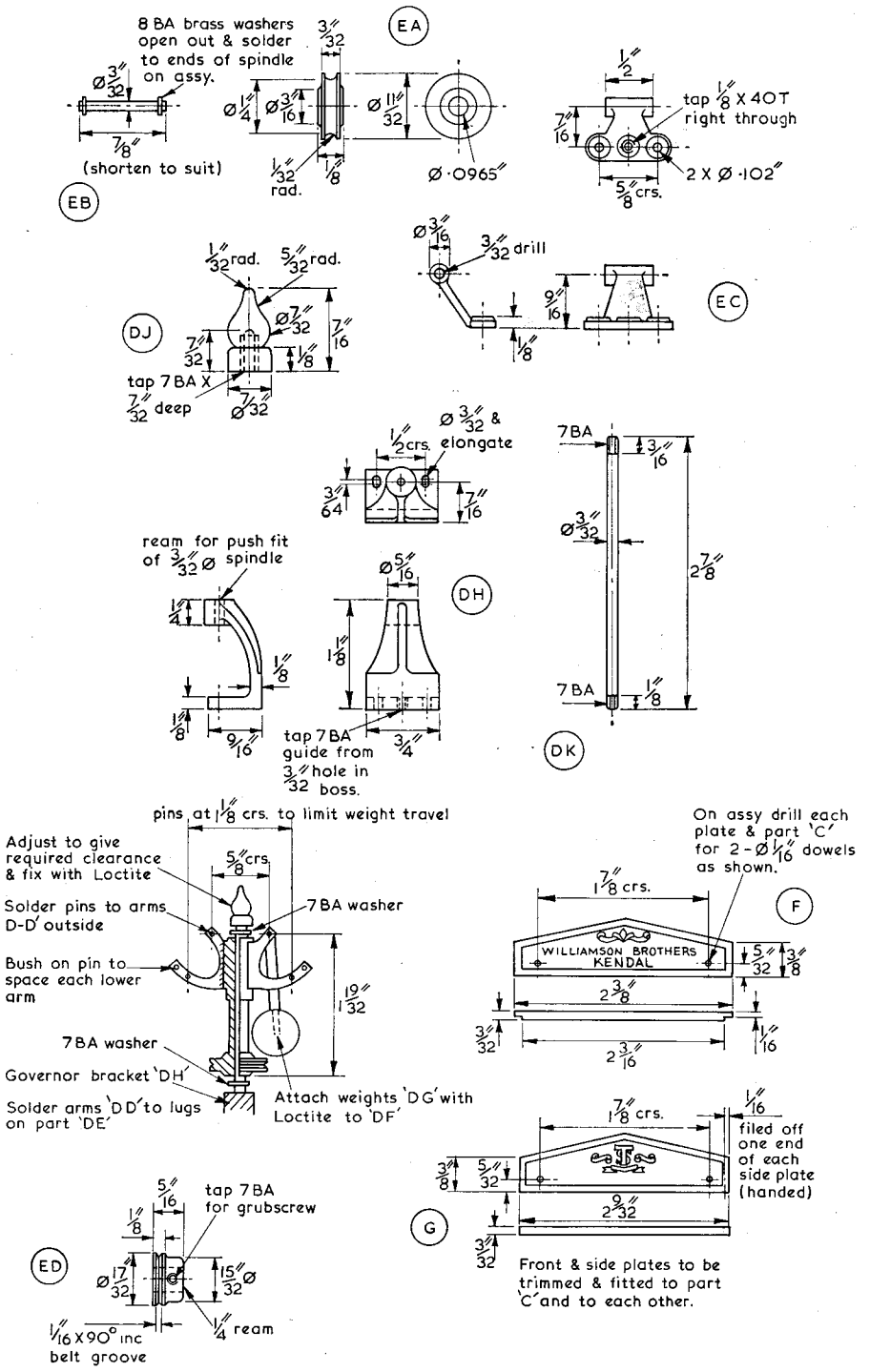
Erecting the Governor

The general arrangement is shown in Fig. 23. The biggest difficulty is soldering the drive arms to the carrier, and I recommend that you assemble these with a clamp, drill very small holes through, and fit rivets—later to be filed off—whilst soldering. To get the arms correctly aligned, slip a piece of pinwire through the upper holes, and make up the joint at the lower hole in each pair. The latter calls for washers between, but if you can manage it I suggest you chuck a piece of 3/32 in. brass, drill No. 59, and part off 1/16 in. wide to make a proper bush. Tin the surfaces, assemble with the rivets I mentioned earlier, check the position, and solder up. It is important that the two upper holes be at the correct height and distance from the centre of the carrier, so check this carefully. This having been done, file round the junction of the arms and carrier, making any sharp corners into little radii, and generally clean up. The weights can then be attached, the pin being lightly riveted over outside the arms and given a touch of solder.

Fitting the Brackets

The governor bracket must be fitted to the machined pad on the entablature so that the spindle stands dead central. Do this by eye—it is what it looks like that matters—and locate it so that it doesn't project beyond the front of the casting; 1/64 in. back is OK. Mark through the holes, and then drill and tap for the studs. You can then adjust for position with the enlongated holes after the decorative panels are fitted—the elongation is not for belt tensioning. The jockey fits above the flywheel main bearing; fit the drive pulley so that it locates the shaft endways, slide on the main bearing, and then the bracket on top.

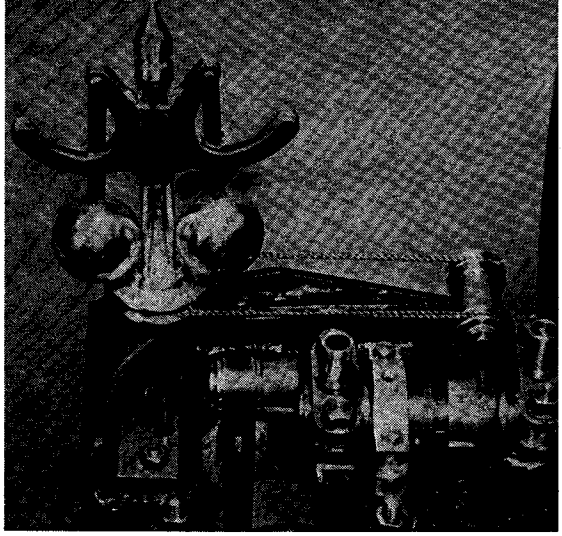
Fit the jockeys, and then adjust the position—bend if need be—till the cord will run straight onto the little pulleys. If the drive pulley fouls the bracket either bend or file the latter to clear. I had to bend up to clear the pulley, and then the top



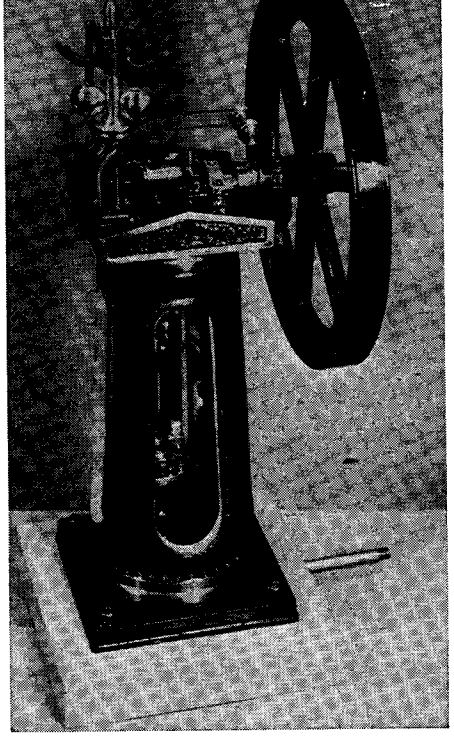
boss forward to get the cord straight. I used a linen fishing line, dewaxed, as a drive cord, but a Meccano rubber band works as well. Don't use nylon—it slips.

Decorative Panels, Parts F and G

Leave these till all other work, test running, and perhaps even painting is done. The Araldite adhesive is very strong, but it is a bit brittle, and



Left: Fig. 23.



Right: Fig. 24.

a chance knock whilst doing something else could loosen the joint. Note: these panels are die-cast in a soft metal, so handle with care, especially when clamping or cutting off any surplus Araldite after assembly.

However, you must dismantle a bit. Take off the governor, undo the eccentric and big end bearings, and then lift out the shaft complete. Detach the entablature from the column, and then thoroughly degrease it. (Boiling in detergent solution is perhaps the best way, but if you have painted it, douse in CTC or Trichlorethylene.) With medium emery abrade the machined surfaces which carry the panels, and again degrease. Take the front plate and file the back surface flat—if it needs it—and then offer this to the entablature. Mark for the two little rebates and file these so that the dimension shown as 2 3/16 in. is a trifle less than the width of the entablature and the thickness of the rebate 1/16 in. Finish the edges to dimension, and do all other work—polishing etc.—needed.

Take each side panel in turn and treat likewise apart from the rebate. For the present these will project 3/32 in. or so beyond the front of the entablature. Mark each to its mating side (they will be "handed" when you've finished) and then file the front edge of each until, when the front plate is also offered up, it meets both the front plate and the entablature. Try and get the join as unobtrusive as possible. Collect together all your clamps, and have a rehearsal as to how you are going to clamp all up whilst assembling. If you can put them in a suitable position you could fit little dowels to help hold the job if you like. Have several tries till you are satisfied that you can clamp up without any hesitation. Thoroughly abrade the backs of the plates.

Degrease everything again, and thereafter avoid touching the surfaces with your fingers. Mix the Araldite as instructed—it helps if you warm the tubes for a few minutes first—and then coat the front face of the entablature, a thin even film. Offer up the front plate and clamp up lightly. Repeat for both sideplates, working quickly but carefully, but in this case apply a little Araldite to the rebates also. Have a good look at the job and make sure nothing is askew, adjusting if need be. If all is in order, tighten up the clamps just enough to ensure that nothing will shift of its own accord, but don't have so much pressure you squeeze out all the "glue" and get a dry joint, or worse, mark the metal. Wipe off surplus, and make sure no Araldite gets on the clamps. Now leave (a) at room temperature for 6 hours or (b) on a storage heater for 1½ hours and then shave off any surplus Araldite that remains. You can remove the clamps now, and if you are dissatisfied with the job, take it apart now, clean down and start again. Otherwise, leave in a warm place to cure—overnight on a radiator, longer elsewhere. Finally, trim off any overlapping edges and repolish if need be.

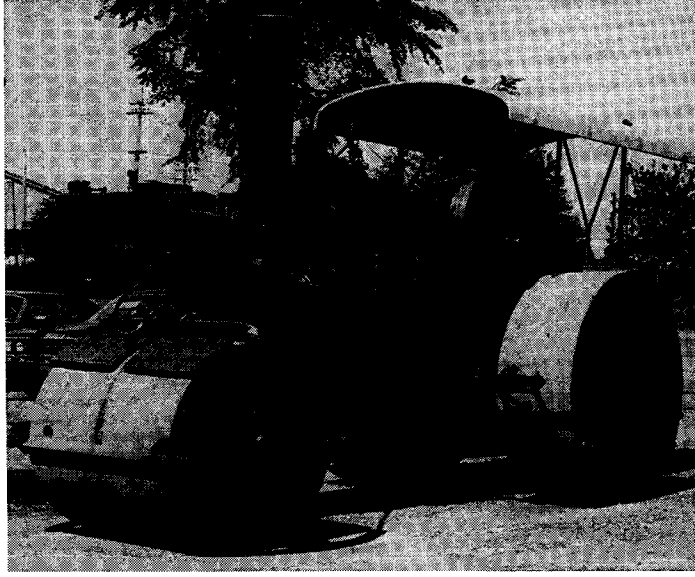
Final Assembly

Retouch any paintwork that has been damaged (I have said nothing about painting — there is a book about it and everyone seems to have their own ideas anyway!) and have a look round for any signs of excessive wear or slack, especially on the eccentric strap. As a rule, if an engine has run 6 hours or so at 500-1000 r.p.m. (that's a third of a millions revs. or so!) any "bright marks"—e.g. on the slide-bars—are only a fraction of a thou. and finger pressure will correct any misalignment. But glands may need attention, as they bed down quite a lot in the early stages. Remove any "black oil", graphite etc., and replace with proper steam oil. I see I have forgotten about the exhaust pipe—it's a simple job, though, and I expect you have already made it. If you need union connections I suggest

Continued on page 1082

CANADA REVISITED

by W. J. Hughes



Fowler roller imported into Canada in 1913.

WHEN WE ARRIVED at Ottawa we were met by John Corby, who is Curator of Industrial Technology at the National Museum of Science and Technology. A long task here had been the restoration to complete working order, and brand-new appearance, of the Leeds-built Fowler steam roller No. 13626, imported into Canada in 1913 by the City of Toronto. The whole machine had been stripped down to the bare bones, and many parts renewed completely, including the tender.

It was nice to think that I had been able to play just a small part in the reconstruction. Some time ago John mentioned in a letter that the rectangular "Fowler" nameplate was missing from the roller headstock. My old friend Arthur Fearnley of Castleford was kind enough to lend me an existing one, and the late Peter Lamb of Severn Lamb Ltd. generously had a duplicate plate cast from this in brass. I shipped the duplicate over to John, so thanks to this international co-operation the roller headstock became properly re-adorned. The engine itself is painted green, lined out in red, black and yellow, and is a credit to the museum as well as to the city of its origin.

An extremely fine selection of full-sized railway locomotives is a feature of the museum, with several of the larger ones in one big hall, but a few smaller (and older) ones strategically placed as centres of attention elsewhere.

One of these is a 4-4-0 wood-burner built by the Portland Co. in 1872 for the Grand Trunk Railway when the gauge was being changed from 5 ft. 6 in. to 4 ft. 8½ in. It served on the G.T.R. until 1903, and then was sold to the Chaudière Valley line for the lumber industry, where it continued until after World War II. In 1950 the old veteran was restored by the Canadian National Railway as part of an exhibition of "Museum Trains".

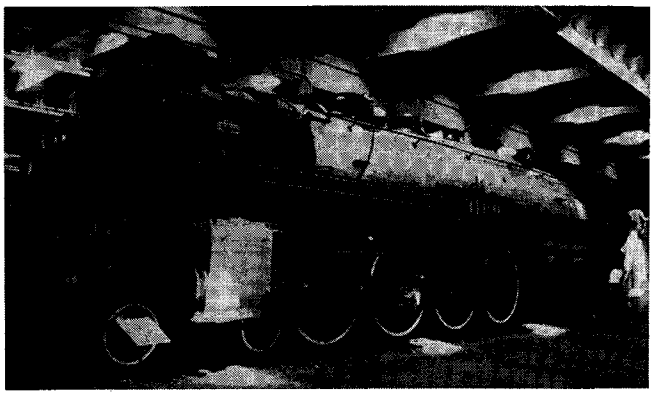
Another old-timer is No. 247, an 0-6-0 saddle-tank which is one of a class (0-8A) built between 1890-95, also for the Grand Trunk but for yard service. After the formation of the C.N.R. and the consequent advent of heavier trains, the class became generally inadequate as to power, and most were scrapped in the early 'twenties. No. 247 is the only example preserved in Canada.

A slightly younger C.N.R. survivor is the Mogul (2-6-0) Class E7A No. 713 which was built at the Montreal Locomotive Works in 1900. It bore the works number 1396, and was used principally on the Central Vermont, a C.N. subsidiary in the United States, on general duties.

In the early twentieth century the backbone of the Canadian Pacific motive power fleet was the Class D-10G of 4-6-0s—"ten-wheelers" of which no less than 502 saw service all over the system. They were fast and reliable, and superheaters were added in later years as the engines came in for overhaul. Some were still in service as late as 1960, when the C.P.R. retired steam, and it is highly appropriate that one of these, No. 926, which was out-shopped in August 1911, should find a home at the National Museum.

In contrast to this numerous class, the C.P.R. had only two of the "Northern" 4-8-4s (Class K-LA) of which No. 3100 is preserved here and the other (No. 3101) is at Regina, Sask. They were built in 1928 at the C.P.R.'s own Angus Works at Montreal, but their great weight of 360 tons proved a handicap in attaining high speeds. Nevertheless, they were a familiar sight at the head of heavy night trains from Toronto to Montreal and vice versa. Both were converted to oil-firing in 1956, and ended their careers in the West.

Canadian National 4-8-4 No. 3100.



Again in contrast were the streamlined "Northern" 4-8-4s (Class U-4) of the Canadian National, whose shape was adopted following a series of wind-tunnel tests with a view to better smoke clearance. These engines also weighed about 70 tons less than those of the C.P.R., and five of them, Nos. 6400-04, were built by the Montreal Locomotive Works in 1936, with six more, Nos. 6405-10, by the Lima Locomotive Works in 1938. These last were for the Grand Trunk Western, another subsidiary of the C.N.R. in the United States, and were virtually identical with the Canadian engines except in the shape of the louvres ahead of the smoke-stack.

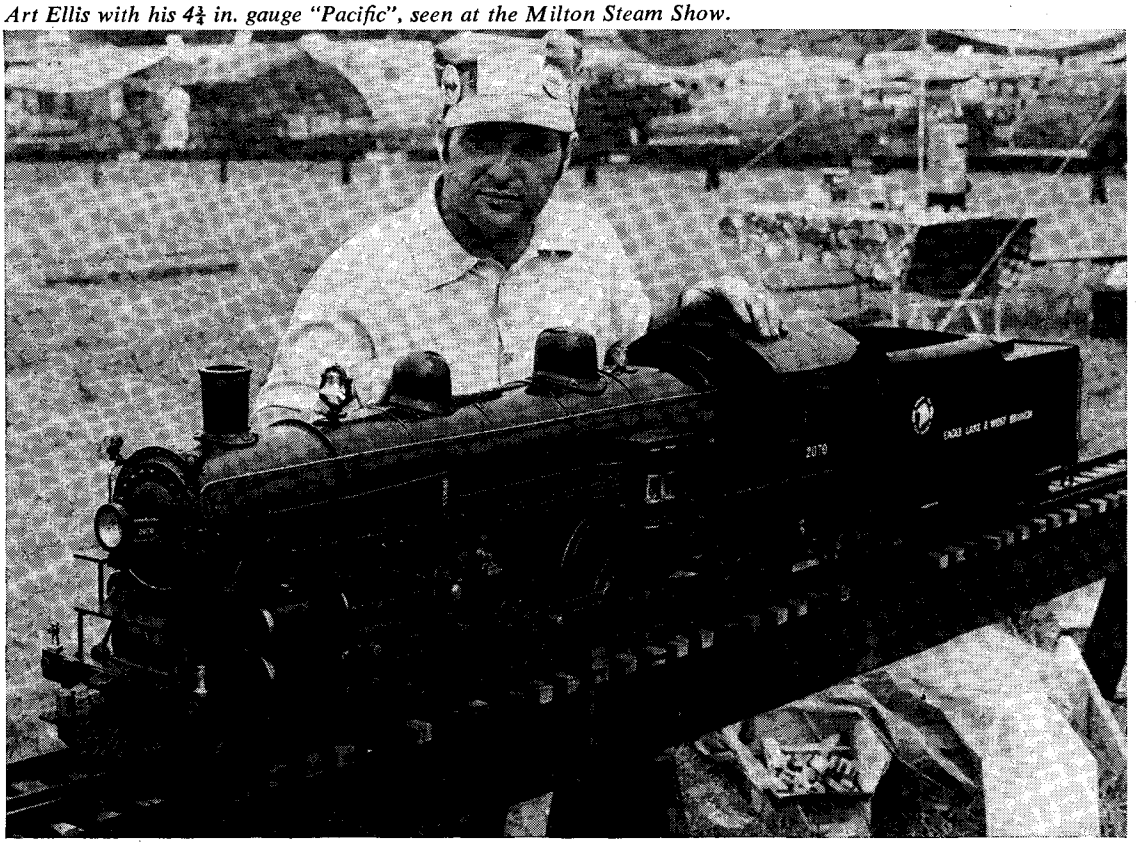
It was No. 6400 which became the best-known of the class, firstly for its impeccable performance in handling the Royal Train on C.N. metals in May 1939, and secondly for its appearance at the New York World's Fair in that year. And this is the engine now preserved in the National Science Museum. However, the others were well-liked too, and on the lucrative Toronto-Montreal service they quite frequently steamed at over 100 m.p.h., hauling seven or eight heavy cars.

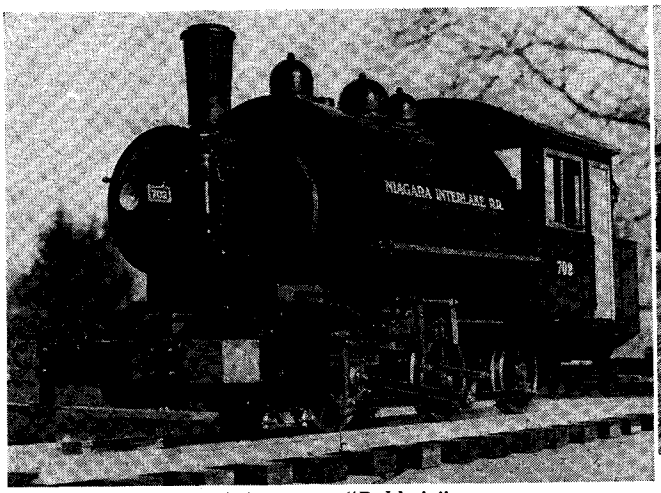
Not far from the "Northern" stands one of her great rivals, the Canadian Pacific "Royal Hudsons", one of which also hauled the Royal Train in 1939. This was No. 2850 (now at the Delson Museum, near Montreal), whereas No. 2858 is the one at Ottawa. Semi-streamlined, these 4-6-4s also had a good reputation for high speed and reliability, and apart from the heavy grades of the Rocky Mountains they worked the transcontinental express trains right through from Montreal to Vancouver, almost 3,000 miles. They too could top the 100 mark, yet on the prairies they could handle trains of 1500 tons.

Besides the static locomotives, the museum has taken over a standard-gauge railway line out of Ottawa and in the summer months runs steam excursions upon it with an ex-C.P.R. locomotive. When we were there some rather feverish activity was going on in the museum workshops, where some hefty chunks of bronze were being machined to renew the brasses in the motion. How we wished we could postpone our flight arrangements for a week or two! But all good things have to come to an end, and in any case there were more awaiting us in our next port of call, which was Toronto again.

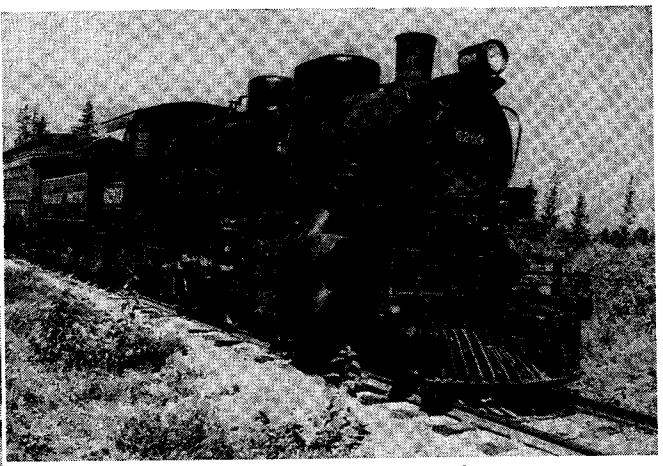
Here we had been invited to stay with some new friends, John and Marion Chappel, who live at

Art Ellis with his 4¾ in. gauge "Pacific", seen at the Milton Steam Show.





