6-19 JUNE 1969 First and Third Friday Volume 135 Number 3370 2/6
(USA & Canada—60 cents)

Model Engineer

MAP HOBBY MAGAZINE

Model Engineer

Founded 1898

Incorporating Mechanics and English Mechanics and Ships and Ship Models

Volume 135 **Number 3370**

June 6 1969

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Second-class postage rates paid at New York, U.S.A. Registered at the G.P.O. for transmission by Canadian Post. American enquiries regarding news stand sales and advertising should be sent to: MODEL ENGINEER, Eastern News Distributors Inc., 155 West 15th Street, New York, N.Y. 10011.

MODEL & ALLIED PUBLICATIONS LTD

COVER PICTURE

Lord Gretton's new miniature liner Southern Cross *designed by David Curwen and built by Severn-Lamb Ltd., of Stratford-upon-Avon. Colour photograph by Charles Hickman.*

NEXT ISSUE

A Gauge "O" high-pressure model "Royal Scot" locomotive: Bourdon's steam engine.

Editorial Director	D. J. LAIDLAW-DICKSON
Managing Editor	V. E. SMEED
Editor	MARTIN EVANS
Technical Consultant	EDGAR T. WESTBURY
Advertisement Manager	ROLAND SUTTON

Subscription 70s. (U.S.A. and Canada $10) post free, index included.

Editorial and Advertisement Offices:

13-35 Bridge Street,
Hemel Hempstead, Herts.
Hemel Hempstead 2501-2-3

ABC
MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS

Also published by MAP:—**Aeromodeller; Model Boats; Model Cars; Radio Control Models & Electronics; Model Railway News; Meccano Magazine.**

The Editor is pleased to consider contributions for publication in *Model Engineer*. Manuscripts should be accompanied if possible by illustrations and should also have a stamped addressed envelope for their return if unsuitable.

SMOKE RINGS

A commentary by the Editor

The late Gems Suzor

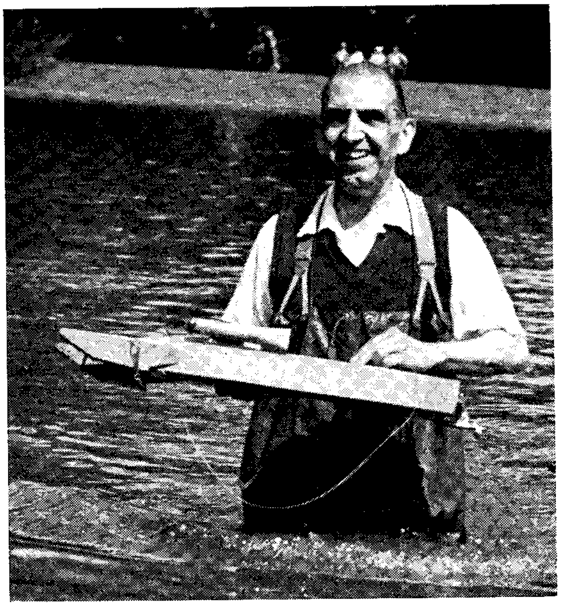
No character in the world of model power boats has had a greater influence on the design and development of hydroplanes and engines than Gems Suzor, of the Model Yacht Club de Paris, whose recent death may be said to close one of the most colourful periods in model speed boat racing.

His first appearance in Britain was at the M.P.B.A. Regatta at Victoria Park in 1925, where his metre boat *Canard* achieved a speed of about 16 m.p.h. on a straight course, and set an entirely new standard of performance for i.c. engined craft. Soon after this, the circular course was adopted for racing hydroplanes, and one of the first boats to achieve distinction under the new ruling was Suzor's *Nickie II*, which was also of 1 metre, but with a larger engine of 30 cc capacity, of novel and ingenious design. In 1929, this boat set up a record of 31.95 m.p.h. for boats with this form of motive power, which was held for four years. Though this was below the best speeds which had then been attained by flash steamers, it was sufficiently impressive to set many competitors devoting attention to the possibilities of petrol engines. In the succession of *Nickies* which were produced in subsequent years, Suzor raised speed standards still higher, and was always in the vanguard of progress.

Never a slave to convention, he was responsible for many improvements and innovations in engines and hulls, some of which have remained up to the present day. His original approach to the many problems involved, and his methods of carrying out designs, amounted practically to inventive genius. For instance, in the 10 cc two-stroke engine of *Mlle Sylla* which was produced in the dark days of the War, and came to Victoria Park for the first post-war Regatta, a mode of timed transfer injection, never previously seen on any engine, was successfully adopted. Some of the constructional methods employed on his engines were equally daring, and succeeded only through superb skill in carrying them out. But he never built a wall of secrecy around his work or sought to hold a monopoly on design; on the contrary, he freely shared ideas and discussed problems with other competitors, though hampered to some extent by the language barrier.

Luck did not always favour Gems Suzor; he had more than his fair share of setbacks and catastrophies, but he always accepted them as part of the

Continued on page 535



The late Gems Suzor with one of his most famous hydroplanes.

Below: Enjoying a picnic with some of his friends at the pond-side.

Below: Cheerful even after his boat had been badly damaged!

FLASH STEAM

Part II

Continued from page 481

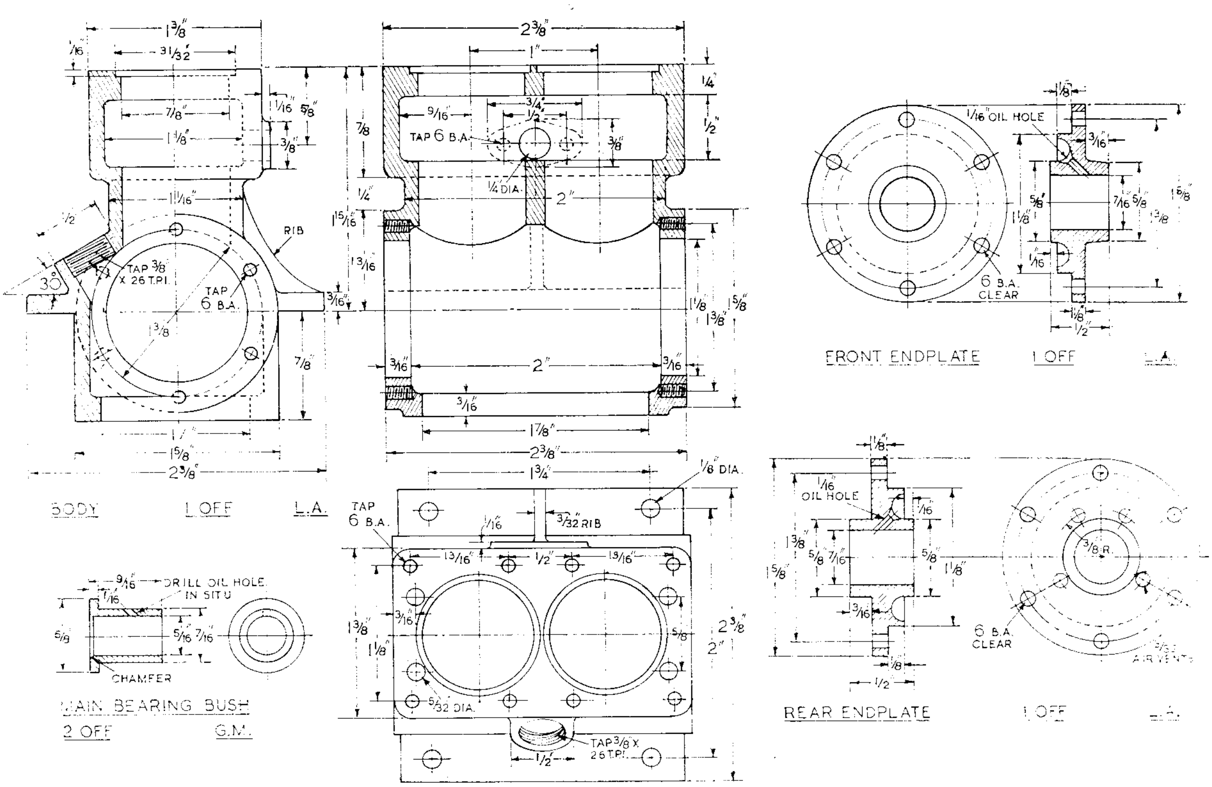
by Edgar T. Westbury

THE MACHINING OPERATIONS on the *Gemini* engine components are all fairly straightforward, and present no difficulties beyond reasonably accurate setting up. A monobloc casting is specified for the body, comprising the horizontally bored crankcase and the two vertically bored seatings for the cylinder liner, with a cored cavity to form an exhaust jacket. The recommended procedure for machining is as follows: after checking up on dimensions and location of machining centres by the usual marking-out methods, the base surface should be machined flat, by holding the casting at the head end, in the four-jaw chuck. Exact centring is not necessary, but axial squareness should be ensured by measurement from the underside of the bearer lugs to the face of the chuck. The base is then faced off to a distance of $\frac{7}{8}$ in. from the crankcase centre; though this measurement is not critical, the machined surface should be flat and smooth, so that it can be used as a mounting face for subsequent operations.