Art Ellis's 3½ in. gauge "Baldwin".



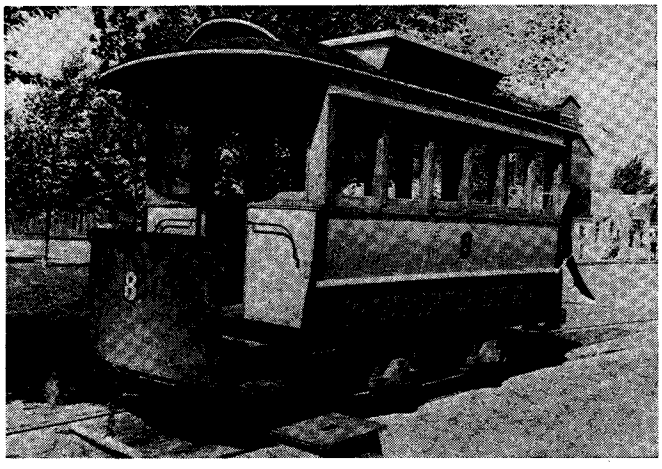
Above and below: 0-6-0 Switcher now in use on passenger service in Heritage Park, Calgary. Photographs by Ron Moulton.

Newmarket, a pleasant township several miles out from Toronto itself. They drove us in to the city to attend a dinner given by the Toronto S.M.E. in our honour, at which many flattering things were said about me and I was presented with a much-cherished Certificate of Honorary Membership of the Society. Another souvenir of the occasion was a miniature Allchin traction engine mounted on a polished wood base with a suitably engraved brass plate, and needless to say both this and the certificate now have positions of honour in our house.

From the dinner we all went on to a meeting of the Society held at the Physics Building (John's domain) of the University, where after the formal business — election of officers — various members each give a brief talk about models they had brought along.

Unfortunately this was where the gremlins which had beset my camera caught up again, and so I cannot show pictures of these models. One outstanding one, by Herbert Jordan, was a Porsche racing engine with double overhead camshafts, and with carburettors which are models of full-sized Webers. This engine has run at 20,000 r.p.m. It has a starter motor which, though of scale appearance, works by air, since the Bendix type of drive gave trouble in small scale.

Horse-drawn tram from Winnipeg, now in use in Heritage Park, Calgary.



Bill Huxhold showed a miniature milling machine which has variable speed traverse from a "surplus" 24-volt motor. The horizontal spindle, which is removable, takes 8 mm. collets, and there is also a vertical spindle. Another example of Bill's work was a radial engine built from scratch, fabricated from bar stock and with no castings. It still needed a carburettor.

An early exploratory and trading vessel of the well-known Hudsons Bay Company was the *Nonesuch,* of which a full-sized replica was built in England a few years ago for the Company's Centennial. Jack Visser is building a model from blueprints of the replica, and making a beautiful job of it, principally from scrap. Ed. Thompson's first attempt at lathe work was on show—an excellent example of the E. T. Westbury paddle engine, and Duncan Heriot showed some parts for a "Northern" 4-8-4 locomotive which, he explained,

he had bought as a project for his retirement but had started early!

These were just a few of the interesting and varied pieces which, along with the happy social atmosphere and pleasant personal contacts, made an evening which will never be forgotten either by my wife or myself.

The Niagara Interlake R.R.

Another happy social occasion, as well as very interesting from the modelling point of view, was our visit to the beautiful home of Janice and Art Ellis at the town of St. Catherines in Ontario. Art is the President of two companies which provide his workaday occupation, but as a hobby he runs in his large garden the Niagara Interlake Rail Road, a raised track 250 ft. long, of 3½ in. and 4¾ in. gauge. (In North America they use both 4¾ in. and 5 in. gauge, of course.)

Art supplied me with two photographs of his engines. The first shows him with his 1 in. scale "Pacific", and was taken at the Milton Steam Show in 1973. He purchased this engine, which is of typical American design and appearance, and which runs very well. He repainted the engine, and made and fitted a new throttle, as well as fitting O-rings throughout.

The other locomotive could be called a Canadian version of an English design. It started out to be the Bassett-Lowke 3½ in. gauge side-tank 0-6-0, but Art decided he wanted a larger engine to match up more nearly with the "Pacific". At the same time he did not want to scrap the work which had gone into the 3½ in. gauge chassis.

The solution was to look through his books, where he found a narrow gauge (3 ft. 6 in.) Baldwin locomotive which fitted well into a 1 in. scale profile. And so the Bassett-Lowke became the Baldwin saddle-tank switcher, with what I think will be agreed is a very satisfactory result.

Unhappily we did not have the chance to run these two engines, as it came on to rain heavily after lunch. But we all hoped that some day there will be another trip, and if so, the N.I.R.R. certainly will be on our itinerary.

A Small Rounding-off Jig

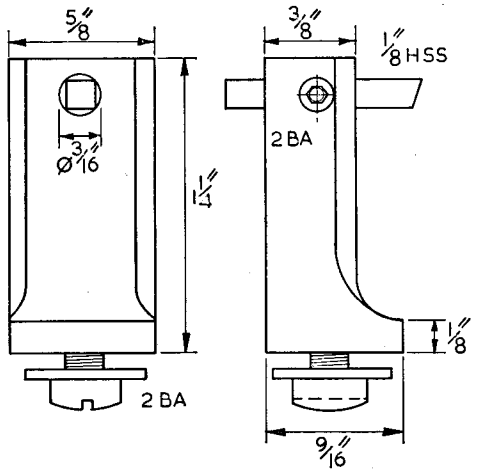
by R. L. Tingey

THIS JIG was designed for rounding off Gauge 1 outside cylinders on the Unimat lathe, but it is suitable for other small lathes. Essentially the jig consists of a strong alloy fork with a 1⅛ in. gap in which an alloy cylinder turns about an axis; the alloy cylinder is turned to a finish which closely fits the bore of the steam cylinder which is to be rounded off on the outside. The whole lot is clamped to the cross-slide of the small lathe and presented, parallel to the centre line, to a mill turning between centres. The square faces of the steam cylinder are slowly fed to the cutter and the corner rounded off to a semicircle. The jig gives access both above and below to provide a continuous feed of workpiece. The side of the jig can be used to round off connecting rods and coupling rods.

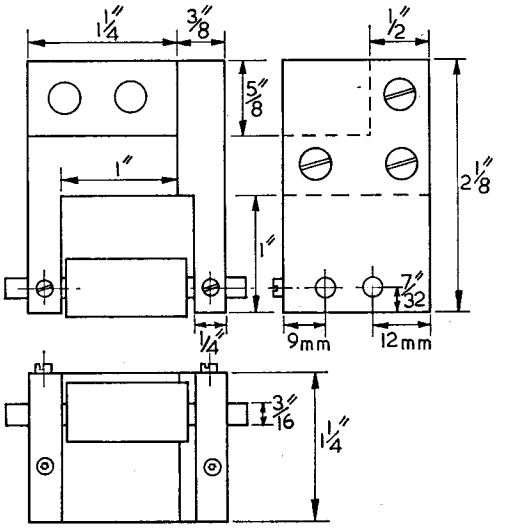
The jig is made from a block of 1¼ in. square dural and a piece of ⅜ in. thick dural. Cut the pieces to size and finish one side of the block and one surface of the other as flat as possible, using emery cloth on a flat surface; a piece of glass is ideal for this. Mark out the three holes on the ⅜ in. piece and centre pop, clamp the two finished surfaces together and drill just over 1 in. deep with a No. 34 drill, remove the side and drill it through with a No. 27 drill: countersink. Mark up the block and saw out the two pieces, filing the angles clean (cut out the two pieces carefully, as they will be useful for packing on the cross-slide or milling table). Drill the two clamping holes with a ¼ in. drill. Cut away or file out ⅛ in. of the side plate to give a bigger gap in the fork, and cut away any of the side plate thought to be surplus. Tap the three holes 4 BA and assemble; use a shorter screw for the rear hole so that it will not obstruct the ¼ in. securing hole.

Clamp the jig to the cross-slide using the T-nuts from the milling table or from the vice. Check that it is flat to the surface and parallel to the bars. If all is well, remove the jig, take out the screws and clean up with CTC; re-secure using Loctite or similar. When the retaining compound has cured, reclamp the jig to the cross-slide and drill through the front at centre height with a 3/16 in. drill. Turn the jig upside down and clamp to the cross-slide with a clamping claw using a packing piece approximately 3 mm. thick, then drill through again. Remove to drill and tap for the locking screws. Drill through the front to the lower holes with a No. 34 drill, tap 4 BA and fit two short Allen grub screws; they should not protrude when clamped onto the axle. Drill through the top to the upper holes with a No. 44 drill and tap 6 BA, fit two cheesehead screws. Cut a piece of 3/16 in. silver steel, 2⅛ in. long, for the axle.

To use the jig for rounding off a cylinder with a half-inch bore, first turn a length of dural rod to



FLY CUTTER



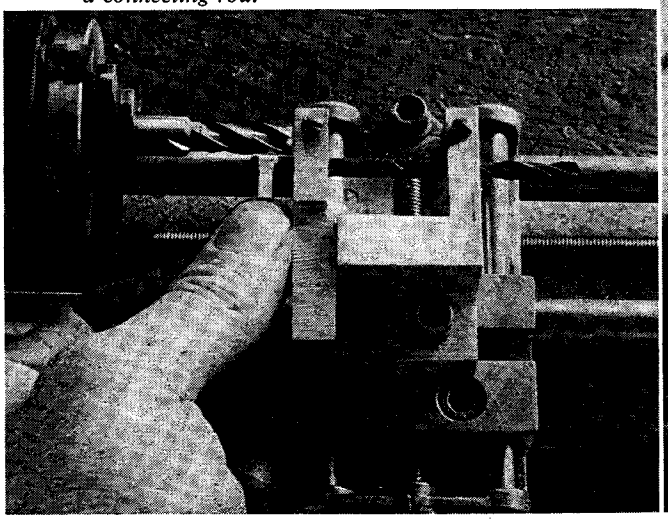
A SMALL ROUNDING OFF JIG

exactly fit the bore. Drill the rod through in the lathe with a 3/16 in. drill, fit the rod into the bore and fit the lot into the jig, pushing the axle through and securing with the screws. Chuck a long 5/16 in. dia. end mill in the three-jaw and secure the end of the cutter with a centre in the tailstock. Set the lathe to turn at 850 r.p.m. Now when the jig sets the workpiece against the turning endmill, by means of the cross-slide handwheel, the cylinder block will be seized and pulled violently into the mill. To prevent this the work must be held firmly when starting a cut, and always pulled towards the operator when cutting; always against the turning cutter. In this way you are always pulling against the direction of rotation and can have full control.

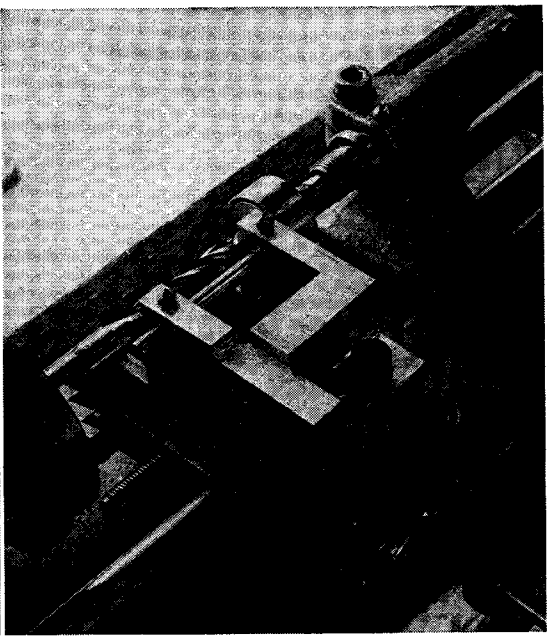
Start with the square corners using the top hole of the jig; they can be rounded one at a time. When they are nicely round put the block in the bottom hole, readjust the cross-slide, and finish off turning right through — the jig gives access for fingers below and above, always pulling against the direction of rotation, and switching off before returning for another cut. Before using the jig would be a good time to fit a foot switch to the lathe in place of, or in addition to, the switch that

Continued on page 1089

The side of the jig being used to round off the end of a connecting rod.



The jig set up in the lathe. Note the long end mill between centres.



MORE ABOUT THE STAKING TOOL

by George H. Thomas

IF I SAY that I am sorry to be writing about this thing again it will be because it is delaying the completion and publication of other articles on workshop methods and equipment which have, for too long, been promised to readers who have taken the trouble to write to me requesting them. However, in view of the interest which has been shown in this simple piece of equipment it was felt that certain matters which have arisen justified the writing of a few more words on the subject.

First there was the criticism that the base should have been under the table and not under the column. This came from one for whose work and opinions I have always had a high regard and I accept that his criticism is valid, especially if it is to be used for closing rivets much larger than those which I generally use (1/16 in. dia.).

All that is necessary to provide a base under the table is to lengthen the stem of the latter, see Fig. 1, item 1, and for operations which do not require the use of the table a longer stake-holder can be provided, item 2. These simple modifications will enable the component parts to be assembled either way, i.e. with column or the table over the base, the various set-ups being clearly shown in the photographs. To modify the table it was bolted to a faceplate with stem set true to clock; parted off; boss faced off and hole bored out to 11/16 in. dia. The new stem was made from a $3\frac{5}{8}$ in. length of P.G.M.S. $\frac{3}{4}$ in. dia. (The use of P.G. steel saved turning the item from $\frac{7}{8}$ in. stuff as the tolerance on $\frac{3}{4}$ in. B.M.S. is +.000, −.003, and mine was mostly −.002 which is too small). The piece was drilled through $\frac{3}{8}$ in. and the end opened up to an accurate 7/16 in. to accommodate locating spigots. The end was turned down to 11/16 in. dia., a close sliding fit in the table to which it was secured by Loctite 35 after proper degreasing with carbon tetrachloride and a whiff of Primer T. The next day the end of the stem, which was made to protrude a little, was faced off flush with the table. It will be noticed that the stake-holder (item 2) is provided with a reducing adaptor (3) permitting the use of stakes having shanks either 5/16 in. or 7/16 in. dia.

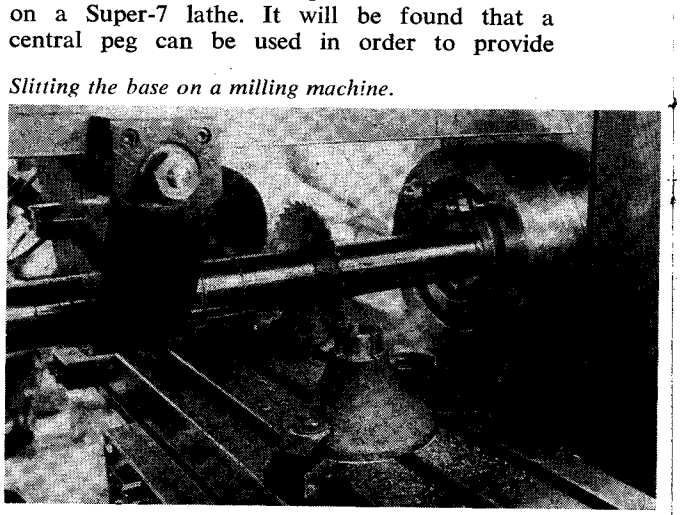
The Base

I recently obtained from our suppliers (Reeves) one of the base castings which is supplied with the set, as I wished to make my staking tool independent of the base which I had used until then and which belonged to my "Lorch" watchmaker's drilling machine. I found that the shape was not in accordance with the drawing (Vol. 141, p. 351) and it was found necessary, owing to the greater amount of metal in it, to extend the slit to both sides of the casting. This new base has now been completed and in use it is perfectly satisfactory. No details of machining operations have, as yet, been given for the base, but I think that it merits a few words for the less experienced worker.

The underside of the casting was cleaned over with an old file to remove any "pimples" and it was then gripped in a chuck to turn the clamping collar which I increased from 1 1/16 in. to $1\frac{1}{8}$ in. dia. and at the same setting the hole was drilled, bored and reamed to .7505. (In the absence of a $\frac{3}{4}$ in. reamer or hole measuring gear, use a piece of $\frac{3}{4}$ in. silver steel and bore to a close fit.) This bore size is based on the assumption that the small ends of the arms have been, or will be, treated in the same manner and that all the $\frac{3}{4}$ in. bores will be the same within $\frac{1}{2}$ thou. to ensure interchangeability. Next comes the slitting operation which is probably the only one which might present any difficulty. I did mine on a horizontal miller by clamping a $\frac{3}{4}$ in. stub to the table with a set-screw and tee nut; the casting was planted over this with thin card interposed between the casting and table and held down with two clamps, the slitting being done with a 4 in. x 1/16 in. cutter. After feeding well in, the work was turned through half a turn to slit the other side.

For those without a suitable miller, other means must be found and the operation can be done on a Super-7 lathe. It will be found that a central peg can be used in order to provide

Slitting the base on a milling machine.



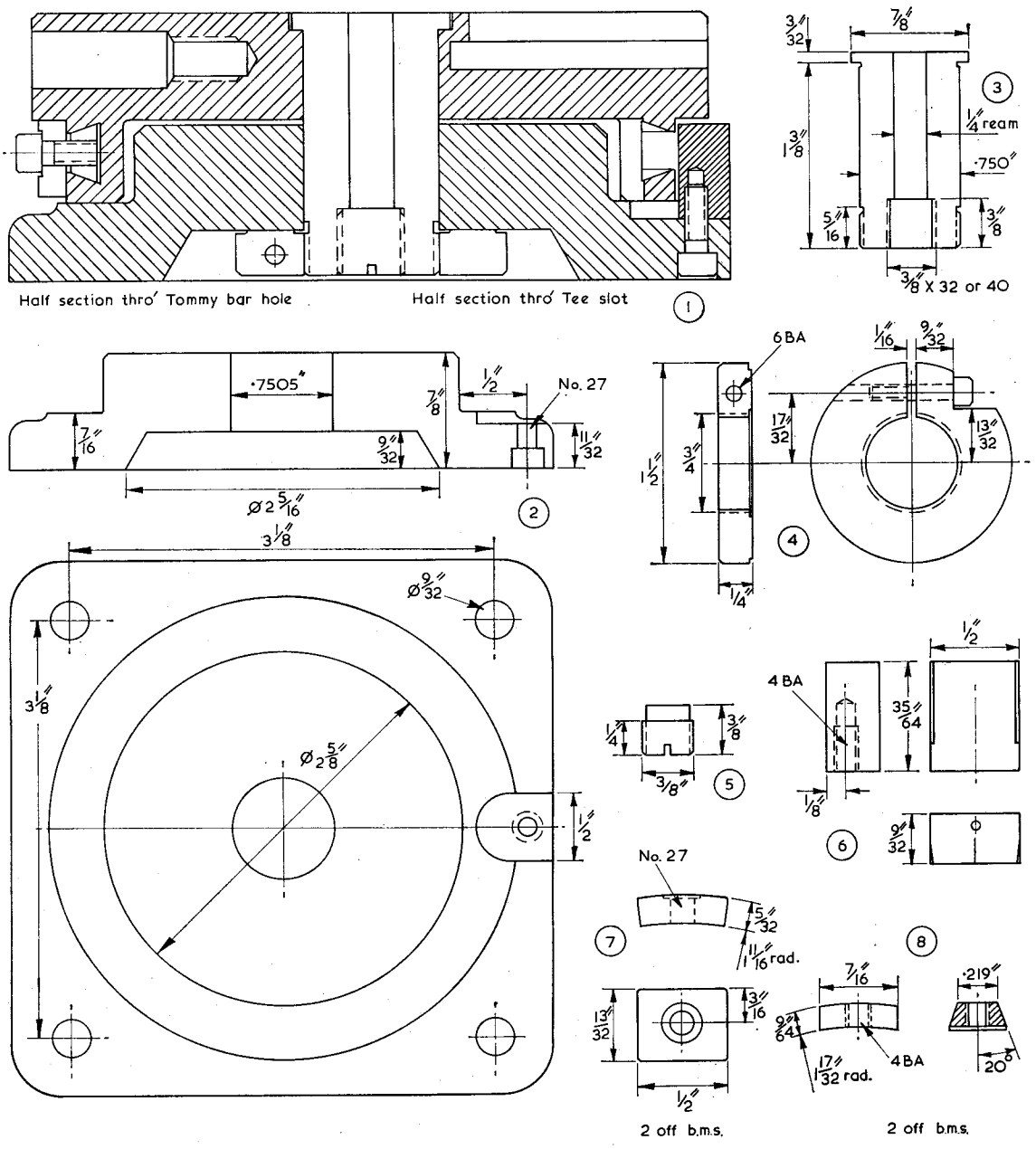
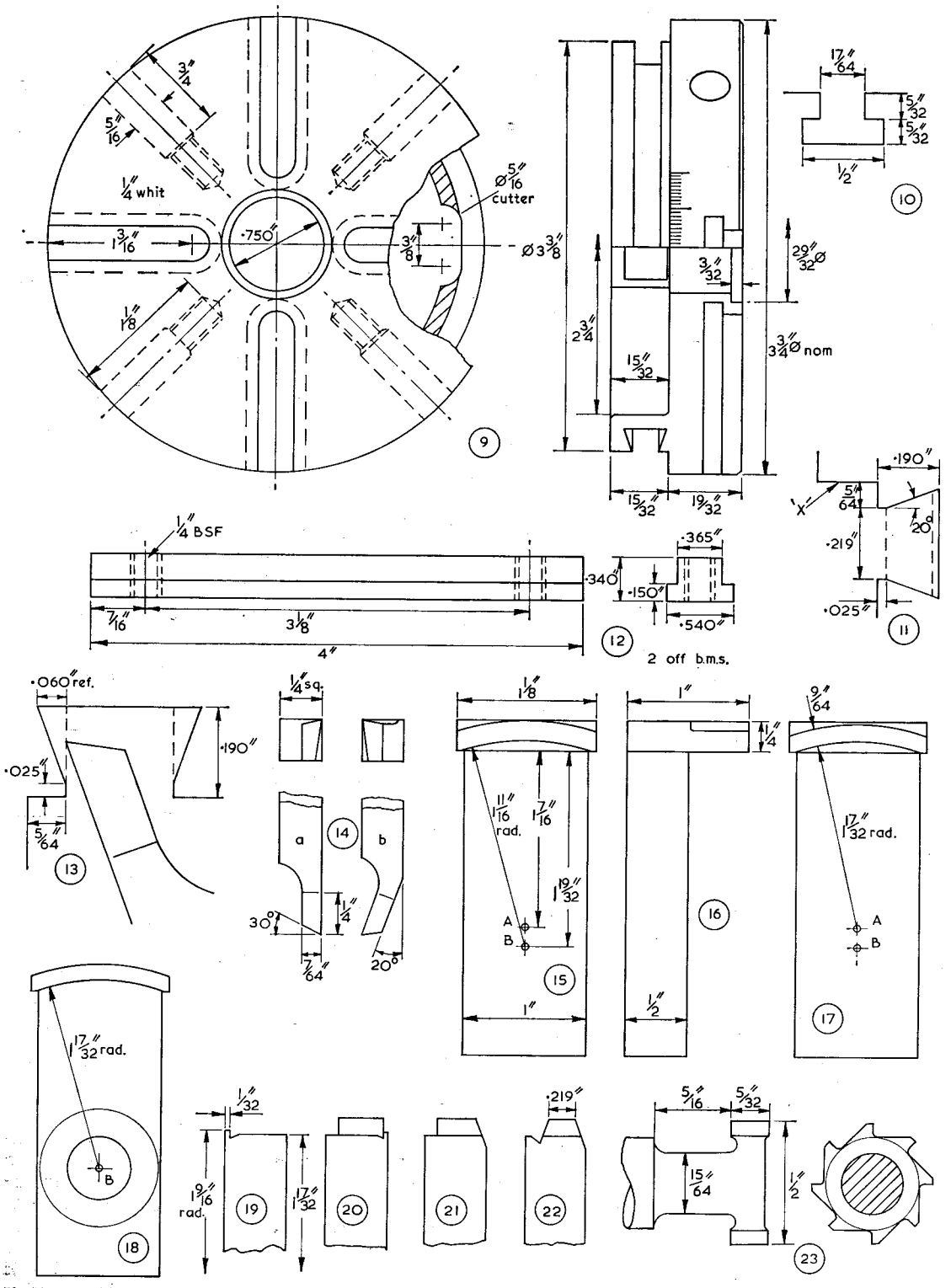


Fig. 1

positive location and that this is attached to the plug which is now provided with these lathes to fill the large hole left in the cross-slide when it is used for milling or boring. Whilst the use of such a plug was very desirable on the earlier Super-7s in order to keep swarf out of the feed-screw, it is essential on the later models having automatic cross-feed. Dimensions for this plug are given. With the base casting located in this manner it can conveniently be clamped down by a bar and two bolts in available tee-slots. The direction of rotation of the cutter will tend to hold the work down but as there is an element of "climb" milling, the slide locking screws should be tightened a little to prevent it being drawn into the cut. After completing the first cut, withdraw and turn the casting round, lining up the first cut with a rule held against the side of the cutter, then do the other


3/4
5/16
1/4 whit
1 3/16
·750
3/8
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1/8
9
17/64
5/32
5/32
1/2
10
2 3/4
15/32
3/32
29/32 Ø
3 3/4 Ø nom
15/32
19/32
·190
5/64
20°
·219
·025
11
1/4 BSF
·340
·365
·150
·540
7/16
3 1/8
4
12
2 off b.m.s.
·060 ref.
·190
·025
5/64
13
1/4 sq.
a
14
b
30°
1/4
7/64
20°
1/8
11/16 rad.
1 7/16
1 19/32
A
B
15
1
1
1/4
16
9/64
17/32 rad.
A
B
17
17/32 rad.
B
18
1/32
9/16 rad.
19
17/32
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21
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22
5/16
5/32
15/64
1/2
23

FIG. 2

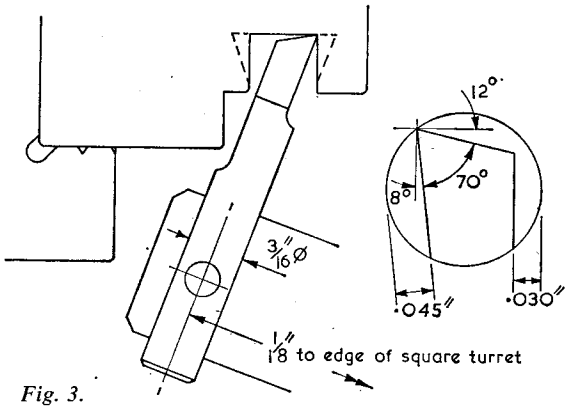


Fig. 3.

side. I suggest a 3 in. x 1/16 in. x 1 in. cutter which is not only just about right for the job but is a useful size likely to be available to the average worker. Very small slitting saws are made with $\frac{1}{4}$ in. bore; next, up to $2\frac{1}{4}$ in. dia. they are supplied with $\frac{5}{8}$ in. bore and cutters larger than that generally have 1 in. bores. I recommend a convenient type of arbor for 1 in. bore cutters (mine will take either $\frac{5}{8}$ in. or 1 in. bores) which can be made either with No. 2 M.T. shank, tapped for drawbar, or a plain shank to be gripped in a chuck; I prefer the former. With no milling facilities at all available it will be a case of drilling the three holes and screwing down on to a piece of wood and doing a little penance with a hacksaw—but not the day I write this with a shade temperature of 92 deg!

When making small components involving a number of machining operations which could include turning, milling, drilling, etc., common-sense dictates that they be left on the end of the parent material as long as possible as this provides a convenient means of holding and facilitates transfer from chuck to milling machine vice as many times as is necessary; cutting-off is deferred for as long as possible. Although the clamping collar is, compared with many of the little bits we have to produce, quite substantial, it paid to make it on the end of a piece of $1\frac{1}{2}$ in. x $\frac{1}{2}$ in. b.m.s. $5\frac{1}{2}$ in. long. First the width was reduced to $1\frac{3}{8}$ in. for the length of the component (not 1 5/16 in. as shown on the original drawings, to allow for the larger bore); this was followed by marking out, clamping to faceplate—use a wobbler in the centre-punch mark—and boring the hole to $1\frac{1}{8}$ in. dia. Next, before substituting the rotary table for the vice, the corners were knocked off at 45 deg. with an end-mill. Clamped to the rotary table, located by a suitable spigot in the $1\frac{1}{8}$ in. hole, the end was rounded. Next, held in a small vice, the $\frac{1}{4}$ BSF tapping hole (No. 4) was put through and then it was cut off from the parent stock. The $\frac{1}{4}$ in. radius around the clamping bolt was done by end-milling

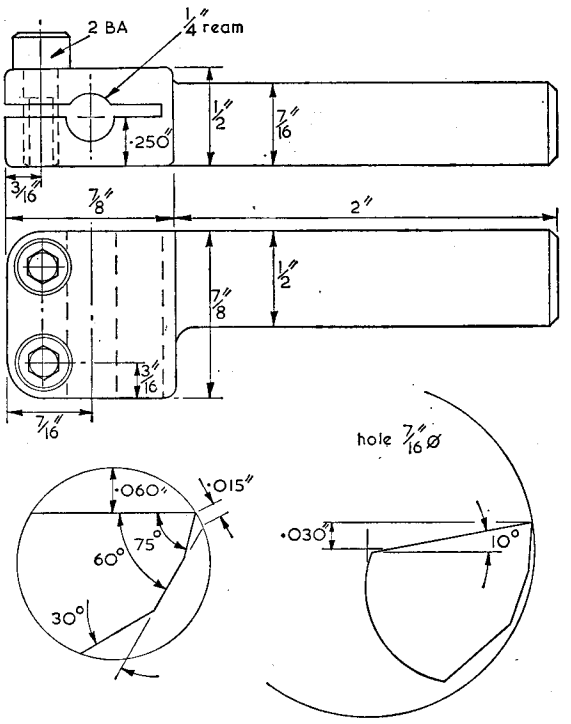
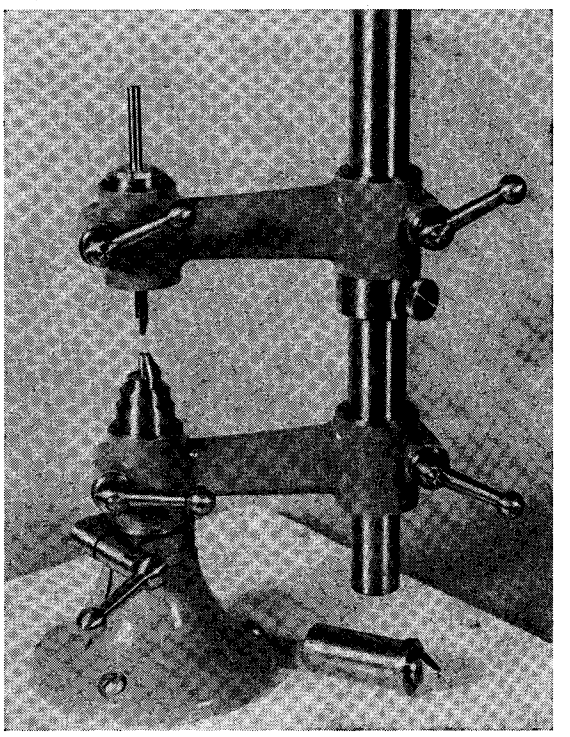
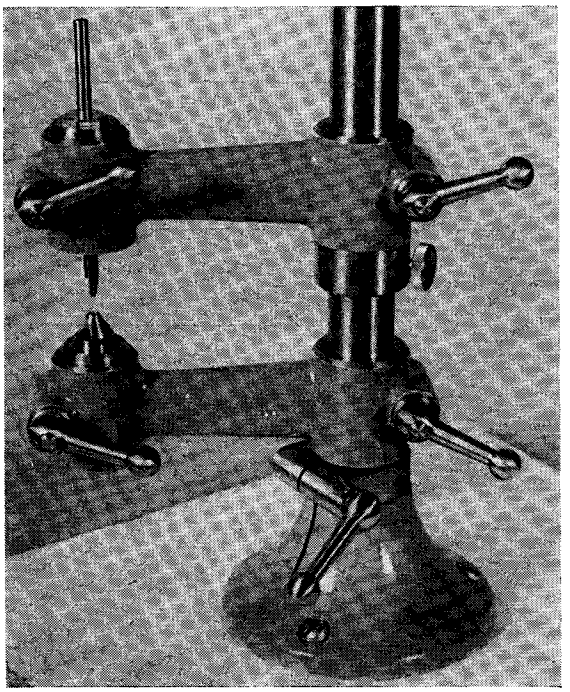


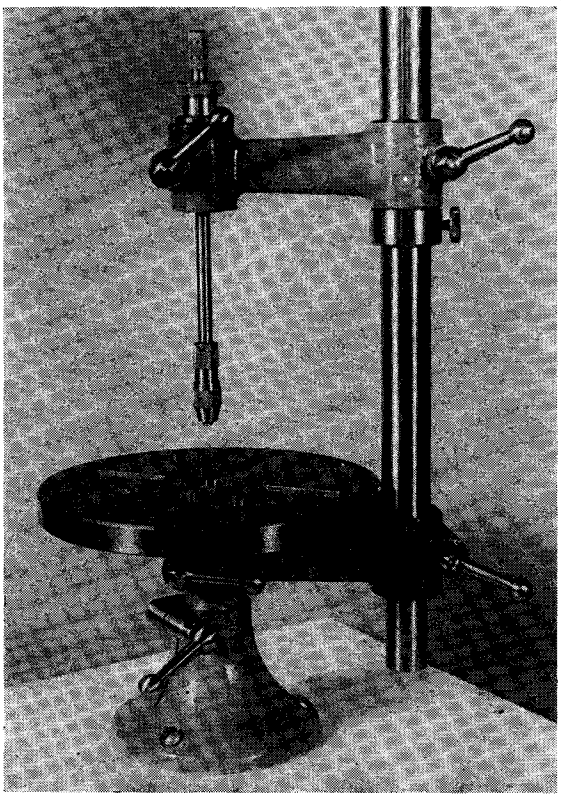
FIG. 4

Set-up with extended stake-holder in the base.





Set-up for working inside channels, boxes or tubes. Below: Set-up for tapping.



at 45 deg. at each corner and then filing. Throughout all the operations the length of parent material aided the setting up by providing means of holding and clamping down.

Spacing holes on a pitch circle

At a S.M.E.E. meeting this year a member suggested that it might be feasible to provide graduations or other means on the table to enable holes to be spaced correctly around any given pitch circle and I have sketched a simple method by which this might be done (item 7). The outer edge of the table could have any desired number of holes made with a small centre-drill, the most usual number for general purposes being either 24 or 60, the former giving 7 different spacings and the latter 11. A small block carrying a spring arm with a detent point at the end is secured by a pinching screw to the column. To use this feature the column would be clamped into the base, a suitable spigot or locating device inserted into the central hole (7/16 in.) of the table, and the work held down to the table with small clamps. In certain circumstances it might be possible to hold down by a bolt right through the work and the table. The upper arm, with punch holder and accurate centre-punch—kept for this and similar work—swung out to meet the desired radius after which the required centre-punch dots can be made with accuracy and no marking out. The centre-punch should be turned from silver-steel with the point running true to the stem. For this and much similar work I find that punches made from 3/16 in. dia. silver-steel are quite large enough (and cost less) and so, for all but the heaviest jobs, I now use this size. A suitable holder is shown at item 4, the recess at the top, like the $\frac{1}{4}$ in. size, houses a "C" spring which effectively prevents the punch from falling under its own weight.

To be continued

WILLIAMSON ENGINE

From page 1072

you terminate both "permanent" pipes with a flange, and have a flange-to-union adaptor for working. Unions look all wrong when the engine is on show, whether at home or in an exhibition!

I think that's all. Fig. 24 shows the finished engine, and though it may differ a little from yours (some improvements have been made in the "production" casting sets) and the photograph was taken before the proper decorative panels were available (those shown are made with dentists' drills) I think you will agree that she looks very well. I hope you have had fun making it, and that yours runs as well as mine does! □

EXPO-STEAM 1976

Peter Wilkes

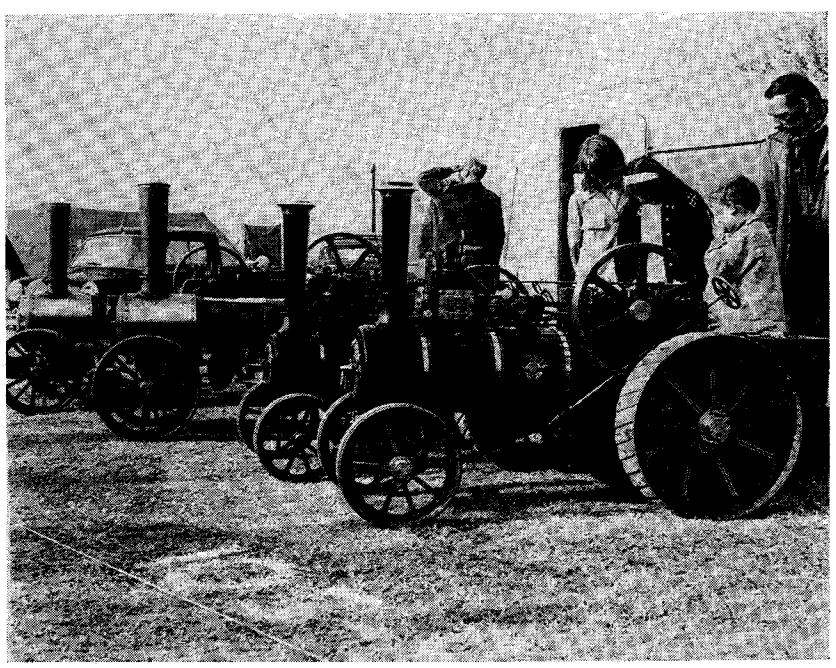
Peter Clifton's 2 in. scale 89-key Marengi organ, from the Peterborough Society.

IN DROUGHT-STRICKEN East Anglia, the daily hope was for rain, yet ironically it chose to put in an appearance on the days when everyone hoped for a continuation of the dry spell, the first and last days of Expo Steam, held at the East of England Showground near Peterborough. In fact, so heavy was the rain on the final day that many entrants had given up and gone away by mid-afternoon. And this was a tragedy for Expo 76 lived up to the reputation it has got during the three preceding years it has been held on this site.

There were over 80 full-size engines assembled, and while space prohibits details of them all, mention must be made of the magnificent collection of "Fowell" engines. As steam organiser John Crawley said, "This is the centenary year of the Fowell company and we wanted to mark this historic occasion, so we decided on a line-up of existing Fowell engines". Today the Fowell is something of a rare bird with only seven known to have survived. And it is a triumph on the part of John Crawley that he was able to have six of them at Peterborough. In fact he discovered only too late that the seventh could have also appeared.

On view were Fowell No. 91 of 1902 vintage, No. 92, although not in steam for it was still under preservation, No. 93, a 7 h.p. made in 1905. The successors to the original company, W. H. Oldman (St. Ives) Ltd. entered Nos. 97 and 103, and completing the collection was No. 108 built in 1922.

But to many, even at a gathering like Expo Steam, it is the miniatures that take the eye showing the skill and patience of the model engineer. Alas, they more than anyone suffered from the weather, but during the dry periods some truly great engines were on view to an admiring public. Mr. J. Stubbs of Costock had a $4\frac{1}{2}$ in. scale Burrell



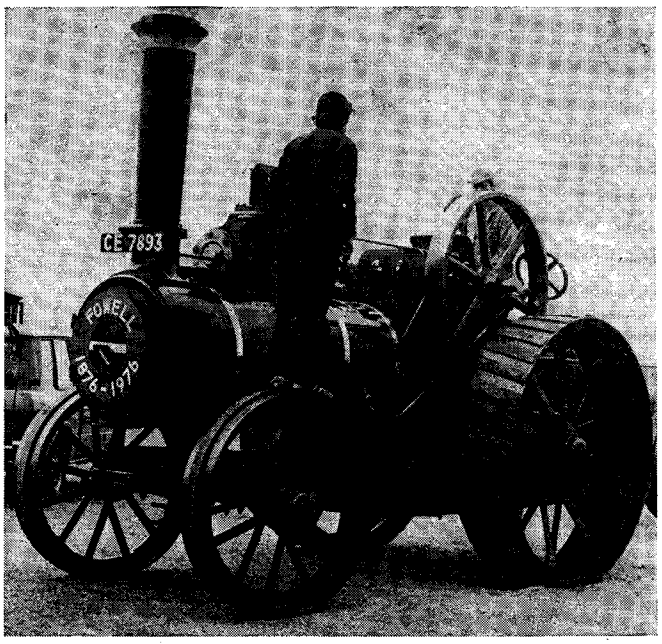
A fine line-up of large-scale model traction engines. A 4 in. scale Allchin in the foreground.

6 h.p., a 4 in. scale Allchin 7 h.p. traction engine and a 4 in. scale Fowler BB1 ploughing engine that has still another three years' work before completion.

Ken Tyler had his well-known 3 in. scale showman's engine, while son Robert added a 3 in. scale Marshall threshing drum, completed during the winter with the Powell baler and 3 in. scale Burrell traction engine. Another engine that brought admiration was the 4 in. scale, s.c. ploughing engine from the Fowler stable built and owned by H. T. Ellis of Ongar. Add the 1½ in. scale Foster showman's engine of Mr. E. A. Two, modelled on that famous fairground engine "Ex Mayor", also at Expo, the Wallis and Steevens 4½ in. scale Simplicity road rollers of W. T. Palmer & B. Johnson, and you get some idea of what was on offer.

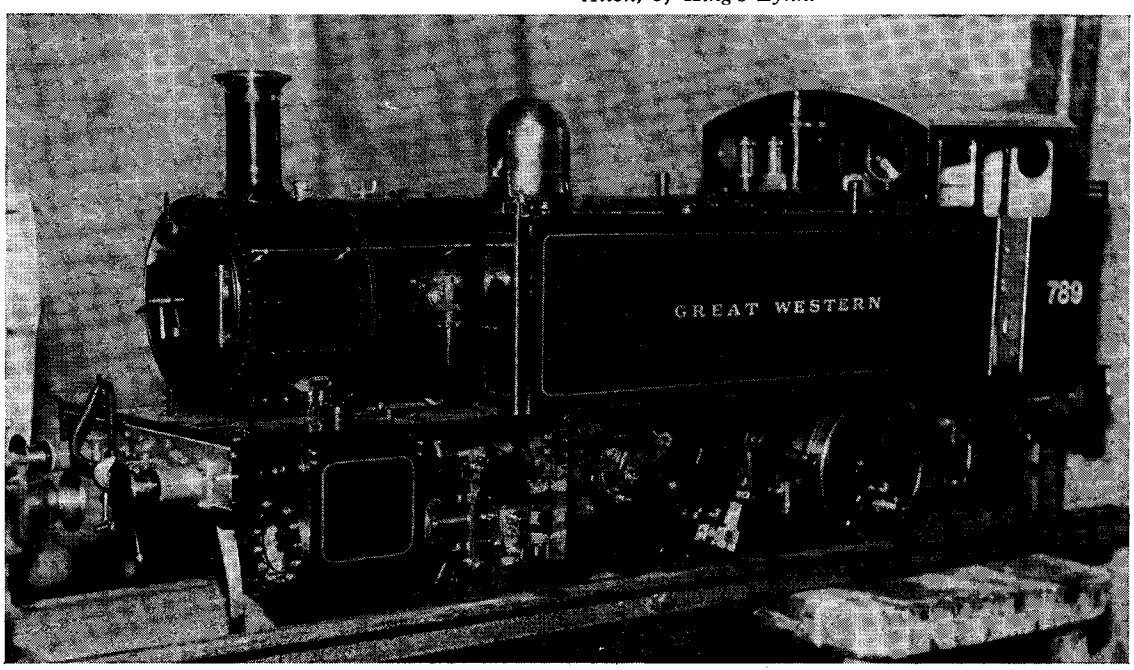
But model engineering went even further through the efforts of the Peterborough Society of Model Engineers, who fortunately had their assembly, with the exception of Ron Hobbs' 5 in. gauge L.N.E.R. B1 *Springbok,* under cover. And those who took advantage saw every aspect of model engineering. Again, in the presence of such a collection it is hard to single out exhibits for mention, but the 5 in. gauge A.3 of Ken Edge, built to works drawings, and the equally attractive 5 in. gauge *Simplex* from R. L. Allen of King's Lynn were but two examples of the skill of the model engineer.

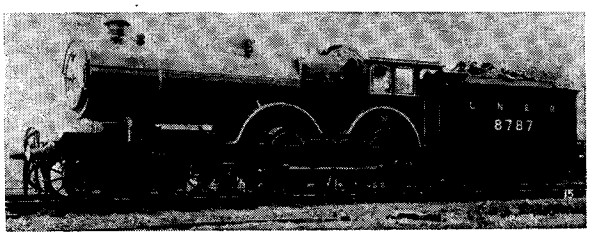
And every visitor admired the 2 in. scale 89-key Marenghi organ of Peter Clifton of Peterborough making its Expo debut, for right outside the Society tent was the full-size Marenghi from which he had copied the tiny miniature.