An angle plate should be used to mount the casting for boring and facing the crankcase, holding it in place either by a strap and two bolts over the head, or clamps over the bearer lugs. A sheet of paper under the base will protect the surface from bruising and also improve the grip. It should hardly be necessary to remind constructors that the faces of the angle plate should be exactly at right angles for mounting work in this way; though obvious, this should never be taken for granted, because even if initially accurate, some angle plates are liable to distortion by ageing or stress. It is easy to check from the faceplate surface, however, by using a good quality try-square. When the angle plate, with the casting in position, is mounted on the faceplate, it can be shifted as required to centralise the crankcase; the edges of the bearer lugs should, of course, be squared off from the faceplate before the casting is clamped down. Some constructors may prefer to hold the body in the four-jaw chuck, over the edges of the bearer lugs, and the top and base respectively. This is quite practicable, but it provides neither so positive alignment nor security as angle plate mountings. In order to run the lathe at reasonable speed for machining, some means of balancing the assembly will be found necessary and it is easier to attach and adjust balance weights to a faceplate than to a chuck.

When properly centred, the front end of the crankcase can be faced flat, and the bore at the two ends machined at one setting to provide a register for the end plates. If the chambered bore of the main length of the crankcase has been cored out to full size, it will need no machining, but if not, it should be opened out with an internal recessing tool, to $\frac{1}{4}$ in. more than the register diameter. It may be observed that as the casting is symmetrical, it does not matter which end is the front or the rear, and only convenience in locating the exhaust port or the oil filler when installed need be considered. But it is generally desirable that the face of the crankcase which can be machined at the same setting as the bore should be taken as the major reference surface, and preferably located at the flywheel end. To machine the other end face it would be desirable to mount the casting on a true mandrel, but as this may not be readily available, the next best thing is to reverse it on the angle plate and butt the mechanical face firmly against the faceplate. Exact centring is not important; the essential thing is to ensure that the two faces should be parallel with each other and square with the register axis.

For machining the liner seatings, the casting can be mounted directly on the faceplate by clamps over the bearer lugs; again it will be found that this is preferable to chuck mounting, where shifting to two (or more) settings is involved. Before centring either bore, the top surface should be machined all over, but not necessarily to its finished level. To locate the bore centres, the cored holes may be plugged and marked out in the conventional manner, but if wooden plugs are used, metal centre plates should be cemented or otherwise fixed to them, so that when marked out with lengthwise and crosswise lines, the intersections can be accurately centre-punched. Setting up from the punch dots can be simplified by the use of a home-made 'wobbler,' such as that illustrated on page 138 of *Metal Turning Lathes*. More elaborate devices are available and may be precise but not more facile; the results obtainable with simple devices are well within the limits required for this particular oper-



BODY 1 OFF L.A.

MAIN BEARING BUSH 2 OFF G.M.

FRONT ENDPLATE 1 OFF L.A.

REAR ENDPLATE 1 OFF L.A.

ation. In boring the seatings, their upper and lower registers should be of equal size and truly in alignment, with the counterbores at the top end clearly formed, and a sharp internal angle. Note that the size of the counterbores is so arranged as to avoid risk that they might run into each other, because of the limited distance between the cylinder centre.

The cored cavity in the casting, which forms an exhaust jacket, is intended to be of rectangular shape, and cannot be machined out, but should the space in the jacket be restricted, it can be chambered out concentric with the bores by an internal recessing tool. In the event of machining the component from the solid, the jacket space machined in this way will be of 'figure 8' section, with bores breaking into each other but leaving a thickened centre. The only disadvantage of this is that more surplus metal is left in the jacket than is desirable. A facing on the side of the casting (shown in dotted lines in the side elevation), provides a flange for attaching the exhaust pipe, and is drilled $\frac{1}{4}$ in. dia. in its centre. It can be machined by mounting the castings on an angle plate at right-angles to the former setting, not necessarily set up centrally, unless it is desired to drill the hole at the same setting.