This 1908 7 n.h.p. Fowell, No. 97, was shown by H. W. Oldman of St. Ives.

Below: A fine 5 in. gauge "Simplex" 0-6-0T by R. L. Allen, of King's Lynn.





SUPER-CLAUD

A new locomotive for 5 in. gauge, based on the large 4-4-0's of the old Great Eastern Railway

Part VII

by Martin Evans

From page 969

THE BOILER for *Super-Claud* is a very different proposition to the simple wide-firebox boiler described for the Gauge "I" L.B.S.C.R. "Atlantic" in the last issue; but it is not really difficult to make.

Most builders seem to agree that the throatplate is the most difficult item in a Belpaire type boiler, especially if this is made as in full-size practice; with flanges formed each way to take both the barrel tube and the outer firebox wrapper. But I don't think this is necessary in one-inch scale work, the single flanged plate, as shown in my drawing, being quite adequate.

If the joint between the barrel and the firebox in this boiler is made with Easyflo No. 2 (which I strongly recommend) there will be no doubt as to its soundness, as it should be possible to see a bright ring of the silver solder all around after the job has been done. However, for those builders who want to make doubly sure, a narrow flanged ring can be made up, from a strip of copper about $\frac{1}{2}$ in. x $\frac{1}{4}$ in. bent into a circle and the joint silver-soldered. This is pushed into the end of the barrel as shown and gives a larger area of contact for the silver solder, when making the barrel/wrapper joint. I am indebted to Don Young for this neat idea.

We cannot use my favourite type of crown stays in this boiler, as there is a large area of flat outer wrapper to be supported, but the traditional plate crown stays can be improved by the "cutaways" shown along the lower edges. These can be cut by first drilling $\frac{1}{2}$ in. dia. holes, and then sawing up from the bottom; but leave the end holes as they are. It should not be necessary to use more than eight rivets in all, to hold the crown stays to the inner firebox for silver-soldering, the "feet" of the stays being tapped down until they are in fairly close contact—the solder will do the rest.

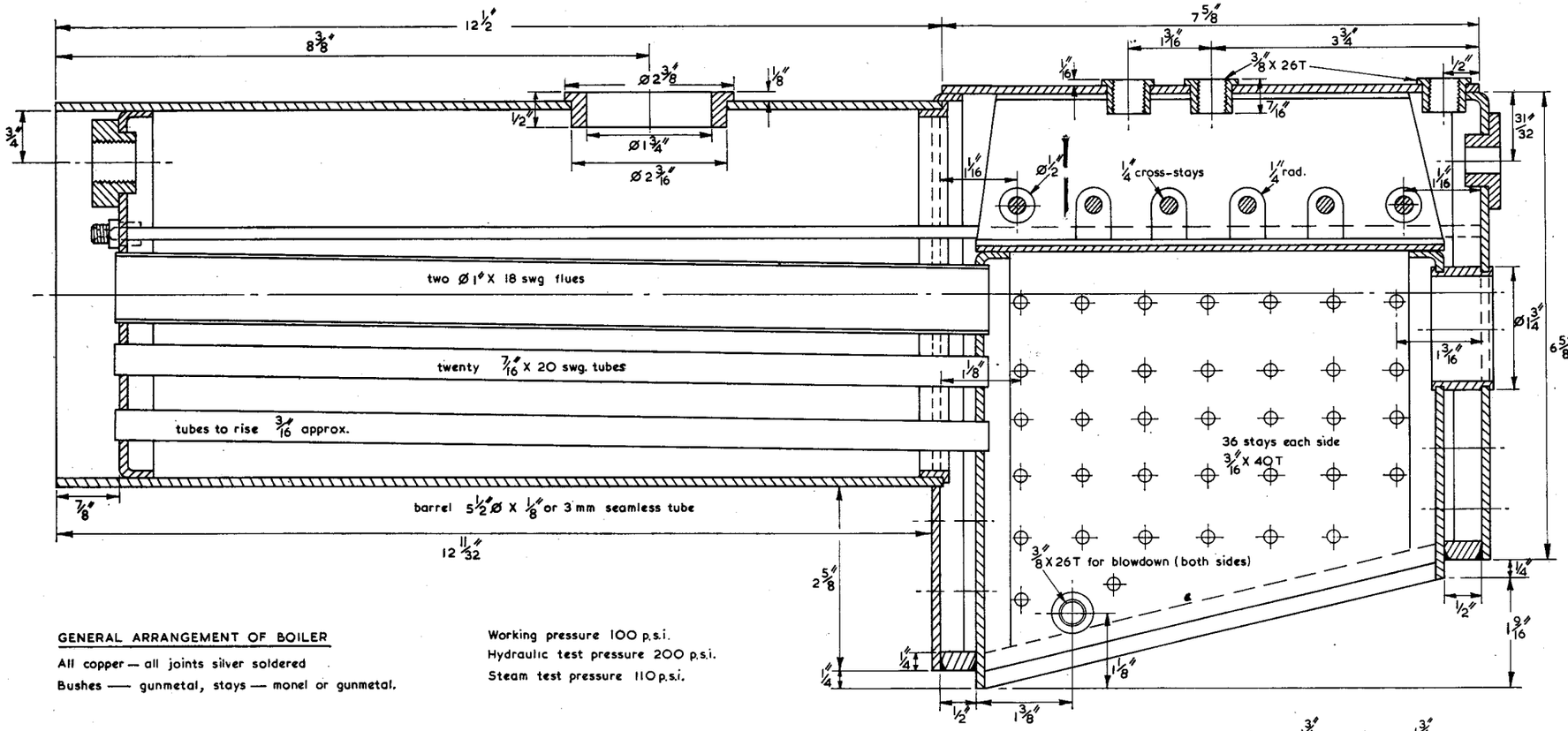
The attachment of the crown stays to the outer wrapper is a little more difficult. It may seem rather a tricky operation to insert rivets near the front end, as the stays here are nearly 7 in. from the (at the time) open backhead end, but there is no objection to using screws at this point, provided that they are made of bronze or monel metal. They can be run over with Easyflo on the outside afterwards.

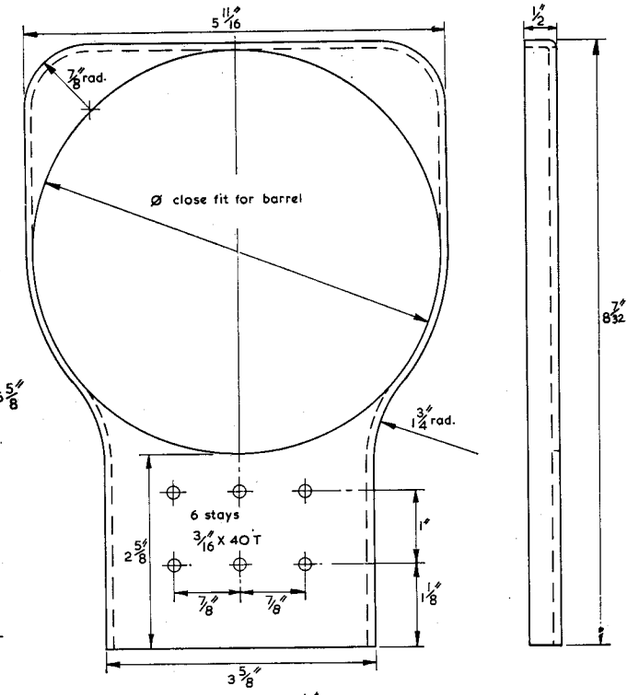
To go back to the beginning so to speak, the barrel is cut from $5\frac{1}{2}$ in. x $\frac{1}{8}$ in. seamless copper tube. I got my own barrel tube from Smiths of Clerkenwell, but this was two years ago; I hope they still stock this size, but if not, the barrel will have to be rolled up from sheet, in which case either $\frac{1}{8}$ in. or 3 mm. will be satisfactory. Even 3 mm. gives us a handsome margin of safety.

Note the large inner dome bush. This is to allow the use of a slide valve (L.M.S.) type of regulator, which in my opinion is about the best type for models of this scale. It also allows the fitting of top feed, a feature of the *Super-Claud*s when first built, but removed later when rebuilt by Gresley who apparently preferred backhead clacks—I wonder why?

Regarding the other flanged plates, the firebox backplate is the quickest to make, the firehole ring being brazed to it and lightly flanged over: a higher melting point silver solder can be used here, Argobond or C.4 being very suitable. The firebox tubeplate is identical to the firebox backplate apart from its much greater depth. Set out and drill the tube and superheater flue holes $\frac{1}{8}$ in. dia. to start off with, then this plate can be used as a drilling jig for the holes in the smokebox tubeplate. Open out the holes to a few thou. under the nominal 7/16 in. and 1 in. diameters. When drilling the smokebox tubeplate, don't forget the rise of the tubes towards the smokebox end—this slope makes tube sweeping a little easier. The holes in the smokebox tubeplate can be drilled or reamed the full size.

There are four tapped holes in the smokebox tubeplate, but don't tap these right through at this stage, or the threads will be damaged by the heat from the brazing torch or blowpipe; thread them just enough to get a "start". The rather large





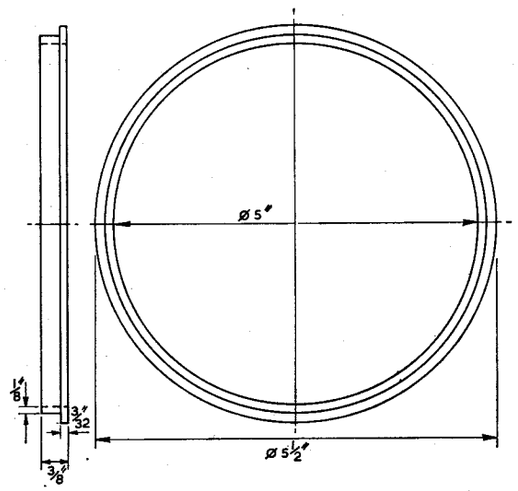
THROATPLATE : 1/8" or 3 mm

GENERAL ARRANGEMENT OF BOILER

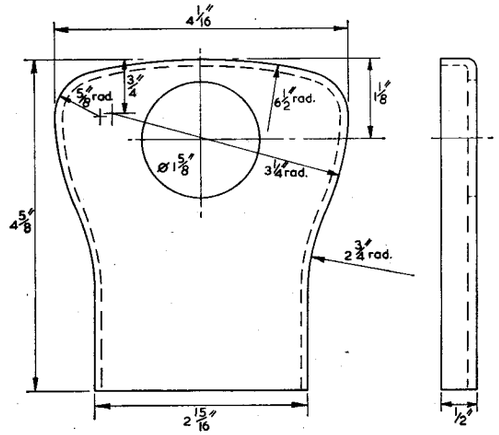
All copper — all joints silver soldered

Bushes — gunmetal, stays — monel or gunmetal.

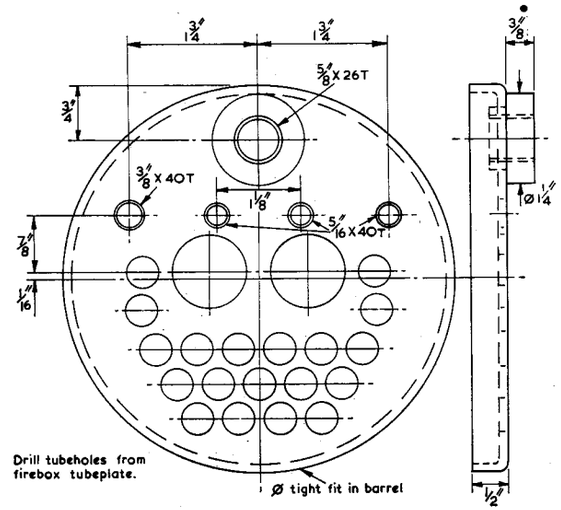
Working pressure 100 p.s.i.
Hydraulic test pressure 200 p.s.i.
Steam test pressure 110 p.s.i.



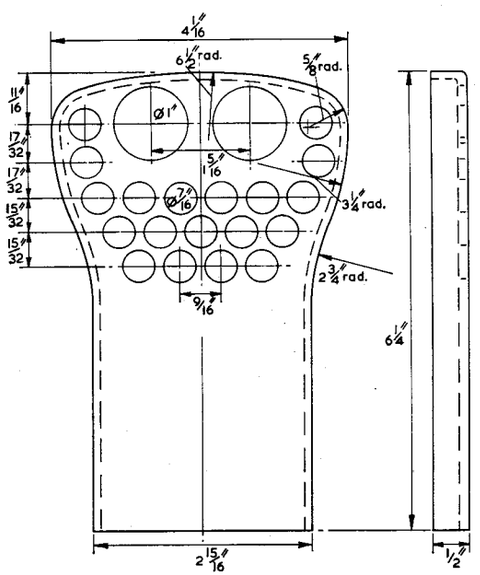
STRENGTHENING RING FOR THROATPLATE



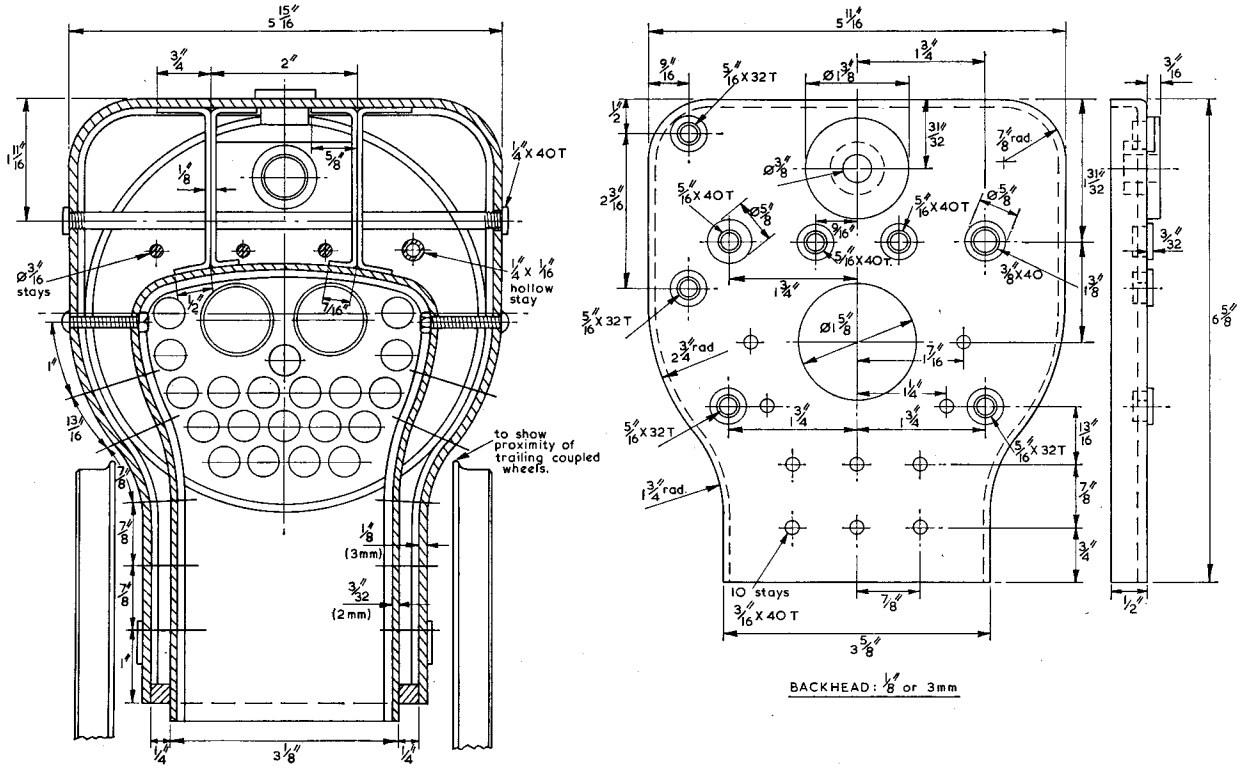
FIREBOX BACKPLATE : 1/8" or 3mm



SMOKEBOX TUBEPLATE : 1/8" or 3mm



FIREBOX TUBEPLATE : 1/8" or 3mm



tapped bush to take the main steam pipe helps to support the plate, and can be brazed before assembly. Again, don't tap right through.

I have shown the backhead with TWO bushes for feed clacks. Those intending to fit top-feed will only need ONE bush here, which can be used for a hand pump delivery. Builders who prefer side clacks will also only need one bush. Again, the bushes on the backhead have been made on the large side so as to stiffen the plate and avoid having to fit too many stays. There are three longitudinal stays plus the usual hollow stay for the blower. I no longer fit these longitudinal stays myself, as I don't think they are any better than "passengers", but I am showing them on the drawing as I know that many builders do not share my opinion on this point! If builders do fit all these stays, it might be a good plan to use bushes for the left-hand stay (looking at the backhead from the driver's position) as well as for the blower, as the additional metal will help to support the backhead where there is rather a large area that would otherwise be unsupported. Once again, all these bushes can be brazed in position before fitting the backhead.

On the vexed question of side stays, I can only say that I much prefer a screwed stay which is threaded through both outer and inner wrapper, with a nut on the inside, whether these are to be silver-soldered over, or some high-melting point soft solder used as a caulking medium. If the stays are to be threaded, they should be of gunmetal or monel metal as copper is wretched stuff to screw-cut.

I know that many of our "professionals" use ordinary copper rivets for boiler stays, but my advice to beginners, or to those with limited boiler-making experience, is to follow full-size practice and stick to screwed stays.

As locomotive boiler making has been described many times in *M.E.* over recent years, and in some detail, I will not say much more about the subject here, except to remind beginners that a hydraulic test to twice working pressure is essential. Before this can be carried out, all the bushes will have to be blanked off, with threaded stubs. I have quite a collection of these now, made from brass. I usually thread these slightly oversize and put just a taste of plumbers' jointing on the threads before use, as if there are any leaks from the bushes, it prevents the builder seeing whether there are leaks coming from the boiler itself!

To blank off the big dome bush, it is a good idea to make a steel disc and set out on this the fixing holes for the dome cover proper — twelve evenly spaced No. 34 holes will do nicely, the bush being drilled No. 42 and tapped 6 BA. Use stainless steel (or gunmetal or monel metal) screws here—

never mild steel. The disc can then be used as a drilling jig for the inner dome cover.

I have given a dimensioned position for the two blow-down bushes but this should be checked off from the holes in the frames, in case of any slight discrepancy. All the bushes can be fixed with Easy-flo No. 2 which will avoid having to heat the boiler to much more than a dull red. I always use this silver-solder for the final heating job on the boiler itself — the foundation ring and the backhead flange, and particularly the firehole ring, which being of heavy gauge copper needs quite a lot of heating.

★ ★ ★

I have recently heard of quite a few criticisms of the drawings of the 5 in. gauge 0-6-0T *Simplex*. The chief complaint seems to be about the running board angle edging, which some builders say has to be cut away to clear the steam chest cover. There is actually no mistake on the drawings, which gives a clearance of 1/16 in., or allowing for two thicknesses of gasket, a full 1/32 in. The reason why many builders get a "foul" here is probably because they are using studs and nuts on top of the steam chest cover, whereas I use countersunk screws for the outer row only. Granted that studs are much better practice, but I would rather use countersunk screws here and avoid having to pitch the running boards quite a bit higher, which would involve several bends and upset the alignment of the side tanks etc.

Some critics say that an easy solution would be to make the running boards quite a bit wider, so that the angle completely clears any steam chest studs; but I don't think this would look right on this type of engine. The cylinders on many full-size engines of this type project outside the running boards, often by quite a large amount.

Writing to the Journal of the Steam Locomotive Society of Victoria (Australia), Mr. Alex Russell makes quite a few criticisms of *Simplex*, though he is kind enough to agree that it is a "very rugged design, very fast and of excellent hauling capacity". Apart from the point about the running boards mentioned above, Mr. Russell says that the engine is too light at about 120 lb. I agree; but he then goes on to say that because of the "boiler design", the boiler and its plates are unnecessarily heavy!

I am sorry to note that one of the most attractive features of the *Simplex* boiler—the simple crown stays unconnected to the outer wrapper—are not allowed in Australia, the A.M.B.S.C. Code insisting that crown stays must be connected to the outer wrapper. I cannot understand this ultra-conservative attitude, and hope that one day our friends "down-under" will come to see the error of their ways! This method of staying (as I have said in *M.E.* before) has been used in this country on many occasions, and has been proved to be quite safe beyond all doubt. I was very pleased to see that Bill Hughes has also adopted it for his portable engine, together with the internal stiffening ribs.

Mr. Russell says that there are many faults in my locomotive designs; perhaps there are, but I will venture to claim that there are a good deal less than in the work of some other designers I could mention! I will in any case fall back on one of the late LBSC's favourite remarks: "Those who never make mistakes, never make anything"!

ROUNDING-OFF JIG

From page 1077

is fitted, which can rarely be found rapidly when needed. The foot can remain in contact with the footswitch and leave both hands to deal with emergencies. If one cannot be easily purchased then make it from two foot-size pieces of plywood and a hinge, using a "push-on" "push-off" switch. Fit a small block to limit movement.

When rounding off connecting or coupling rods use the projecting ends of the axle and a shorter end mill, not secured in the tailstock, then the work can be brought very close to the tool. Odd sizes of hole in connecting rods can be accommodated by using the blunt end of an appropriate number drill as an axis.

The jig is capable of turning out some nicely finished surfaces, but remember, if the work is turned the wrong way, or inadvertently let go, the mill makes a nasty mess of the flat surface, and the little lathe gets a nasty jolt.

PRECISION LATHES

SIR,—I am writing in connection with a letter published in your magazine dated 6 August written by a Mr. G. H. Thomas of New Milton, Hants., concerning small lathes.

I must disagree with his statement that a small precision lathe built to Schlesinger's limits would cost between £5,000 and £10,000 and would like to draw your readers' attention to the range of precision lathes marketed by us which are manufactured in Austria and are marketed under the trade names of Emcomat and Maximat. Every machine leaving the factory is checked to the full inspection standard laid down in the Schlesinger Publication for toolroom lathes and these machines are retailed by us in the U.K. at prices between £543 and £892.

Naturally, literature and price sheets on these machines are available from the address below on request.

C. Worner, Managing Director
Elliott Machine Equipment Ltd.,
BEC House, Victoria Road, N.W.10.

THE BRISTOL EXHIBITION

Reported by D. E. Lawrence

THE LAST EXHIBITION put on by this Society was in 1969 so it was time for another and there is no doubt that when Bristol do something they do it in the grand manner. This Exhibition might be called the Bristol and West Show, such was its scale and excellence. Ken Cribb was the Chairman of the special Exhibition Committee and, I gather, he and his fellows had been left to get on with it with little interference from the main Committee. In my opinion the result was a resounding success. The publicity was somewhat unusual, to say the least; according to the Society's Chairman's remarks at the opening a Mr. Gadd had been invited to formally open the show and it seemed that at the last minute he was not available. But down at the dock in which the Brunel ship *S.S. Great Britain* is being restored, an eminent Victorian engineer *was* available and he was duly persuaded to ride through the town in a horse-drawn coach — advertising the show, of course — and on arrival at the Hall he charmingly declared the Exhibition open. Afterwards he was given a conducted tour of the stands, marvelling the while over the progress engineering had made during his enforced absence from the scene! All this was great fun, of course, and enjoyed by everybody there.

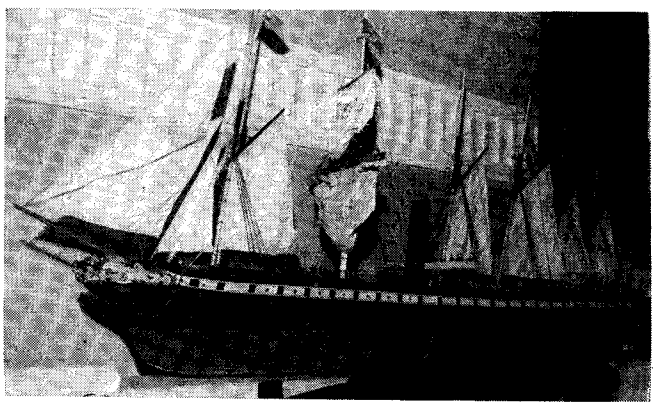
The Exhibition was non-competitive and indeed had there been cups or trophies awarded it would have been a most difficult task for any judge to "pick the winner". The well-produced programme listed almost 180 locomotives alone; 36 marine exhibits; 49 stationary steam engines; 31 tools and workshop equipment items and some of these were groups entered as a single item. The variety can be shown by a dip through the lists at random: a 5 in. gauge GWR 1361 0-6-0ST with truck and brake van; a Danish crab fishing vessel; a Howard single furrow horse-drawn plough; a vertical boiler with engine; a drop hammer and cropper; a very large collection of machinist's hand tools, instruments and accessories; a 10 in. standard microscope; a 1 in. scale working tram layout; a model glider; a $\frac{3}{4}$ in. scale naval q.f. gun; a working $\frac{1}{3}$ scale hand lawn mower; a dulcimer.

It was quite apparent from the programme that Bristol had had tremendous support from neighbouring clubs (some not so near at that). Also, heading in the direction of an IMLEC cup winners cup, there were six of the eight past IMLEC winners on show. Obviously I can only mention a fraction of the 400 plus models exhibited, so let's begin with the locomotives.

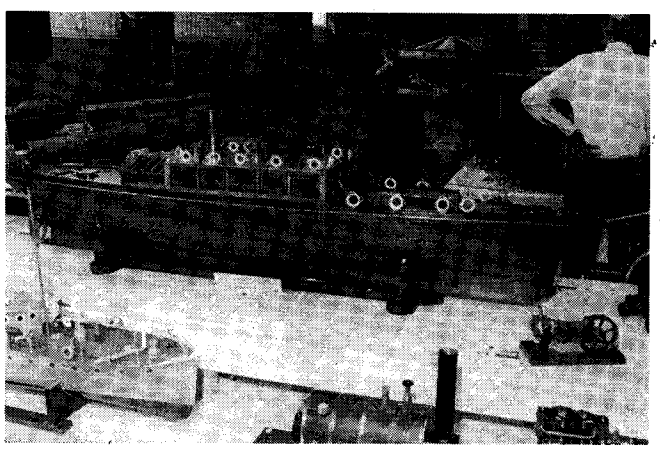
The co-operative spirit is very much in evidence amongst the Bristol boys; there are several syndicates building locomotives ranging from $7\frac{1}{4}$ in. gauge down to $3\frac{1}{2}$ in. A group of three $7\frac{1}{4}$ in. gauge 0-4-4T ex SR class 0.2 engines are being built. another group of three are making 5 in. gauge LMS "Duchess" Pacifics; all three boilers were shown, each weighing 76 lb. and having fairly long combustion chambers with six 1 in. dia. near-vertical water tubes therein. During conversation with one of the syndicate, I was reminded of my own experiments with a long combustion chamber boiler for a similar locomotive. (I wrote to *M.E.* on the subject about May/June 1968.) It seems the syndicate met some structural problems with the water tubes which took some time and trouble to solve. However, judging by the quality of work put into the many parts displayed, it looks as though the Society's track will have three very useful and powerful engines to deal with the passenger traffic at Ashton Court.

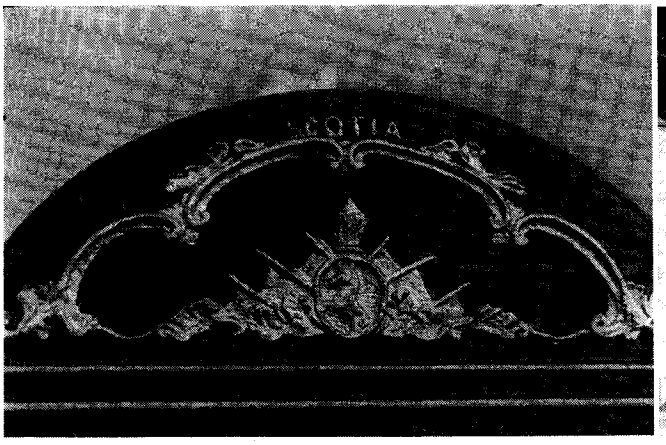
Another syndicate which should be mentioned is the "Greenly" one formed to build eight $3\frac{1}{2}$ in. gauge 0-6-0 saddle tanks to a Greenly design. The syndicate is mainly composed of young members with a couple of old hands "keeping an eye" on things. This sounds to me an excellent way of bringing on young people in the hobby and it must be encouraging to older members to see the youngsters do so well.

There was some remarkably fine and ingenious work in the marine section. Perhaps the most fascinating was the 8 ft. long equipped hull of a model H.M.S. *Vanguard* which I estimate was about $\frac{1}{8}$ in. - 1 ft. scale. This ship is being made by J. G. Martin of Weston-super-Mare and he must be a very versatile craftsman;

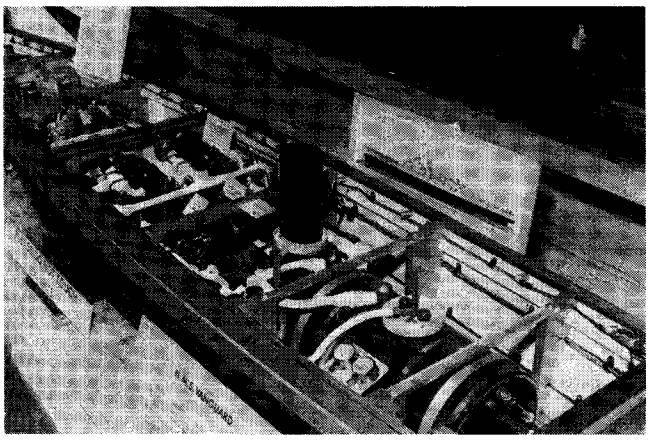


Model of Brunel's famous "Great Britain" by M. Taylor, of London.
Below: J. Hippisley's river steamer.

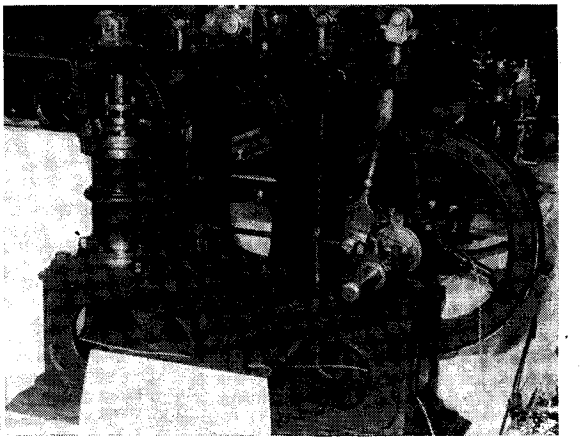




Paddle box detail on P.S. "Scotia".
Below: The interior of J. Martin's H.M.S. "Vanguard".



An elderly, large model beam engine shown by Ron Ireland.

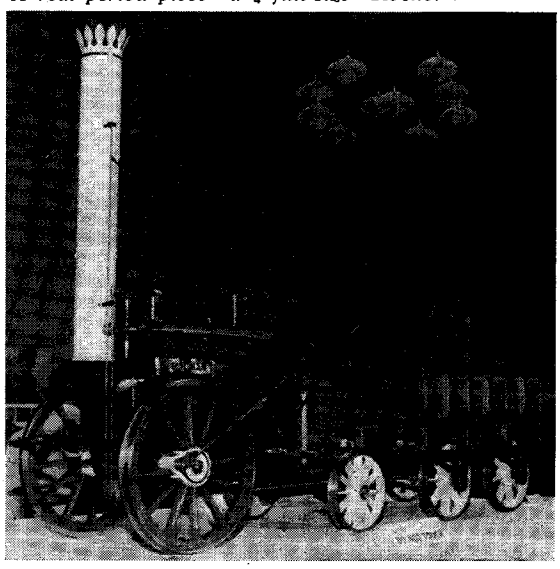


the hull contained the radio control six-channel proportional digital outfit, butane fired boiler, two main twin-cylinder steam engines of 1 in. bore by $\frac{7}{8}$ in. stroke, a small auxiliary engine, Stuart boiler feed pump, compressed air tank supplying the reversing gear (I could not make out how the steering engine worked), and there was also an auxiliary water tank and about a dozen or so butane containers connected, if my tracing of the piping is correct, to a common main. The hull was absolutely packed with gear, but it was all installed in an orderly manner.

Some delightful work was apparent in Bruce Fleet's traditional Thames slipper launch. The graceful hull was of plank-on-frame construction, very smoothly finished and varnished to show the lines to the best advantage. The furnishings were neatly done and the "Surrey with the fringe on top" canopy with its golden tassels all round was just right for this period piece. The power unit was a 15 cc. *Kiwi* engine. Equally well done was another period model by John Hippisley of Bath; this was a Thames river steamer of about 1870, approximately 5 ft. long and fitted with a centre flue boiler and compound steam engine. The deck had the usual wooden slatted bench seats as found on these old-timers (and some fairly modern ones as well) and the bow was ornately carved; radio control was fitted. Back to Bruce Fleet again whose unfinished $\frac{1}{8}$ in. - 1 ft. model of the Cunard paddle steamer *Scotia* showed very fine and delicate work. The stewards kindly put the ship on a table so that I could photograph it more easily and get some close-ups of the hand-worked detail. The model has an electric motor for its main engines which purists might find to be incongruous in an otherwise faithful old type model and, if I may venture an aside, was there ever a *straight* electric-powered ship? The Brunel connection with Bristol was represented by two models of his ships the *Great Britain* and *Great Eastern*. There I'm afraid I have to leave the sea and come ashore to land—to road locomotives and the like.

At the entrance to the main hall were two fine 2 in. scale showman's engines, one a Fowler by R. G. Burton of Yeovil and the other a Burrell by R. J. Smith who also had a set of 2 in. scale Savage galloping horses. The set was well detailed and the horses were painted and had trappings in the traditional style. In the centre was the Savage steam engine in period Indian red livery with lots of polished brass around,

A real period piece—a $\frac{1}{4}$ full-size "Rocket".



all very colourful and picturesque. These were just three out of 28 items listed in this section which included several agricultural models by John Haining.

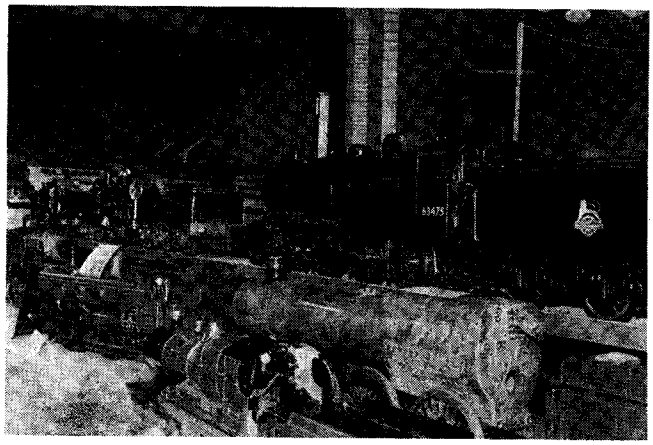
Probably the smallest piece of "watchmaking" engineering in the show was a 0.32 cc. four-stroke single overhead camshaft petrol engine by Iain Holland of Nailsea. The bore and stroke were given as 9/32 in. and 5/16 in. and this little engine was one of those marvels of miniaturisation you don't believe until you see it. The same man also exhibited a similar engine of 0.67 cc. which had pushrod overhead valves.

All the demonstrations and "wheels going round" exhibits were in the large gymnasium next to the main hall and, running on air, were a couple of dozen stationary engines, including some old favourites of Stuart Turner design. Also on this stand under steam from its own boiler was R. Russell's beam engine with drop hammer and cropper. This set appeared to be about 1 in. scale and represented a bygone age of metal forming. Model beam engines are usually of 1 in. scale or larger and I was quite intrigued with a smaller scale one by A. K. Pope; it was barely 6 in. high on its plinth and looked surprisingly delicate. The 70 ft. of portable track was set up in this room and youngsters were given rides on it, the usual motive power being steam, though I understand a "diesel-type" was also to be used. Alongside the track was a very rare model of a 5 in. gauge two-cylinder GWR "Atlantic" of an early series of the 29XXs. I was told the builder was Dave Viviash of Swindon (B.R.) who makes his engines to go, not to look at, and although the "Atlantic" was rather rough and unpolished, my informant said it performed very well on the track and was highly regarded for that quality.

The workshop area

The workshop area was fairly large and demonstrations were given on the lathes; at the brazing hearth where parts for the *Simplex* boilers were being formed; on the miller and on the spark erosion machine of Eric Griffiths. This last was very interesting—a syndicate member was making several safety valve parts for their LMS "Duchess" Pacifics and each top cap had 30 holes of 0.020 in. dia., another 30 of 0.024 in. dia. and a further 7 of 0.024 in. dia. Eric Griffiths showed me one of them complete with all the holes and as far as I'm concerned he is welcome—injectors I can manage! There was the work of two more syndicates in this hall: four *Maid of Kent*s being built in various guises, two as SR L.1s, one LNWR *George V* and one Midland 999. A great number of parts were laid out for show including home-made patterns, and all the work was by Bristol members. The other syndicate was from the Mid-Gwent College of Further Education who are producing five *Simplex*es and all showed good plain work. The Society has plans for a ground level 7¼ in. gauge railway at their Ashton Court site and the motive power for this was displayed including three complete small engines, an incomplete GWR small *Prairie* tank and the hefty chassis for an LNER A3 Pacific.

Back in the main hall, the largest single exhibit could easily be seen mounted on a plinth at eye level; this was a one-quarter full size *Rocket* by E. W. Cook of Stroud. The driving wheels were made in the fashion of the period with wooden spokes and felloes and iron (or steel) tyres. The firebox wrapper was dished and riveted which I thought was a very careful bit of coppersmithing. The tender was of wood, of course, and this was well done, as was also the coopering of the water barrel mounted across the tender. The whole locomotive was nicely finished in colourful livery with

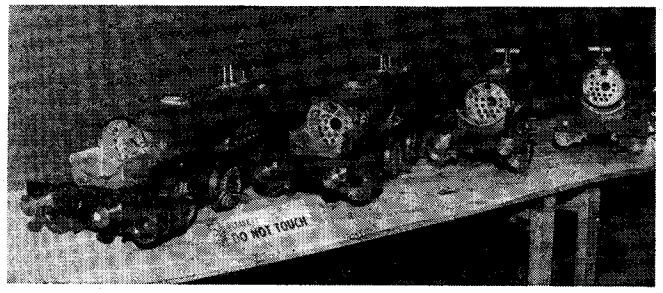


Some of the 3½ in. and 5 in. gauge locomotives, including some I.M.L.E.C. winners.

highly varnished woodwork. At a lower level on the same stand and in contrast to the colourful array above it was R. Starling's 5 in. gauge B.R. class 9 tender. This was finished in works grey all over and detail did not immediately stand out. The work on this tender was first class and there was a large amount of correct detail put in.

Most of the stage was taken up by a collection of "O" gauge tinplate railways and rolling stock, the simplicity of which was in complete contrast to the detailed meticulous fidelity of the work in the hall. But there can hardly have been any older railway enthusiast who did not look at these collectors' items with nostalgia and remember the trains of his boyhood; I did. The popular scale for tramway models is ¾ in. to 1 ft., but I must say I was very impressed with Felix Cunuder's 1 in. scale tramway with its well-made Cardiff Corporation trams running on about 40 ft. of straight 5 in. gauge double track. The trams were automatically controlled and ran in each direction at two-minute intervals. Trams were changed at longer intervals and I rather liked the open top four-wheeler which ran with that odd dipping and yawing action peculiar to trams of this wheelbase. Very many years

A colourful set of gallopers by R. J. Smith.



Handiwork of the "Simplex Syndicate".

ago, a long departed relative of mine would get "sea-sick" on the top deck of such a tram!

I still have several pages of notes left but can now only briefly mention a Beyer-Garratt enthusiast, Peter Wardle, whose 2½ in. gauge 4-8-4 + 4-8-4 (narrow gauge) locomotive was shown on the National 2½ in. Gauge Society's stand. The Beyer-Garratt, though not yet finished, is about 5 ft. long and has a tremendous amount of detail in it. Finally to delight the eye was a collection of 17 railway paintings by Paul Gribble hung on the walls round the hall at convenient height for viewing. I've no idea of the artistic merit or standard of these paintings, but the draughtsmanship (if I can call it that) and proportions in each were very good indeed.

All those people who visited this very fine show and who used the canteen, will remember the charming and good-humoured ladies who indefatigably dispensed refreshment to them; the ladies were members' wives and friends, all volunteers, and they served there for the whole period of the show, and of course, they richly deserve a heartfelt pat on the back. Considering the wide range of other human summertime activities and interests against which this show was competing, the attendance of over 9,000 must be considered as reasonably good.

A SINE BAR FOR THE MILLING MACHINE

by E. H. Ives

THIS WAS THE OUTCOME of one of those "impossible" jobs we model engineers get asked to do. "Can you cut a bevel gear similar to the one I have to run on the other end of the same shaft and match with the same crown wheel but with two less teeth?" said a friend.

First reaction was to say "No!" but later I promised to see what I could do. A search through my *M.E.* card index revealed an article by R. S. Minchin in November 1964 and another by D. J. Unwin in October 1971 and armed with these and a pocket calculator, I spent an evening proving that it was just possible if I used the upper limit of the face width for the new bevel. I am able to borrow a dividing head for my lathe, but not for the milling machine, so I had the problem of fixing this to the mill and inclining it to 13° 48′, the calculated angle. Obviously, I thought, a sine bar is needed. Again recourse was made to the *M.E.* index but this time it only revealed one general article on the subject so I had to set to and design one to suit my equipment, although with very little modification it should suit most machines. The result is shown in Fig. 1.

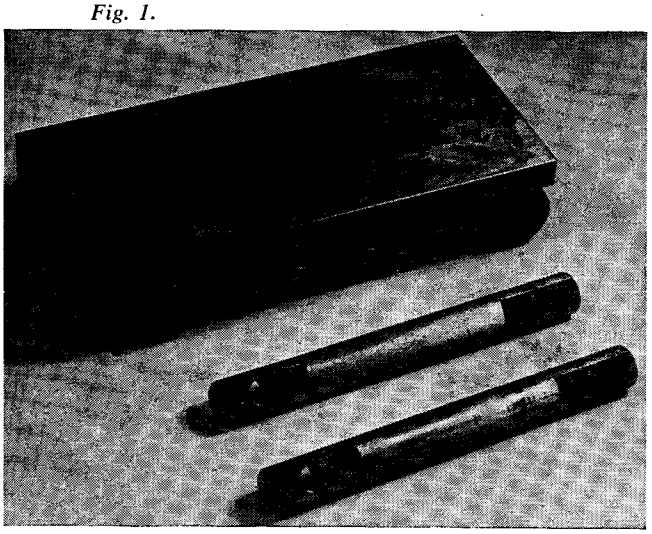
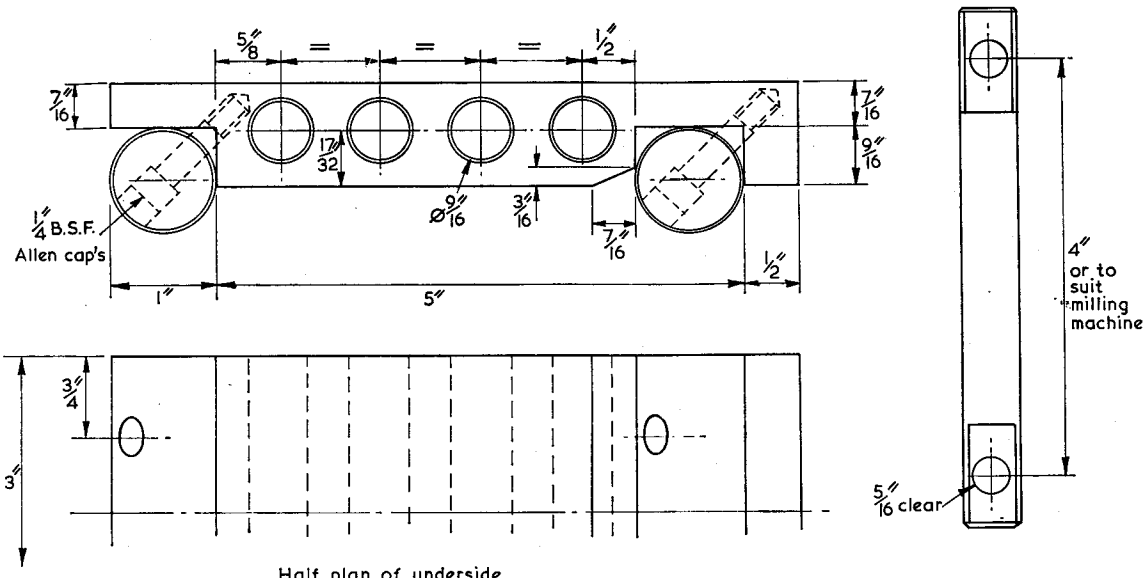


Fig. 1.

Basically the tool consists of a platform or bar to which are fixed two rollers exactly 5 in. apart. Multiplying the sine of the required angle by 5 gives the height of the packing needed under one of the rollers to produce that angle. The cross-drilled holes take special clamping pins to hold the device to the machine table.

A piece of 3 in. x 1 in. mild steel 6½ in. long is required for the platform and this should be carefully marked out for the clamping holes. Not trusting the drilling machine to drill squarely through the bar, it was set up on the lathe cross-slide and drilled from the chuck using a vee pad in the tailstock to provide the push (Fig. 2). Lightly chamfer the corners of the holes.