To drill, tap and face the projecting lug for the oil filler, it is advisable to make a block of metal or hardwood, with its faces at 30 deg. to each other, and attach the casting to it for mounting on the faceplate. To simplify fixing, the holes in the bearer lugs may be drilled to take screws. It may be considered easier to carry out this operation in the drilling machine, but unless this has a tilting table, an angled block will still be required for mounting. In my experience, the little extra work involved in the setting up of the job in the lathe is well worth while, as the thread can be screwcut if necessary and the face can be tooled more accurately than by using a facing cutter or pin drill. The only other operations on the casting are the drilling and tapping of holes, most of which can be located by spotting from matching components when they are ready for assembly. As no underside plan is included, the holes for attaching the sump are not shown, but obviously they can be located in the same way. The four $\frac{5}{32}$ in. dia. holes in the top face must be located by measurement to line up with the oblique holes in the steam chest, to convey the exhaust steam to the jacket.

Front and rear end plates

The castings for these components are identical, but their machining differs slightly. In both cases, they may be held over the rim in the reversed jaws of the chuck for major machining on the register spigot and faces, also boring the centre, all at the same setting, so that positive concentric accuracy and alignment are assured beyond all question. A semi-circular recess is turned in the inner face to reduce weight. To machine the face of the boss, the outer flange and the rim, the end plates may be wrung on to a stub to ensure that they are concentrically located from the bore. The boss of the rear end plate is turned parallel on the outside to provide a register for the gear backplate and with a flat outer flange for it to bed against. Four air vent holes, $\frac{3}{32}$ in. dia., are drilled through this end plate in the approximate positions shown, to allow oil mist to pass into the gear casing.

Plain bush bearings are specified for this engine, mainly because, in view of difficulty in keeping condensed water out of the bearings, ball or roller races are liable to have a short life, however much care is taken to exclude, or subsequently flush out, moisture from them. They could, however, be fitted by minor modification of the end plates, if desired. The bushes shown in the drawing should be made of cast gunmetal or soft bronze; hard bronze is liable to cut or score the shaft journals, unless they are made of a hard wearing steel or surface hardened in some way. Machining is straightforward, preferably from the bar, so that boring and turning can be done at one setting, and they can be parted off finished. About 0.001 in. interference should be allowed for pressing in. The oil holes should be drilled through both the end plates and bushes *in situ* and countersunk to catch the oil as effectively as possible.