The next job is the clamping pins as these are required to hold the bar to the milling machine table for later operations. An odd piece of shafting which happened to be the right diameter provided the material for me but you may have to turn them from ⅝ in. rod. The ends are cross drilled to suit the slots in the machine table and to take my stan-



SINE BAR

dard set of 5/16 in. B.S.F. studs which, with various tee nuts fit both the lathe and the mill. A small flat is milled on each end to seat the nuts.

As my piece of mild steel was slightly bruised on the surfaces, I cleaned these up by flycutting a few thou. off both sides before setting the work crossways on the mill and clocking it square. The 5 in. distance between the shoulders for the rollers needs to be spot on otherwise one gets awkward figures to multiply. By removing the swarf guard from the mill I found that with a ¼ in. side-and-face cutter I could just get enough cross movement on the table to be able to use the index on the slide to measure this at one go. Even so I found the shoulders to be .004 in. too long when measured with a dial caliper gauge and so had to add this amount of shimstock. Take note of the vertical height index reading to keep the grooves to exactly the same depth.

The 7/16 in. x 3/16 in. chamfer to the right-hand groove in Fig. 1 is needed when the sine bar is used in the near vertical position so that the packing can clear the underside of the bar. To cut this, a strip of metal is placed in one of the machine slots under the end of the bar to tilt it as below.

Fig. 2.

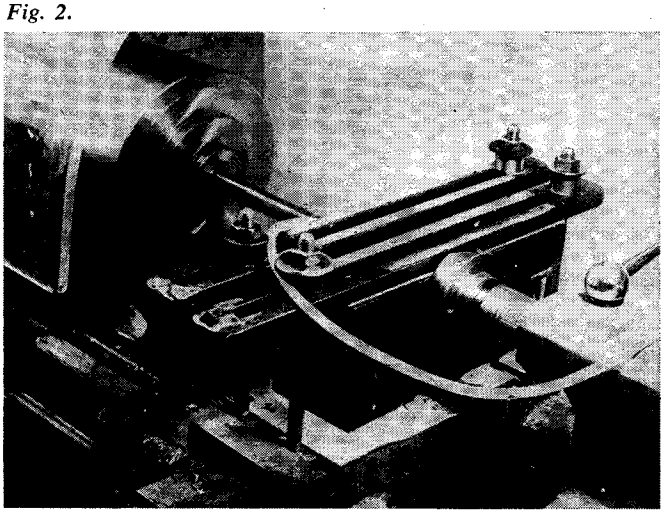
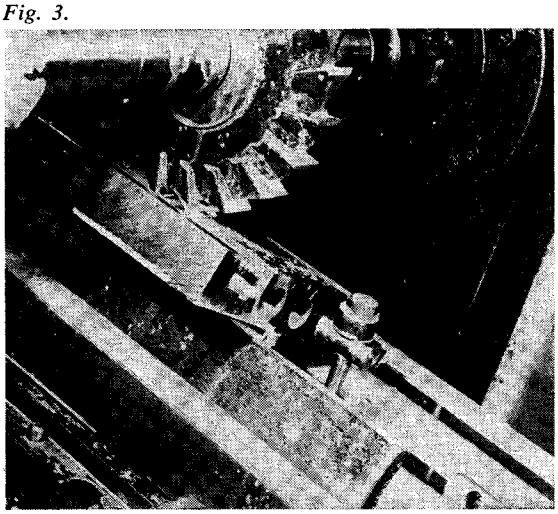


Fig. 3.



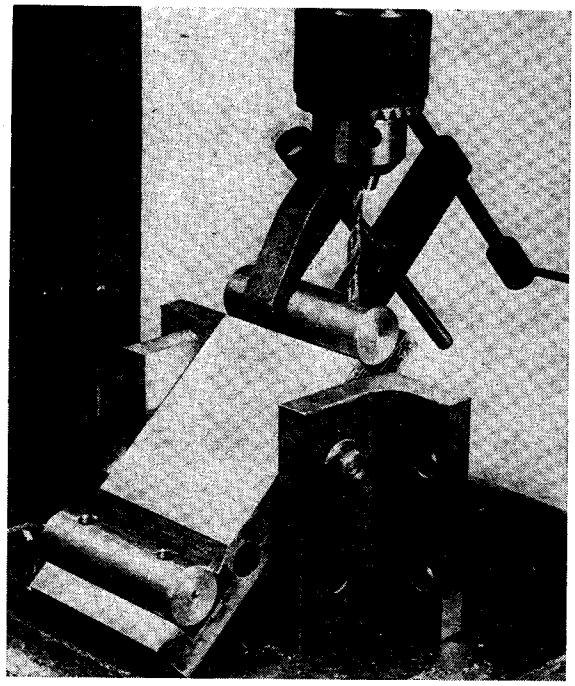
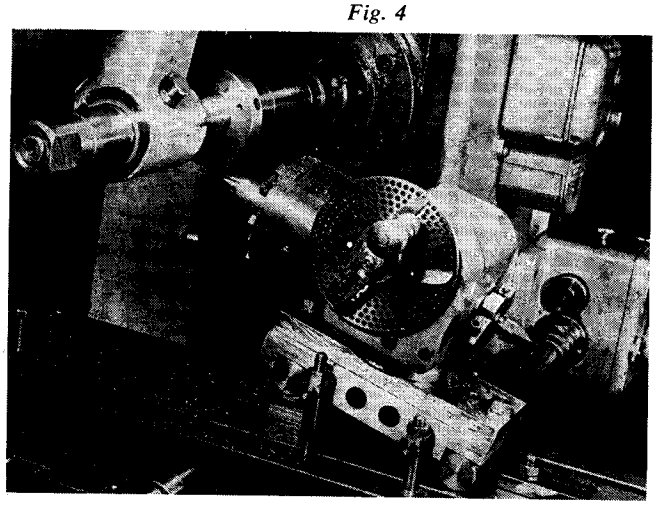
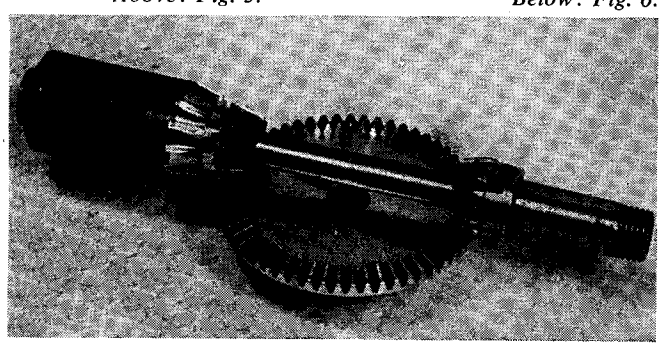


Fig. 4



Above: Fig. 5.



Below: Fig. 6.

Part off the rollers from 1 in. dia. mild steel bar, face and chamfer the ends and cross drill them for the $\frac{1}{4}$ in. BSF Allen cap screws. If you use screws only 1 in. long the counterbores will have to be slightly deeper than shown. Drilling through these into the bar itself may be a problem. I used the set-up shown in Fig. 4. The home-made angle plates that normally serve as a machine vice on the mill were used to set the work to the correct angle. Set the depth stop so that the drill does not quite go through. Tap the holes and bolt the parts together.

The height of the sine bar can now be checked using a dial test indicator on the surface plate. Mine was .002 in. out so the surface was again flycut on the mill which corrected it. A scraper was then worked over the surface to frost it. It would have been nice to have had the whole thing hardened and ground, but the limited use to which it is going to be put makes this seem unnecessary.

Cutting the bevel gear (Fig. 5), following the instructions in *M.E.*, proved surprisingly easy and only took about half an hour compared with the fortnight of spare time preparing to cut it! The bevel meshed with the crown wheel and the whole assembly (Fig. 6) runs sweetly. Now, while I am in the bevel gear cutting mood, I am preparing the blanks and cutters for the compensating gear on my model Ransomes Sims and Jefferies traction engine so the sine bar will be needed again.

Echills Wood Railway

SIR,—Since the photograph, reproduced on the cover of issue 3544, was taken in 1975, considerable improvements and extensions have been made to Echills Wood Railway at Soneleigh. The station "Harvesters" has been extended to include a turntable, storage siding, and engine facilities. Perhaps readers would like to know more of the engines illustrated?

Reading from left to right: "Penrhyn" owned by Dr. B. Rogers, and "Dolbadarn" owned by K. Blackham. These engines, designed and built by Roger Marsh (Minimum Gauge Railways), are based on the Dinorwic Hunslet "Dolbadarn", which is now working on the Llanberis Lake Railway. The next engine, "Zebediela", also designed and built by Roger Marsh, is based on the Beira Railway's 4-4-0s built by Falcon of Loughborough in 1896. They were superseded when the line was converted from 2 ft. gauge to 3 ft. 6 in. The prototype, with others, went to South Africa where they were known as the "Lawleys", and she eventually finished her working life on the Zebediela Citrus Estates in the Northern Transvaal.

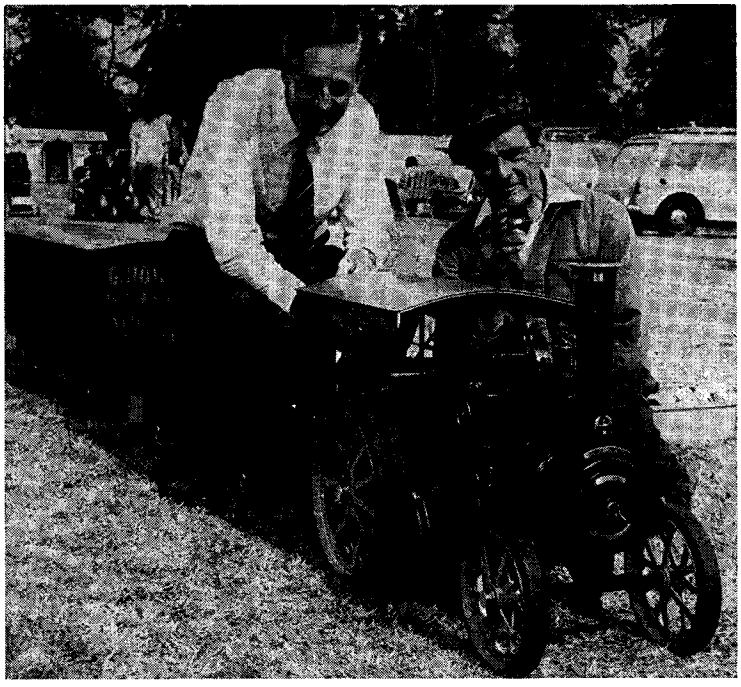
The fourth loco is a cabless Hunslet, of basic Roger Marsh design, built by John Milner for Eric Doyle using castings and drawings supplied by Roger Marsh.

The Echills Wood Railway is a private line, but a number of open days are held during the year to which $7\frac{1}{4}$ in. gauge loco owners are invited. Although the line is "narrow gauge" in concept, in the past visiting locos have included a *Double Tich*, a *Midge*, a B1, an L.S.W.R. 0-4-0 Dock Tank, and Dennis Evans' beautiful *Duke of Gloucester*.

Kenilworth. K. Blackham

GUILDFORD INTERNATIONAL RALLY

by G. F. Asplin



The Editor at the controls of Gordon Howells' 2 in. scale road locomotive.

THE MODEL TRACTION ENGINE RALLY held at Stoke Park, Guildford, on 17 and 18 July 1976 was an integral part of our International Steam "Meet". The Society had, since 10 July, been host to approximately 100 overseas visitors, mostly from Europe, and on the previous weekend the recently extended live steam track had been full with G.M.E.S. and visitors' engines, with opportunities to drive engines in size from a 3½ in. gauge *Rob Roy* to a 5 in. gauge German 4 6-4 or a 200 mm. gauge Stanier Class 5. Our visitors had also been to preserved standard gauge railways and two 7¼ in. gauge railways.

The extension of the live steam track has meant a reduction in available space in the existing site, so Guildford Borough Council kindly provided extra land for use at the Rally and all the visiting traction engines were able to steam around at their leisure and allow our overseas visitors to drive a number of the engines. The general view of the line-up of the traction engines waiting for the "off" shows the wide variety of engines to be seen, ranging from 1 in. scale to 4½ in. scale.

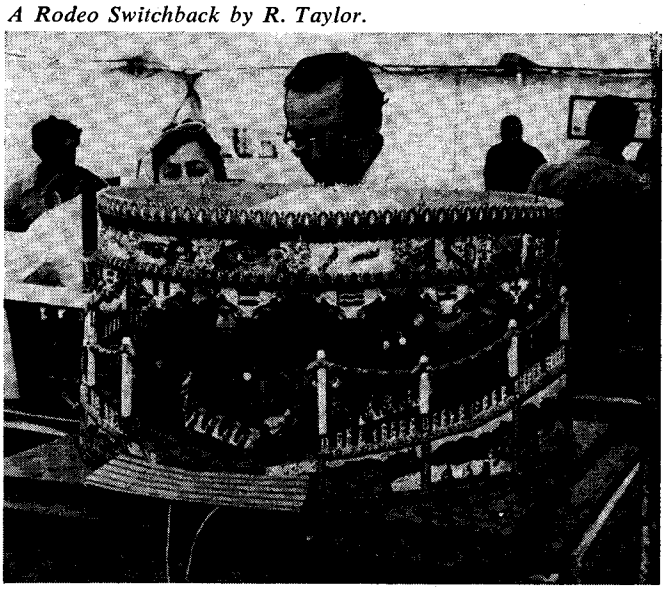
This year, the Society had erected an extra large marquee and this housed our own model engineering exhibition and many model fairground exhibits which could have the required electrical supply and also be under cover in the unlikely event of rain. The large numbers of fairground exhibits enabled the visiting public to see the varied types on display. Space precludes the mention of all these exhibits, but the two chosen are the working steam saw mill built by Jack Burgess of High Wycombe and the model of Jimmy Williams' "Rodeo Switchback" built by R. Taylor of Feltham. These working models are very much appreciated by the public as they are seen with their lamps lit and appropriate music being played.

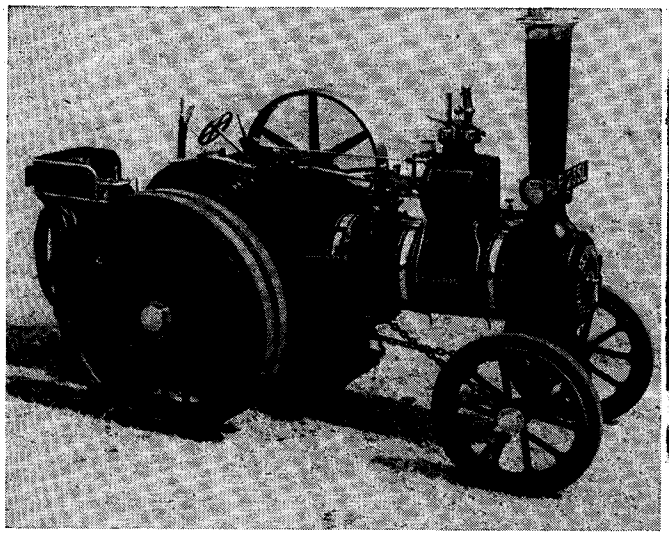
As this is the ninth rally, many of the traction engines, fairground exhibits, and their owners are old friends of the Society. As shown in one of the photographs, Martin Evans was at the controls of Gordon Howell's 2 in. scale, double crank compound road locomotive which is a freelance design broadly based on a Burrell.

Another engine to be seen in steam was Bob Jones' 4½ in. scale Burrell traction engine. This is a single-cylinder machine, the cylinder dimensions being 3 in. bore and 3½ in. stroke.

A regular visitor is Mr. Shipman's 3 in. scale Wallis and Steevens lorry. This is a double crank compound

A Rodeo Switchback by R. Taylor.



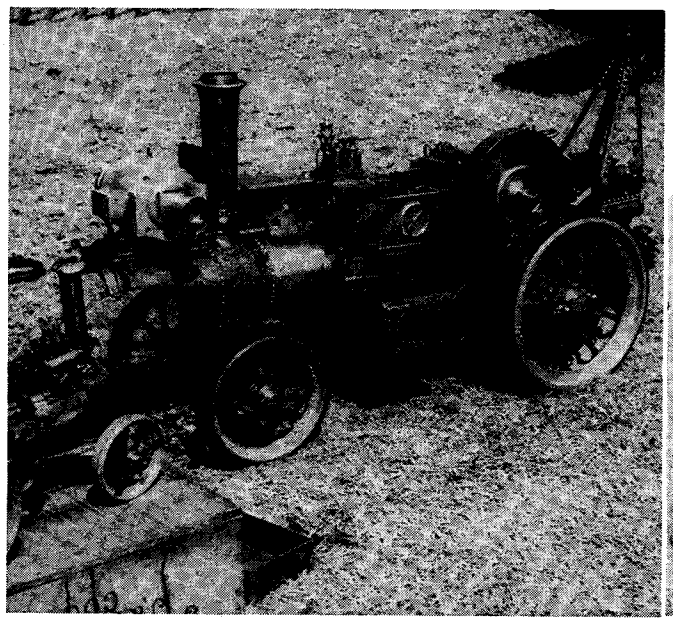


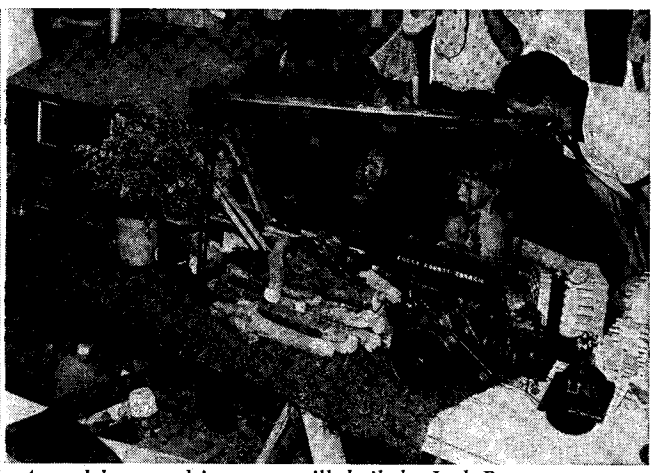
Bob Jones' 4½ in. scale Burrell.

and a special feature of this machine is that it has Bouley tangential wheels. A partly-built 2 in. scale Burrell double crank compound showman's engine was exhibited by Mr. Manday. These four machines shown in the photographs are only a very small representative selection of those present. Other traction engines included two 2½ in. scale Burrells built by Jack Leavold and Len Arnold of Southampton, a 1½ in. scale 7 n.h.p. Fowler traction engine being built by Alf Howick of G.M.E.S.

Returning to the main event, Sunday saw large crowds visit Stoke Park and enjoy all aspects of the proceedings. Otto Straznicky's 5 in. gauge ground level

A partly-built 2 in. scale Burrell showman's engine by Mr. Manday.





A model steam-driven saw mill, built by Jack Burgess.

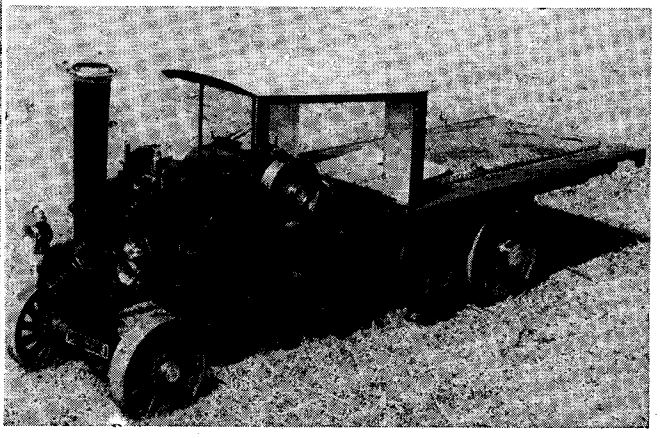
track was continually busy, and his train which is hauled by a 0-6-0 locomotive reminiscent of Wild West days, was a great favourite with the children.

Visiting model engineers could also try their hand at driving Luc Tenstedt's 200 mm. gauge Stanier Class 5. The track ran over rather undulating ground, but caused no trouble to this large heavy locomotive.

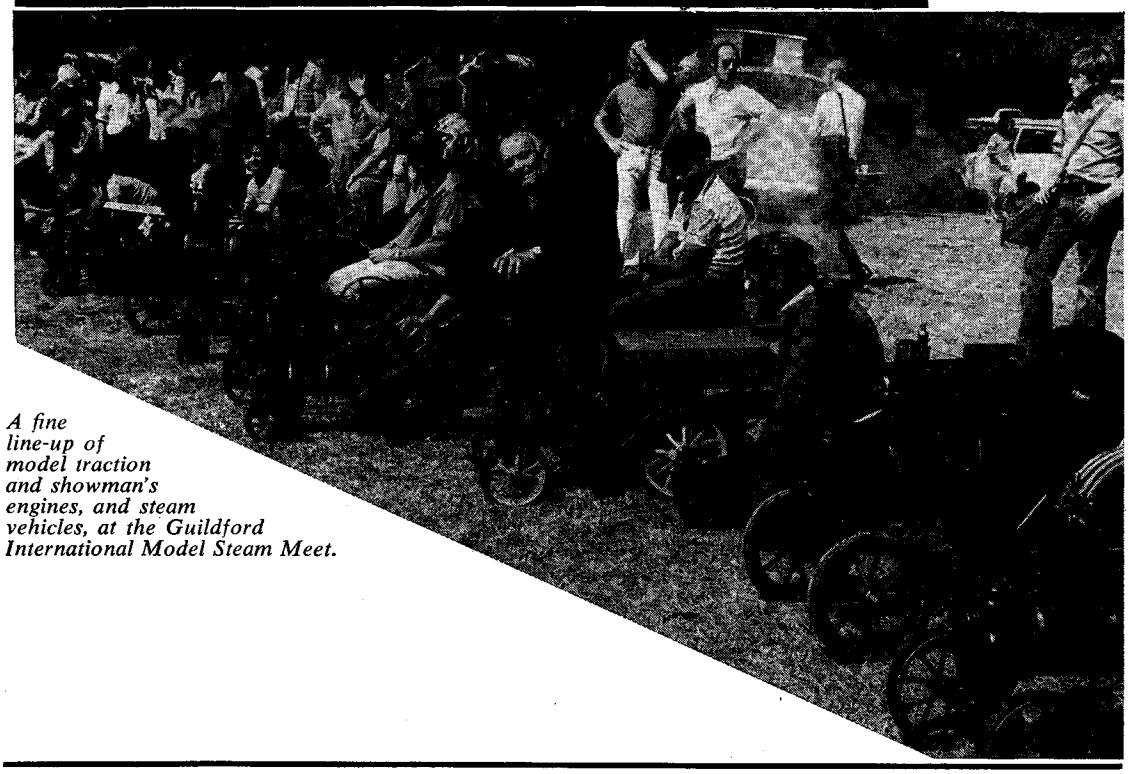
The recently completed extension to the live steam track enabled us to run four trains at once, and we were able to have two G.M.E.S. and two visiting engines on the track. The two G.M.E.S. stalwarts were the Club engine, a 5 in. gauge Halton tank, and Geoff Moore's 5 in. gauge *Minx*, and visiting engines were all 5 in. gauge and either Klaus Zimmerman's 0-6-0T, Dr. Von Gumpert's 4-6-4 *Big Lady* or Arnold Kaliwolda's East German Railways Class 105 "Pacific". We certainly appreciated the tremendous hauling capacity of these large engines.