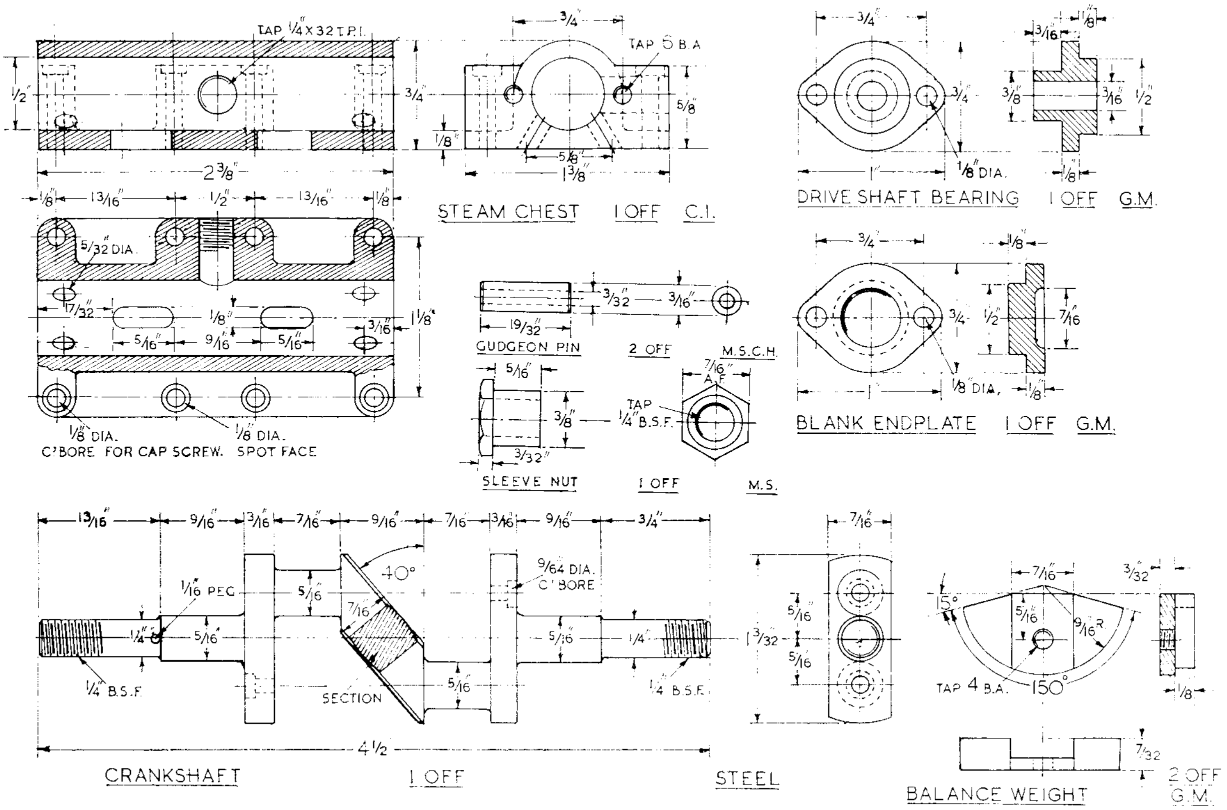
Steam chest

This must be made of a hard-wearing material capable of working to fine clearance with minimum lubrication; and in this respect there is nothing to beat good quality cast-iron, though this is not the easiest metal to machine accurately. The base of the casting should first be faced flat, by holding it across the four-jaw chuck with two of the jaws reversed. It can then be mounted on an angle plate for boring horizontally, thus avoiding any stress which might otherwise be caused by pressure of chuck jaws. If the casting has a cored hole, the use of a core drill, or a rigid spearpoint drill, is advisable for initial boring, but if not, an undersize twist drill must be used. It is hardly practicable to open out the long, small diameter hole to full length with a single-point boring tool, but if any difficulty is experienced in producing a true bore, the mouth of the hole may be bored as deeply as possible to form a guide for a close-fitting D-bit. The essential thing is that a smooth parallel bore should be produced; its exact diameter is less important, as the valve and cover spigots can be made to match. Both end faces of the steam chest should be faced squarely.

The two parts in the underside leading to the cylinders may be cut by end milling; if no ready-made cutters are available, simple flat cutters of the type shown in *Lathe Accessories* will do the job effectively, although somewhat more slowly. The operations may be speeded up by drilling a row of $\frac{3}{32}$ in. holes, prior to milling. It may be noted that small end mills generally tend to cut oversize, especially if they are not chucked perfectly truly, but as the width of these slots affect the valve timing, they should not on any account exceed the $\frac{1}{8}$ in. width specified. It will usually be found that mounting the work on a vertical slide (the fixing holes may be drilled in the steam chest to facilitate this) and running the cutter in the chuck at high speed, will be the most convenient method, if no more elaborate milling appliances are available; but even the vertical-slide can be dispensed with, by mounting the work to the vertical face of an angle plate and adjusting it to lathe centre height before clamping, as described in *Milling in the Lathe*.

Four holes $\frac{5}{32}$ in. dia. are drilled at approximately 60 deg. to the base line, into the bore near each end, at a distance apart corresponding to the holes in the top face of the body. A single hole is drilled and tapped horizontally in the middle of the steam chest (as an alternative, a flange joint may be used) to take the steam entry union. These operations should be carried out prior to finishing the bore of the steam chest by lapping or honing. I know that many experts contend that you cannot lap cast-iron, but only 'charge' it with abrasive; which having become embedded, is very difficult to remove. But it is often the only method available, and I have used it on occasions on small bores with satisfactory results. Honing is, of course, better and quicker, but so far as I know, the honing *mandrels* for use in the lathe are no longer available. It is not impossible to make them, but many motor car repair shops have honing *machines*, and may be prepared to finish the bores at a reasonable charge.

The drive shaft bearing and blank end plates are both simple to machine; in the former, the turning of the inner spigot and flange, also drilling and reaming of the bore, should be carried out at one setting. A stub mandrel may then be used to mount the bearing for machining the outer spigot and flange. It may be found on assembly that the thickness of this flange, or that of the rear (main) end plate, may have to be adjusted so that the gear back plate, when fitted, lies flat on both of them. Incidentally, when machining any of the register spigots specified, care should be taken to fit them as closely as possible, but not necessarily over the whole of their length. If the fit allows of any clearance, it may affect concentric location, or