And so at 6 p.m. on Sunday, the largest and most successful event ever staged by the Society came to an end with appropriately a posed photograph to show how this was truly "international". In the photograph left to right are: Dr. Von Gumpert from West Germany. Rob Van Dort from Holland, Luc Tenstedt's from Belgium, Bob McMillan of G.M.E.S., Fred Kiesel from the U.S.A. and Ken Tinkler from Australia.

A 3 in. scale Wallis & Steevens steam wagon by Mr. Shipman.



From left to right: Dr. Von Gumpert— West Germany, Rob Van Dort— Holland, Luc Tenstedt— Belgium, Bob McMillan— Guildford M.E.S., Fred Kiesel— U.S.A., Ken Tinkler— Australia.



A fine line-up of model traction and showman's engines, and steam vehicles, at the Guildford International Model Steam Meet.

T.S.S. "Sarnia"

SIR,—In his account of the 1976 St. Albans Exhibition (*M.E.*, 6 August), D. E. Lawrence refers to his interest being aroused by a "twin screw motor ship hull being fabricated from plywood—etc.", for which no details were given about what the finished model might be.

I think it possible that your correspondent might have been referring to my model which, one day, will be a scale replica of T.S.S. *Sarnia*. The prototype is at present in service with British Rail as a Sealink cross-Channel ferry between Weymouth and the Channel Islands.

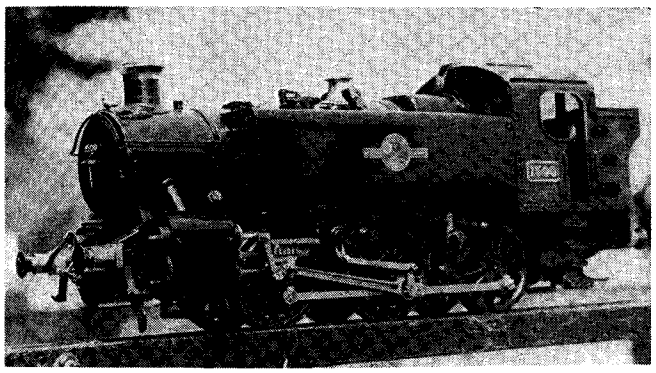
Hitchin. C. Langston

NATIONAL 2½" GAUGE SOCIETY RALLY

Reported by D. E. Lawrence

THE SOCIETY held their 1976 Rally at the Harrow & Wembley SME's track and they had a reasonable turnout of locomotives. I arrived in mid-morning in time to see Mike Johnston's SECR Wainwright "D" class hauling a train of three period coaches along the track without a driver. Actually Mike kept fairly close attendance from the trackside on the unmanned train, but, because it was not under immediate control, when the next engines came on the "D" class 4-4-0 had to return to the shed. I must say I would like to see this train running on a ground level track through small scale scenery; I fancy it would look just right.

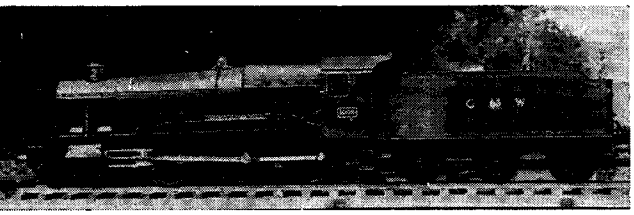
Thirteen-year-old Daniel Morgan driving LBSC's "Harriet".



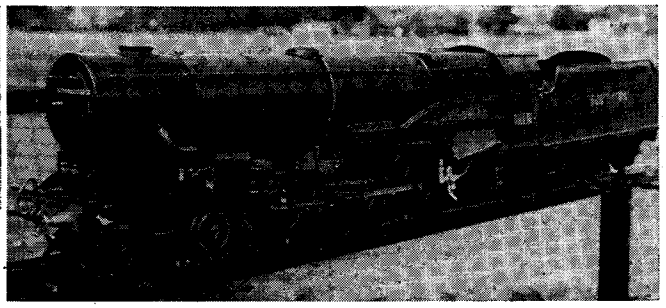
Chris. Devenish's GWR 15XX.
Below: Jim Robson handles the mallet "Annabel".

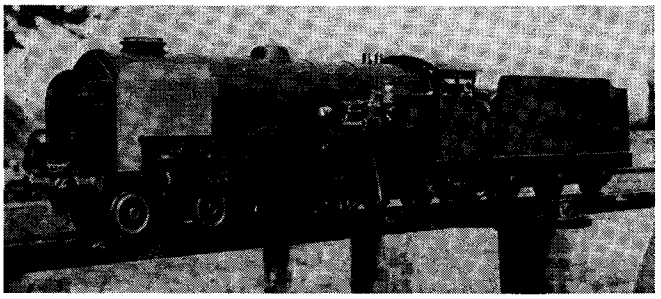
Several members of the North London SME have some of the late LBSC's own locomotives and thus there is a significant support for 2½ in. gauge there. Those running were the 4-6-2 *Tugboat Annie,* 0-6-0 *Harriet,* 0-6-0 *Mary Ann,* the big Erie R.R. 2-6-0 + 0-6-4 *Annabel* and the LNER 2-8-2 which is based on the P2 locomotives. This was described by LBSC as a "rebuilt engine from a load of junk" in one of his famous Lobby Chats. Young David Morgan, only 13 years old, handled *Harriet* very well, getting about 6 m.p.h. out of it on a continuous run. Conversely, Jim Robson was unable to get *Annabel* to perform as

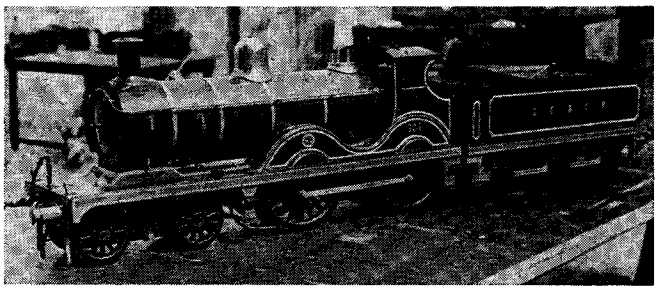
Tom Luxford of the North London Society driving a "commercial" 2-8-2 which was rebuilt by LBSC.



Chris. Devenish's GWR "County".







On right: LBSC's "Tugboat Annie", Paul Wiese's propane-fired free-lance "Atlantic", and a fine Wainwright 4-4-0 by Mike Johnston.

it should, mainly, I think, because it was doing very little work; the four big cylinders can handle several times Jim's weight. A very nice job was Fred Eaton's LNER *Green Arrow*, a 2-6-2 which was very fast on the run and which steamed very well. Unfortunately, a bent spring hanger on a coupled axlebox cut short Fred's enjoyment.

George Williams had a nearly complete *Austere Ada*, LBSC's version of the WD Austerity 2-8-0s built for war service in World War II. This was a very slippery customer and gave George some trouble until he removed the leading pony truck and then it ran quite happily. There were about two dozen locomotives there in all, including three or four partly built, and I think the best looking was the "Atlantic" belonging to Paul Wiese of Bristol. Paul is the Secretary of the National 2½ in. gauge Society and he is very keen on fostering this gauge. He has certainly produced a handsome engine; it is gas fired and the tank is accommodated in the tender, a neat and tidy arrangement which overcomes one of the little problems of firing in this gauge.

A visit to the Ravenglass and Eskdale Railway and a postscript to "Ella"

by B. G. Markham

ON THE LAST Friday in May, I set off with *Ella* safely packed in the back of my car to drive the 280 miles to Ravenglass to lend her to the Ravenglass and Eskdale Railway for their Centenary Celebrations. I was fulfilling a promise made some two and a half years ago.

By midday the first 250 miles were passed and I was enjoying a picnic lunch on the beautiful Cumbrian Fells and thinking that perhaps I would be repaying in a small measure the kindness shown by the railway staff to a small boy nearly sixty years ago. I should have realised that I would return more in debt than ever. It was a lovely day and there seemed no point in arriving while everyone was at lunch. I suppressed the thought that railways don't shut down for meals.

When I got to Ravenglass I found the General Manager, Douglas Ferreira, in the old Furness Railway goods shed—shortly to be the paint and joiners' shop but at present used for the Centenary Exhibition —a fine old stone building. We walked together over to the engine shed where we found the Chief Engineer, Ian Smith, had just completed some adjustments to the pony truck of the new engine *Northern Rock*. *River Irt*, a rebuilt "Heywood", was coupled on and the new engine was pulled out into the daylight and a fine sight she made.

When I first saw the designs for the new engine, it was going to be a tank, but to give the drivers a smoother ride it was decided to build a 2-6-2 tender engine; this is just as well because a tank engine built on the same massive lines would have been very hard on the track.

Like Heywood's engines, *Northern Rock* has been built not as a scale model but on entirely functional lines to do a specific job of work. She has outside frames, piston valves with narrow rings and Walschaerts valve gear and like all the present engines, a single bar crosshead. The boiler has a wide firebox, is without a superheater and burns coke, as have all the 15 in. gauge engines from the earliest days except the Heywoods.

An interesting detail is the steam operation of the cylinder drain cocks which were supplied by Severn-Lamb. There is a three-way cock in the cab by which the cocks can be connected either to atmosphere or boiler pressure. When boiler pressure is applied they are closed, but will open if excessive pressure occurs in the cylinders. There are also pressure relief valves. None of the other engines have drain cocks controlled from the footplate and in fact on one it is necessary to use a spanner.

During my ride on *Northern Rock*, there were occasionally large drops of water in the exhaust during

normal running and when this occurred, I noticed that the driver would momentarily open the drain cocks.

An interesting feature is that the driving wheels are carried on a sleeve which can slide on the axle on the Heywood principle but without the connection to the coupled wheels to give full articulation. This feature is also used on the diesel locomotive *Shelagh of Eskdale* which uses the sliding sleeve taken from *Ella.*

Northern Rock has two items of equipment which are second-hand — a "Britannia" whistle and on the tender the tool box from *Ella.* She was officially named and commissioned on 29 May by Sir Mark Henig.

On 30 May the engineers who had done all the driving up to then handed over to ex-Southern Railway driver Glyn Wells, and my younger son and I had the privilege of accompanying him on the footplate. It was most impressive. Steam pressure was maintained within a pound or two of blowing off the whole time with the damper mostly I think less than half open. On wet metals she pulled away without slip in full gear and a steam chest pressure of 150.

The ride was very smooth on the laminated springs and there was none of the bouncing up and down one gets with *River Esk* on coil springs. Laterally she also seemed very steady and it was therefore rather surprising that there was quite a bit of flange squeal. Our driver said that *Northern Rock* was the best thing since the "Merchant Navy". She was designed and built by the Railway Company who deserve the greatest credit.

My little *Ella,* or in the language of Lakeland, La'al *Ella,* was placed in the Exhibition surrounded by various Heywood relics and photographs. The relics included *Ella*'s frames, coupling rods and the pattern for the furnace backplate casting. In another part of the Exhibition there was a Heywood covered passenger coach, Bassett-Lowke open coaches and a Greenly-Bassett-Lowke "Atlantic", *Count Louis,* a sister of the Railway's first 15 in. gauge engine, *Sans Pareil.*

I managed to get in a footplate trip on *River Irt* (the rebuild of Heywood's *Muriel*) and to have another look at the motion work. I found that some of the pins in the valve gear which I thought were steel were made of bronze and also that one of the links in the straight line motion was bronze. This is the link shown on the left-hand side of page 287 of 19 March issue and is $\frac{5}{8}$ in. wide and $1\frac{1}{4}$ in. centres. Covered in dark oil this was by no means obvious in a good light and I am not surprised that I missed it when I examined the gear in a dark and steamy engine-shed. I think that probably on the model it is better to stick to hardened steel than to use bronze.

I found that the coupling rod brasses were not fitted with the split vertical as one would expect and is usual when split brasses are used but with the split horizontal. I found it very difficult to understand why it is done in this way because it means that the maximum bearing pressure comes on the joint which is likely to cause a breakdown of the oil film. It also means that distortion due to driving in the taper pins will be greater. There is no doubt that the Ravenglass & Eskdale Railway have been assembling the brasses in this way for a long time and Tom Jones, who joined in 1925, is convinced that it is how Heywood intended. It will not be difficult to turn my brasses round 90 deg. and re-ream for the taper pins. I should make it plain that the taper pins remain in the same position relative to the rods as shown on page 289 in 19 March issue.

MODEL ENGINEER HOT AIR ENGINE COMPETITION

A COMPETITION to encourage the design and building of hot air engines will be held at the 1977 Model Engineer Exhibition. Prizes have been generously donated by Mr. A. N. Clark, of Ryde, Isle of Wight, and Professor D. H. Chaddock, C.B.E., has kindly consented to act as Judge.

The only conditions are as follows:

1. The hot air engine entered must be the unaided work of the competitor.
2. No entry will be accepted from a professional model maker.
3. The decision of the Judge/s shall be final.
4. The swept volume of the working cylinder/s shall not exceed 5 c.c.
5. The power output of the engine will be measured by a friction brake with a lever arm and weights.
6. Speed measurement will be by revolution counter and stop watch.
7. All engines entered must have a standard output shaft 5/32 in. dia. x $\frac{3}{4}$ in. (approx.) long.
8. Competitors will have the option to run their engines themselves, under the scrutiny of the Judge/s.
9. Competitors should submit with their entry notes for the Judge/s regarding lubrication, firing, warm-up procedure, minimum and maximum revs. at which the engine should be run.
10. The duration of each run shall be left to the discretion of the Judge/s.
11. Winners will be required to submit details, a photograph and drawings of their engines for publication in *M.E.*
12. Although every care will be taken, the organisers cannot be held responsible for any accidental damage to the engines.
13. Details of entries must be sent to the Exhibition Manager, M.A.P. Ltd., not later than 1 December 1976.

PRIZES:

1. A first prize of £50 would be awarded for the hot air engine developing the highest horsepower.
2. A second prize of £25 would be awarded for the engine developing the second highest horsepower.
3. There would be a consolation prize of £10 for the engine (other than those awarded the 1st and 2nd prizes), which displayed the highest standard of workmanship.
4. There would be a second consolation prize of £10 for the engine which displayed the most original design work.

CLUB NEWS

Trials at Derby

The Derby Society of Model and Experimental Engineers held locomotive efficiency trials on 24 July. There were ten entries for the 5 in. gauge trials, and the winner was Roy Amsbury with his G.W.R. 2-6-2 tank. Second was B. Ward with a *Simplex*, third was F. Hammersley driving his de Winton 0-4-0T, and fourth was S. Baker—0-6-0T *Eva May*.

Only two engines competed in the 3½ in. gauge event, the winner being R. Dickens driving his *Rob Roy*.

Secretary: A. J. Gent, 31 Cromford Road, Ripley, Derbyshire.

News from Nottingham

The Annual Ladies' Night of the Nottingham S.M.E.E. was held on 16 September. The speaker was Mr. D. Cope, a member of a very old established clock-makers in Nottingham. His talk, which was illustrated by slides, was on the history of "Time", which was very much enjoyed. The refreshments were organised by Mrs. F. Day and as usual were much appreciated.

Secretary: R. A. Clark, 21 Sandfield Road, Arnold, Nottingham.

The late J. H. E. Rodgers

I was sorry to hear of the death recently of Mr. J. H. E. (Eric) Rodgers of Leicester. Mr. Rodgers was a great steam enthusiast as well as being well known in the model aircraft engine field. He was responsible for producing the 18 cc. *Cornet*, 6 cc. *Wasp*, 4 cc. *Hornet* and the 2.5 cc. *Spitfire* engine. He had recently completed a 5 in. gauge battery-powered passenger hauler, but perhaps his best known model was his 5 in. gauge *Ann of Holland*, a Bagnall 0-4-0 saddle tank locomotive.

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.

NOVEMBER

5 East Sussex Model Engineers. "Ships Down Under" an illustrated talk by R. Draper. Mercatoria Hall, Mercatoria, St. Leonards-on-Sea, E. Sussex. 7.45 p.m.

5 Stockport & District S.M.E. Bits and Pieces. Wellington House, 324 Wellington Road North, Stockport. 8 p.m.

5 S.M.E.E. Annual Dinner—Piccadilly Hotel.

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

5 Colchester S.M.E.E. Firework Party at the Clubhouse, Old Allotments, Lexden.

5 Rochdale S.M.E.E. Film Night. Technical College. 7.30 p.m.

5 Brighton & Hove S.M.L.E. The Narrow Gauge Look. Films by M. Funnell. Elm Grove School, Brighton. At 8 p.m.

5 Dublin S.M.E.E. "Boiler Making". T. O'Dea. In the Star of the Sea School, Sandymount, Dublin 4. At 8 p.m. Sec: H. R. Mapother, 8 Evora Park, Howth, Co. Dublin.

5/6/7 The Gauge "1" Model Railway Association. Wimbledon Model Railway Exhibition, Working layout. Public Baths, Wimbledon.

6 Derby Society of M.E.E. Bonfire night run at Morley. 18.00 onwards.

6 S.M.E.E. Talk "You can't scale nature—She scales herself" by Professor Chaddock. Marshall House, 28 Wanless Road, London SE24.

6 Northern Ireland M.E.S. Meeting. Strathearn Hotel, Holywood, Co. Down. 3 p.m.

8 Clyde Shiplovers' and Model Makers' Society. "A week on the New Waterway"—Michael Campbell. Kelvingrove Art Gallery and Museum. 7.30 p.m.

8 Bedford M.E.S. Novices' Night Clubhouse, Wilstead. 7.30 p.m.

8 King's Lynn & District S.M.E. Monthly Meeting—St. James' School, King's Lynn. 7.45 p.m.

8 Wirral M.E.S. Film Show by British Rail "Railways in the Steam Age No. 3".

9 Stroud S.M.E. Isle of Wight Railway Films and Lecture—Mr. Tull. Society's Workshops, Old Workhouse, Bisley Road, Stroud, Glos. 7.30 p.m.

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

10 Southampton & District S.M.E. General Meeting. "Bulleid" by S. G. Townroe.

10 Grimsby & Cleethorpes M.E.S. General Meeting.

10 Harrow & Wembley S.M.E. Traction/General Meeting. B.R. Sports Pavilion, Headstone Lane. 7.45 p.m.

10 Sutton Coldfield Railway Society. "Steam in Action 1957–62" Max Lock (cine). Wylde Green Library, Emscote Drive, Little Green Lanes, off Birmingham Road, Sutton Coldfield. 7.30 for 8.15 p.m.

11 Harlington L.S. Members' films.

11 Leyland, Preston & District S.M.E. Meeting. Roebuck Hotel, Leyland Cross, Leyland, Lancs. 8 p.m.

12 Southampton & District S.M.E. Annual Dinner.

12 Chichester and District S.M.E. Annual General Meeting at the Boys' High School, Kingsham Road, Chichester. 7.15 p.m.

12/13 Coleraine and District S.M.E. Exhibition. St. Patrick's Church Hall, Brook Street, Coleraine. N. Ireland.

13 Harlington Locomotive Society. Great Western Society Exhibition – Reading Town Hall. 10 a.m.–6 p.m.

13 S.M.E.E. Rummage Sale. Marshall House, 28 Wanless Road, London SE24.

15 City of Leeds S.M.E.E. "Member Effort Night". Every member attending to bring along something that he is currently constructing. Not a competition. Salem Congregational Church, Hunslet Road, Leeds 10. 7.30 p.m.

15 Worthing & District S.M.E. Informal Evening. Broadwater Hall. 7.30 p.m.

16 Derby S.M.E.E. Meeting—Business to be confirmed. Carriage & Wagon Welfare, Derby.

16 Sutton Coldfield & North Birmingham M.E.S. Brian Timmins slide show.

17 Guildford M.E.S. Bits and Pieces Competition.

17 Sutton Coldfield Railway Society. "Power Signalling in Miniature" – Robin Matham. Wylde Green Library, Emscote Drive, Little Green Lanes, off Birmingham Road, Sutton Coldfield. 7.30 for 8.15 p.m.

17 Guildford M.E.S. Bits and Pieces Evening at H.Q. Stoke Park. 7.45 p.m.

17 Cannock Chase M.E.S. Talk by W. Childs on Canal Engineering. Lea Hall Club. 7.30 p.m.

18 Warrington & District M.E.S. "Hot Pot Supper". Club House, Daresbury. 8 p.m.

18 Harlington Locomotive Society Members' Slides.

18 Hull S.M.E. Italian State Railways in Wartime by J. M. Proud. Trades & Labour Club, Room 3, Beverley Road. 7.45 p.m.

18 Nottingham S.M.E.E. B.R. Steam in the 50's and 60's—J. B. McCann. The Friends' Meeting House, Clarendon Street, Nottingham. 7.30 p.m.

19 East Sussex Model Engineers. "Wealden Iron" an illustrated talk by B. Funnell Mercatoria Hall, Mercatoria, St. Leonards-on-Sea, E. Sussex. 7.45 p.m.

19 Dublin S.M.E.E. "Loctite and its Applications". Guest Speaker. In the Star of the Sea School, Sandymount, Dublin 4. At 8 p.m. Sec: H. R. Mapother, 8 Evora Park, Howth, Co. Dublin.

19 Brighton & Hove S.M.L.E. American Film Night, Elm Grove School, Brighton. At 7.30 p.m.

19 Colchester S.M.E.E. third Models Competition, entry forms to follow.

19 Stockport & District S.M.E. Auction Night. Wellington House, 324 Wellington Road North, Stockport. 8 p.m.

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

19 Rochdale S.M.E.E. Gnome Engine—Mr. N. Hemingway. Technical College. 7.30 p.m

20 S.M.E.E. Competition Day, Working Model Display. Marshall House, 28 Wanless Road, London SE24.

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

22 The Steam Locomotive Society of Victoria. Invitation to Diamond Valley Railway.

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

22 Clyde Shiplovers' and Model Makers' Society. Clyde Steamers Behind the Scenes—Mr. John Thomas. Partick Halls, Burgh Hall Street. 7.30 p.m.

22 Bedford M.E.S. Informal Meeting. Clubhouse, Wilstead. 7.30 p.m.

23 Brighton & Hove S.M.L.E. SAMRC's Meeting, Hosts: Surrey & Sussex 2 mm Group, details later.

23 Stroud S.M.E. Bits and Pieces Evening. Society's Workshops, Old Workhouse, Bisley Road, Stroud, Glos. 7.30 p.m.

24 Harrow & Wembley S.M.E. Social & Competition Evening. B.R. Sports Pavilion, Headstone Lane. 7.45 p.m.

24 Harli gton Locomotive Society. Mr. R. Symes-Schutzmann is talking about his gauge "1" diesel electric 47 class locomotive and his gasfired G.W.R. King.

24 Sutton Coldfield Railway Society. "Members' Auction Night" Wylde Green Library. Emscote Drive, Little Green Lanes, off Birmingham Road, Sutton Coldfield. 7.30 for 8.15 p.m.

24 Hull S.M.E. All members to meet at the Track site at 10 a.m. to oil the track for the winter. Bring brushes etc. Goddard Avenue Track.

24 Harrow & Wembley S M.E. Social and Competition Evening. B.R. Sports Pavilion, Headstone Lane. 7.45 p.m.

25 The Gauge "1" Model Railway Association. M.R.C. Track Night. Keen House, Calshot Street, King's Cross, London N1. From 6.30 p.m.

25 Rugby M.E.S. "Model Night". Hillmorton Community Centre, Hillmorton Road, Rugby.

25 Leyland, Preston & District S.M.E. Meeting. Roebuck Hotel, Leyland Cross, Leyland, Lancs. 8 p.m.

25 Stockport & District S.M.E. Annual Dinner. Rudyard House Hotel, Wellington Road North, Stockport

27 S.M.E.E. Informal Meeting—Stationary Engines, Traction Engines, Road Vehicles. Marshall House, 28 Wanless Road, London SE24.

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.

Valve Gears

SIR,—I am sure that you will not mind if I point out a no doubt unintentional error in the eccentric setting on your gauge "I" "Atlantic". I have to check myself against the same mistake if I've done too much work on launch link arrangements!

The drawing in *M.E.* shows an eccentric advance of 1/16 in., which for launch links would be a match for the given lap if setting no lead in full gear. The equivalent loco link eccentric, however, should be set just over 0.8 mm., or a little over half the drawn amount, for lead = 0 in full gear. As drawn the full gear lead is just over 0.6 mm.—rather a larger proportion than I know you to favour!

In taking this opportunity to comment on the recent article by Dr. Burrows I can only express dismay after so looking forward to it. Whilst Dr. Burrows' maths is doubtless impeccable, his geometrical knowledge of Walschaerts is sadly lacking. The "geometric constraint" on which he bases his whole thesis just never exists, and he talks about equiangular swings about a centreline which he never in fact locates. The eccentric rod length given is therefore incorrect also.

If Dr. Burrows cares to draw out any of his examples and apply dividers from the four 90 deg. points on the PCD, not just his extrema, he will soon find the angles of swing to be far from equal, and that he has not appreciated exactly what backset really is. As it is, his advice to prospective designers is misleading.

Manchester. D. Ashton

Walschaerts Valve Gear

SIR,—It was with great interest that I read the article by Dr. F. M. Burrows in *M.E.* for 3 September on the mathematical determination of backset for Walschaerts valve gear.

Dr. Burrows has used his considerable mathematical skill in an effort to provide an exact solution to a problem that has so far eluded designers.

However, in going through this article I find myself unable to accept the condition of geometrical constraint which forms the basis of the analysis. Perhaps Dr. Burrows would be good enough to correct me if I am wrong in putting forward the following:

In the last paragraph of page 857 he makes the point that in the extreme positions of the expansion link swing the eccentric rod will be in line with the return crank radius OA, and that this line must be the same for both extreme positions in order to give correct 180 deg. timing. It has long been my understanding that this will not be the case when the "correct" backset has been applied as the object of the backset is to cause the eccentric rod to be additionally inclined so as to produce an increase of swing of the expansion link rearwards. I have set the word "correct" in quotation marks because there is clearly no mathematically correct value for this since the introduction of backset produces a timing error due to the different angle. The error is usually small but Dr. Burrows says that his solution up to this point is mathematically correct. Is he sure about this? If he is not, the implication is that the condition of geometrical constraint upon which the analysis is based will not hold and therefore the result is vitiated.

A further point is that I find it a little disquieting that Dr. Burrows gives the impression that the component of motion deriving from the expansion link should be equal to the total valve travel in full gear. I feel certain that Dr. Burrows appreciates that this is not the case, but it is a pity that in an article which purports to be an accurate treatment that such an error should be given prominence.

Dartford. J. Ewins

Cutting Coarse-pitch Threads

SIR,—I should like to comment on the letters by Messrs. R. J. Bell and G. H. Thomas in the 6 August issue concerning my article on coarse screw threads.

First, I agree with Mr. Bell's theory about the error between an axial line at the point of tool contact and a line at the helix angle. A simple calculation however will show just how small that error is: in the example given, the gap which Mr. Bell's rule would reveal is only 0.0003 in., in other words not discernible in practice and of no consequence as the *root* of a screw thread. Grinding of a cutting tool top edge to the correct helix angle is absolutely essential if the tool is not going to dig into the groove which it is cutting.

Secondly, I can assure both letter writers that the method does work without damage to the change-wheels. There seems to be some confusion between the torque required to turn the mandrel and that to move the carriage along the bed, in which action the leadscrew, having been geared up, gears down the movement of the clasp nut 8 to 1. My lathe, as in Mr. Thomas's case, is a Super 7B and I have grave misgivings about driving the mandrel from the leadscrew via the tumbler gears, especially since a manual method of propulsion removes much of the fun from driving a machine tool!

Thirdly, among the coarse pitches, the standard 16-tooth thread dial indicator will only give a meaningful result at 1 in., ½ in. and ¼ in. pitches. If we consider ¾ in. pitch for instance (which is after all the simplest "whole number" apart from those already acknowledged), the thread will only fall into register with the tool every ¾ in., i.e. at ¾ in., 1½ in., 2¼ in. from the original setting; it is impossible to follow this pattern conveniently with the indicator used as standard.

Fourthly, Mr. Thomas's reference to spindle speed seems strange. Of course I meant bottom back gear and for a Super 7 this can mean 25 r.p.m., but I did not specify that speed, simply because the article was intended for owners of other lathes with different bottom speeds. Just consider the speed at which the carriage moves along the bed—say ⅛ in. per second—and you will see the justification for not going faster.

Finally, in computing the width of an Acme thread, the tool should, as Mr. Thomas suggests, be widened to avoid cutting to an excessive depth. For such threads (and also square threads) of a groove width not exceeding say 1/10 in., this correction becomes noticeable when the helix angle exceeds about 10 deg.

East Bergholt. D. A. Gulliver-Brown

Cutting Coarse-pitch Threads

SIR,—In reply to Mr. Gulliver-Brown's letter of 27 August forwarded to me for comment, I agree with him entirely on point 1 as I have already stated in a letter to "Postbag", as yet unpublished.

With regard to the second point, I am still unconvinced. Mr. G.-B.'s attitude appears to be that having once (or more than once) "got away with it", the method is safe, but I still maintain that it is most unwise, and in this I can claim to have the backing of the makers who, in their booklet on the Q-C Gearbox, state under a large CAUTION heading, "The cutting of unusually coarse pitches (in excess of .125 in.) exerts excessive pressure on the leadscrew and gear mechanisms. Great care should be taken so as to minimise the loads imposed". The statement that the leadscrew gears down the movement of the clasp nut 8 to 1 is, I think, misleading because the form of mechanism employed to move the carriage is immaterial except for the amount of friction which it introduces and which, in turn, increases the effort required at the tumbler gears.

I have worked out an example of a screw 1¼ in. dia., having a thread of 1 in. lead. The horizontal component of the cutting force is .29 of that which is purely rotational, i.e. the force at the cutting tool which is resisting the turning of the mandrel. The efficiency of the leadscrew and nut is 36 per cent, so ignoring the friction of the carriage on the bed and of the thrust collar at the end of the leadscrew, the effort required to turn the leadscrew will be .81 of that required to turn the mandrel. Between the tumbler gears and the leadscrew there is a triple compound train of change-wheels and a further 7 or 8 small gears in the gearbox (even when set to a one-to-one ratio), most of which are small in relation to the shafts on which they are mounted. I would guess that the overall efficiency of this gearing to be less than 40 per cent which would have the effect of increasing the effort at the tumbler gears by 2.5 times, namely 2.03. It would seem, therefore, that in this case it would be better to drive the mandrel from the leadscrew rather than vice versa.

When fine (normal) pitches are cut, the reverse of the above would apply because the horizontal component of the cutting force becomes very small and from this it is clear that there must be some point of change-over. Mr. G.-B. states that he has cut coarse pitches (coarser than .125 in.) but he has not indicated *how* coarse. I am sure that he is aware that as the lead is increased so is the load on the gears increased and a point must be reached at which the driving gears fail. With regard to the point that manual propulsion removes much of the fun, I am in full agreement—it wasn't fun, it was hard work! However, I do frequently slip a handle into the mandrel in order to cut very short threads up to shoulders and I have demonstrated this method at M.E. exhibitions when cutting say a ⅛ in. x 60 t.p.i. thread only .070 in. long up to a shoulder. That *is* fun!

In the matter of the thread dial indicator I am afraid that I was in error in stating that it could be used for any whole number of threads. Upon reflection, it is clear that this is true only from 8 t.p.i. upwards (assuming an 8 t.p.i. leadscrew); in the other direction it will give only 4, 2, 1 (and ½, which is not a whole number). I apologise to Mr. G.-B. and my garments are duly rent, but the ¼ in. pitch which he cited as an example was an unfortunate choice because it is not, as he stated, a whole number—it is 1.3333 t.p.i.

Fourthly, spindle speeds. I was thinking in terms of screwcutting generally and cited specific examples; I was not thinking in terms of a carriage velocity of ⅛ in. per second which would arise when cutting a 1 in. leadscrew at 25 r.p.m.—which I would not do. There is nothing more tedious for me than the cutting of odd-pitch threads which preclude the opening of the nut and therefore require the reversal of the machine at each end of each cut and if this is being done in bottom back-gear the job seems to go on for ever. In order to speed things up a little I have produced a couple of quick retracting tool devices with which it is not necessary to use bottom back-gear speed. When cutting BA threads I use the handle in the mandrel which is not only quicker, it saves much wear and tear on the motor.

Coming to the final paragraph, I am glad that Mr. G.-B. agrees with me, but I would have been happier had the whole of my statement been correct. In referring to the fact that the tool width needs to be adjusted when cutting coarse pitches, I inadvertently said that it needed to be widened—it should be narrower. The tool should be the normal width (considered axially) multiplied by the cosine of the helix angle which will always be less than unity. As an example, a four-start, square thread screw, 1 in. lead, ¼ in. pitch, should, together with its mating nut, be cut with a tool .123 in. wide. If they were both cut with a tool .125 in. wide there would be 4 thou. of backlash.

New Milton, Hants. G. H. Thomas

Spark Erosion

SIR,—As a professional manufacturer of spark erosion equipment, I have read with interest the article on the construction of a simple relaxation type unit.

However. there are one or two points I think should have been stressed.

1. The voltage between electrode and workpiece is of the order of 400 volts and can be lethal. TAKE CARE.
2. Non-immersion of the work is a fire hazard. I have seen whole factories burnt down by working this way.
3. Flushing through the electrode *always* improves results. The amount of fluid required, however, is very small and if a job is overflushed the cut will be erratic. This is because the sparking action relies entirely on debris being present in the gap between electrode and workpiece in order to reduce the dielectric strength of the paraffin to an acceptable level for ionisation by the available voltage.
4. It is often stated that since the electrode never touches the workpiece no cutting forces occur in spark erosion. Whilst this is superficially true, there are hydraulic forces at work which can be considerable and which are quite capable of deflecting the electrode. Ninety per cent of problems with spark erosion arise from two factors:
   (a) Poor debris removal (flushing).
   (b) Poor tool holding and rigidity.

Finally, it might be of interest to readers that because of the general acceptance in industry of spark erosion some interesting by-products are available. For example:

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Incidentally, copper tubes of this sort of size conduct steam but not water. Perhaps automatic injectors?

Gloucester. P. Macdonald

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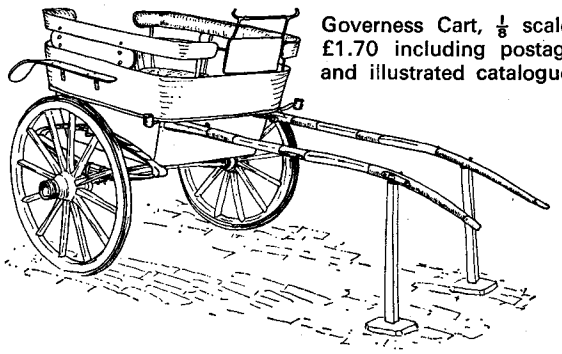

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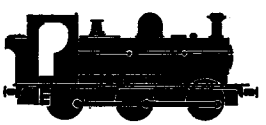

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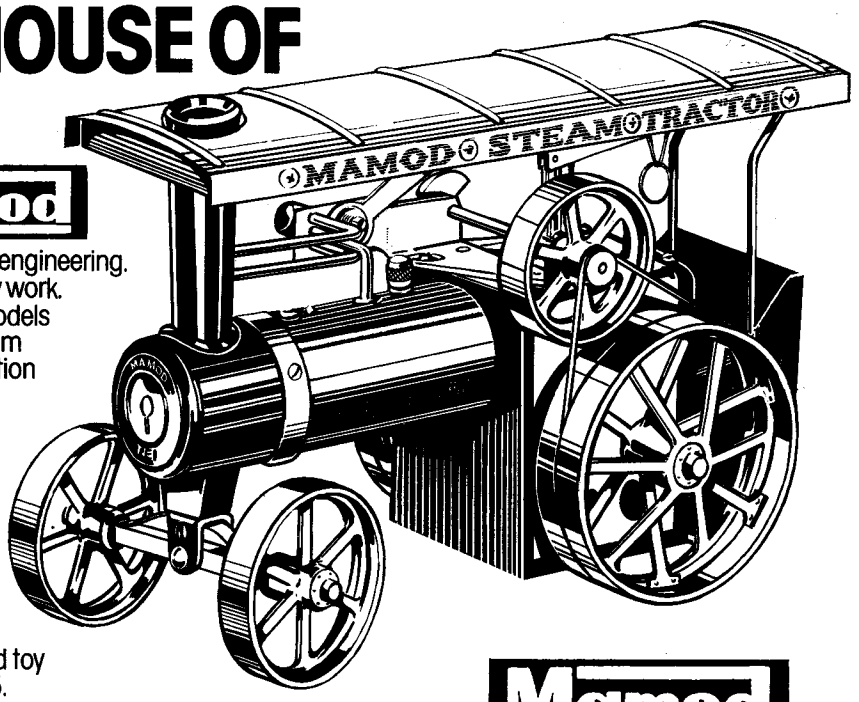

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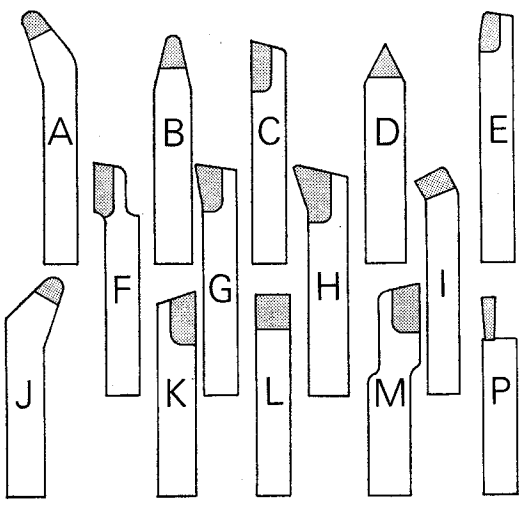

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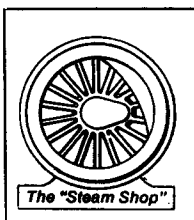

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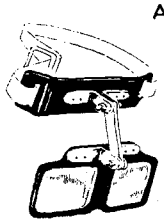

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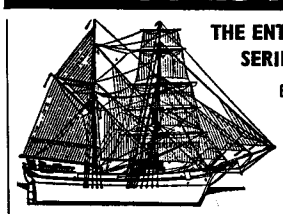

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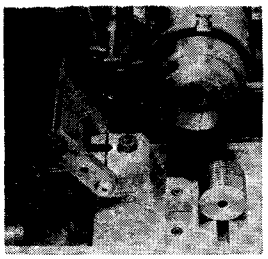

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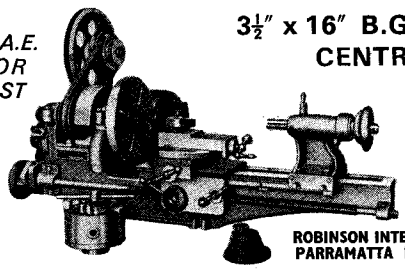

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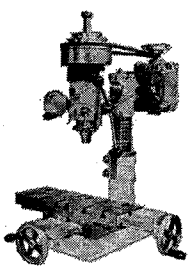

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M.E. QUERY COUPON NOVEMBER 1976

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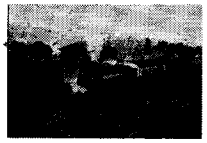
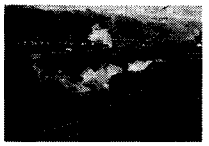
W Thwaite

CHRISTMAS CARDS

1. Southern Westcountry.



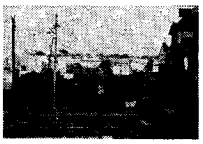
2. Pannier Tank.



5. Prarie Tank - Shunting.

6. Last Cornish Riviera.

3. Narrow Gauge Loco.



4. Southern Engines: "on shed"

7. 4-4-0 at Praze Station.

8. Southern Tank Loco.

all orders posted by return

Prices include P&P.

8 Cards	16 Cards	32 Cards	80 Cards
£1.18	£2.33	£4.50	£11.00

Christmas is that special time, once a year to renew old friendships and share the seasons joys You'll be on the right track with Train Cards for sending warm and friendly wishes across the miles. A selection of 8 old photographs depicting the early days of steam. Cards fold to approx. 150mm x 110mm, complete with envelopes, greetings and descriptive legends.

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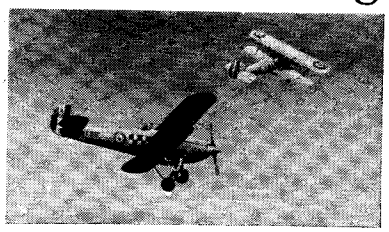
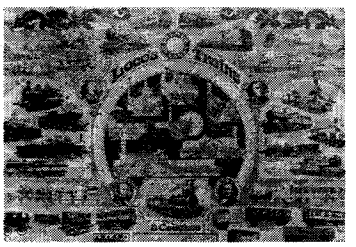
JAGUAR SS/100 594mm x 420mm

A magnificent full colour print of the Jaguar SS/100 introduced in 1935. A limited number of signed and numbered prints by Geoff Shaw are now available. Each lithograph is printed on fine art paper and despatched in a strong tube.
Signed prints ONLY £7.00ea.incl. Unsigned £2.50



HAWKER FURY 594mm x 420mm

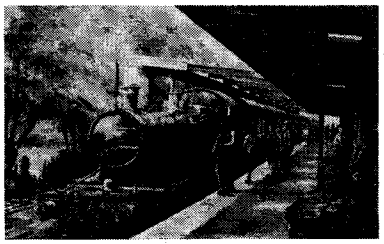
A magnificent full colour print of the Hawker Fury of No.43 Squadron RAF Tangmere –1930's. A limited number of signed and numbered prints by the artist Geoff Shaw are now available. Each Lithograph is printed on fine art paper and despatched in a strong tube.
Signed prints ONLY £7.00ea.incl. Unsigned £2.50.



POSTERS–a great series of posters showing the history in words and pictures of 1. Loco's and trains, 2. Buses and trams, 3. Sport and racing cars, 4. Present day cars, 5. Traction engines. Sizes: 880 x 620mm approx. £1.75inc. P&P. Posted in a stout tube.

"DOUBLE HEADING AT HARTHOPE" 594 x 420 mm.

A new painting from the experienced hand of Geoff Shaw. Two LMS engines are depicted in perfect detail, the first LMS Jubilee Class 4-6-0 No. 5553, Canada, the second is a LMS Princess Class 4-6-2.
A one time familiar scene at Harthope on the climb to Beattock, the Manchester/Glasgow express. Reproduced in full colour on special cartridge paper. A limited edition is now available, each individually signed and numbered by the artist.
Signed prints ONLY £6.00 ea. incl. Unsigned £2.50 incl.



"PRAIRIE TANK AT PAIGNTON" 594 x 420 mm.

Just arriving at Paignton station from Kingswear, the No 4588 Prairie Tank 2-6-2T. This locomotive, once belonging to the Great Western Railway, now runs the 7 miles through attractive countryside owned by the Torbay Steam Railway. This painting by Geoff Shaw was specially commissioned by Cornish Publications and is now available in a limited edition of beautiful full colour prints, each signed and numbered by the artist.
Signed prints at ONLY £6.00 ea. incl. Unsigned £2.50 ea.incl.

No. 70000 BRITTANNIA 594 x 420 mm.

No. 70000 first of the B.R. Standard Pacifics, "Getting Under Way" by Geoff Shaw. This beautiful full colour print is also a limited edition signed by the artist.
ONLY £7.00 each, incl. Unsigned prints ONLY £2.50ea.incl.
Note: this print has been very successful so order now to avoid disapointment, money refunded if sold out.

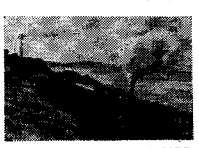
MOUNTED PRINTS

Why not have your print/s block mounted. We can offer this attractive, ready-to-hang on your wall service.
For ONLY £3.00 extra per print incl.

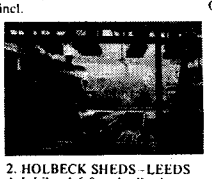
Wall Plaques

ONLY £2.50 ea. incl.

A new series of attractive wall plaques in monochrome, are now available. Taken from originals by Geoff Shaw. Each is mounted and ready to enhance any wall:- the IDEAL GIFT. Size 300 x 200 mm app. SPECIAL OFFER complete set of 4 for ONLY £9.00 incl.

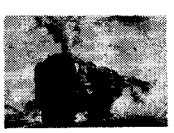


1. No 7827 LYDHAM MANOR
Designed by C.B. COLLETT, Passing Goodrington Sands from Paignton to Kingswear. Built 1950, Swindon, entered Torbay traffic 1973.



2. HOLBECK SHEDS - LEEDS
A Jubilee 4-6-0 and a Duchess 4-6-2 are shown in the foreground. A rebuilt Royal Scot 4-6-0 in the background. All executed in perfect detail by Geoff Shaw.

3. "GLADIATOR AT PADDINGTON"
Castle Class 4-6-0 Gladiator 5076 waits at Paddington to leave with a down express from platform 3. The good old British Rail days!



4. B.R. STANDARD PACIFIC No 70000
Taken from a very successful coloured print.

Prints despatched in protective tubes. These prints are not only beautiful in their own right but are proving to be a SOUND INVESTMENT.
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