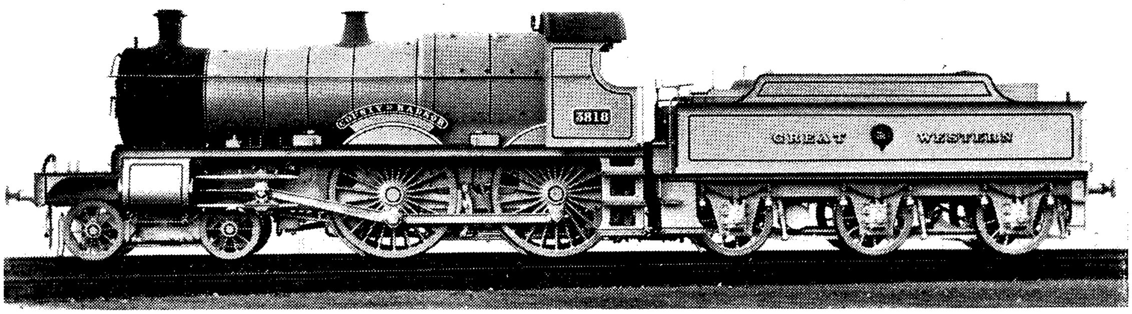
impose undue strain on the fixing bolts. The two end fittings are attached to the steam chest, each by 6 BA set-screws (or better still, studs and nuts) and those at the bearing end also pass through, and secure, the gear back plate.

Crankshaft

This may be made of mild steel, though a better quality high tensile steel may be used with advantage if it can be obtained. Flat bar, $\frac{7}{16}$ in. thick × $1\frac{1}{8}$ in. wide and long enough to clean up to $4\frac{1}{2}$ in. is specified, but if larger section material must be used, it is advisable to face the sides and perhaps the edges, to required thickness, by mounting the bar across the four-jaw chuck, before the other operations are started. This will reduce the amount of work required on more tedious intermittent machining. If free-cutting mild steel is used, liability to distortion after machining is sometimes encountered, but it may be avoided by 'normalising' the steel, that is, heating to dull red and allowing it to cool naturally. Hot-rolled 'Black' steel is less prone to internal stresses, but not quite so easy to machine. Heat treatment of alloy steels is best avoided unless their properties and recommended treatment are known. I mention this, because I am often asked whether samples of steel obtained from various sources are suitable for crankshafts. Sometimes the samples are sent to me for inspection; but I am of course unable to make any decisions on the matter without getting the metal analysed, which is not generally practicable. Readers will no doubt realise that in view of the difficulty of obtaining special materials of any kind, I am obliged to design my engines so that they will at least give reasonably good results when made of common materials, such as mild steel, cast-iron and non-ferrous metals which are the stock-in-trade of general engineering dealers and foundries. Constructors who have ready access to special materials can, and very often do, produce engines which are much better than my basic designs, but I cannot take any chances in this respect.

The crankshaft can be machined between centres after marking out on both ends for the main journal and throw radii centres. In order to ensure lengthwise alignment, marking out is best done by setting the bar on parallel packings, resting on a surface plate or other truly flat surface, and using a scribing block. The bar is first laid flat, and its centre found by adjusting the scriber point to split the width.

To be continued.



COUNTY CARLOW

A $3\frac{1}{2}$ in. gauge G.W.R. 4-4-0 locomotive by Don Young

Part IV

Continued from page 485

THE BOGIE IS a simplified Swindon pattern and, in the first instance, it was drawn close to the original. In this state it contained a multitude of pieces, and though strong enough to support its allotted portion of weight, could not have withstood a bad derailment. The trouble was that the bolt holes seriously weakened the main members. Substitution of a single plate top member effected the cure; as it cannot readily be seen, the overall result is still ' Swindon.'

Most $3\frac{1}{2}$ in. gauge designs, and some for 5 in. gauge, have omitted side control springing from their bogies. For a 4-4-0 wheel arrangement this results in a rather unsteady engine. The method adopted for provision of side control is more Adams than De Glehn, so I have veered a little South of true West!

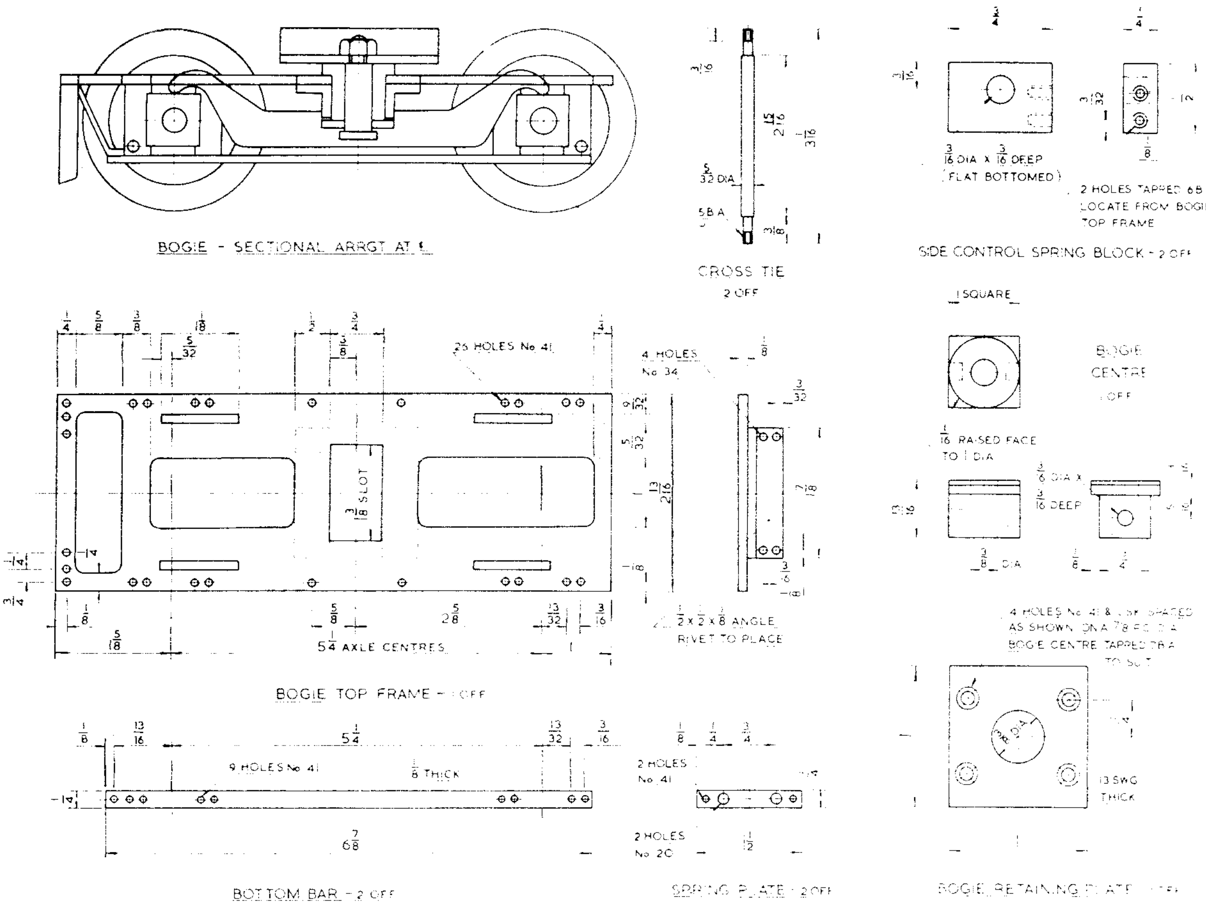
The top frame is a piece of $\frac{1}{8}$ in. steel plate, size $7\frac{7}{8}$ in. × $2\frac{13}{16}$ in. Mark out and cut the slot for the centre, roughly to size. It is finished off later, using the machined centre as a gauge. The four slots, $1\frac{1}{8}$ in. × $\frac{5}{32}$ in. are important as they provide location for the equaliser beams. The three remaining cut-outs are for lightening purposes only and are by no means essential.

Mark off and drill the holes around the edges of the plate. Next we must tackle the bogie centre which can be a gunmetal casting, or from 1 in. square bar of the same material. For bar material, saw off a $\frac{7}{8}$ in. length, chuck in the four-jaw and face off to $\frac{13}{16}$ in. Find the centre of one of the 1 in. × 1 in. faces, chuck truly and drill through to $\frac{3}{8}$ in. dia. At the same setting, face off to produce the $\frac{1}{16}$ in. raised boss. Transfer to the machine vice, on the vertical-slide, and mill the two recessed faces to $\frac{1}{8}$ in. depth. Use the centre to finish off the slot in the top plate. Cut two $1\frac{7}{8}$ in. lengths from $\frac{1}{2}$ in. × $\frac{1}{2}$ in. × $\frac{1}{8}$ in. steel angle and drill the No. 34 holes, as indicated, at each end. Fit the centre into the top frame and clamp the angle pieces to it. Drill through No. 41 and fit $\frac{3}{32}$ in. snap head rivets, six being ample to secure each angle.

The next items required are the bottom bars which are $6\frac{7}{8}$ in. lengths of $\frac{1}{4}$ in. × $\frac{1}{8}$ in. bright steel flat. The holes may be separately marked out or the bars clamped to the top frame and drilled through. The spring plates are from the same section material and are located under the top frame; drill the No. 41 holes from this latter part. Coil springs, $\frac{3}{32}$ in. o.d. × 20-22 s.w.g. wire, are located in the No. 20 holes, so check that the springs fit before riveting the plates in position.

Horns are next on the list, from $\frac{3}{8}$ in. × $\frac{1}{4}$ in. bright bar. Cut eight pieces, each $1\frac{1}{16}$ in. long and face off one end. Fit the soft centre in the headstock mandrel, hold the faced end of one of the pieces against it and tighten the chuck jaws. Face off the outer end to approximately 1 in. length—a few thou error will be of no consequence. Lock the carriage on the lathe bed and at the same setting face off the other seven horns when they will all be of equal length.

It will be an advantage, at this stage, to mark the horns in pairs. Mark off the outer horns and drill the No. 30 hole for the cross ties. Before the horns can be erected the axleboxes must be machined, these are either from gunmetal cast stick or



$\frac{3}{4}$ in. square bar. Machine as for the bogie centre, individually; the method of assembly will take care of any slight errors in the axle hole centres. Do not forget the oil hole, No. 55, lightly countersunk. Try a 4 in. length of $\frac{3}{8}$ in. dia. silver steel in the journals, if you have some to hand; if not the mild steel axle material will suffice. Clamp the front pair of boxes to their respective horns, clamping these in turn to the top frame. Try the dummy axle and adjust until it is square with the top frame, and in the correct position, fore and aft. When the axle turns freely, spot through from the top frame, drill No. 48 to $\frac{5}{32}$ in. depth into the horns; tap 7 BA and fit hexagon headed bolts. Seven BA is one of those fast disappearing sizes, so make your own bolts, $\frac{3}{16}$ in. long, with 8 BA heads, for neatness, a full $\frac{1}{16}$ in. thick.

Repeat for the rear axle and then attach the bottom bars in like manner. Measure the inside distance between the outer horns and machine the cross ties from $\frac{5}{32}$ in. steel rod, to suit. The axle-boxes will almost certainly be tight in their horns so remove each in turn and relieve to an easy fit. At the same time relieve the sides of the slots, as shown on the detail drawing, so that each box can lift approximately $\frac{3}{16}$ in. independent of its opposite number.

Bogie wheels are available as standard items from some suppliers, to the size we require. Chuck centrally in the four-jaw, face the backs then centre, drill and ream through the boss, to $\frac{5}{16}$ in. dia. It will be impossible to bolt this size of wheel to the faceplate for machining the rest of the wheel, so chuck a length of $\frac{1}{2}$ in. or slightly larger, steel bar in the three-jaw. Turn down the first $\frac{5}{16}$ in. to $\frac{1}{4}$ in. dia. and screw BSF or 40 t.p.i. Turn the next $\frac{7}{16}$ in. to a push fit in the wheel. Slide a wheel on to the mandrel and fasten with a suitable nut. Turn the rest of the profile to drawing size, leaving a few thou on the tread for final finishing. Use a fine file to radius the flange lip. Finish the other three wheels to this stage; then take a final fine cut across the tread. Leave the tool setting unchanged and repeat on the other wheels.

For the axles, chuck a $4\frac{5}{16}$ in. length of $\frac{3}{8}$ in. bright steel bar in the three-jaw. Face the end, centre with a No. 2 Slocombe drill, for appearance, and turn down $\frac{1}{2}$ in. length to a .0005 in. interference fit in the wheel. This latter always sounds more difficult to carry out than it really is. To achieve the correct result first turn down the whole $\frac{1}{2}$ in. length to within .002-.004 in. of finished size, using the "mike." For the outer $\frac{1}{16}$ in. take fine skims until the wheel just pushes on to it. Note the cross-slide collar reading, turn back, say, a quarter turn and advance to within a quarter division of the previous setting. Take a cut right across the seat and the required result is achieved. On giving attention to the other end, check that the distance between shoulders is $3\frac{9}{32}$ in., before finishing the wheel seat.

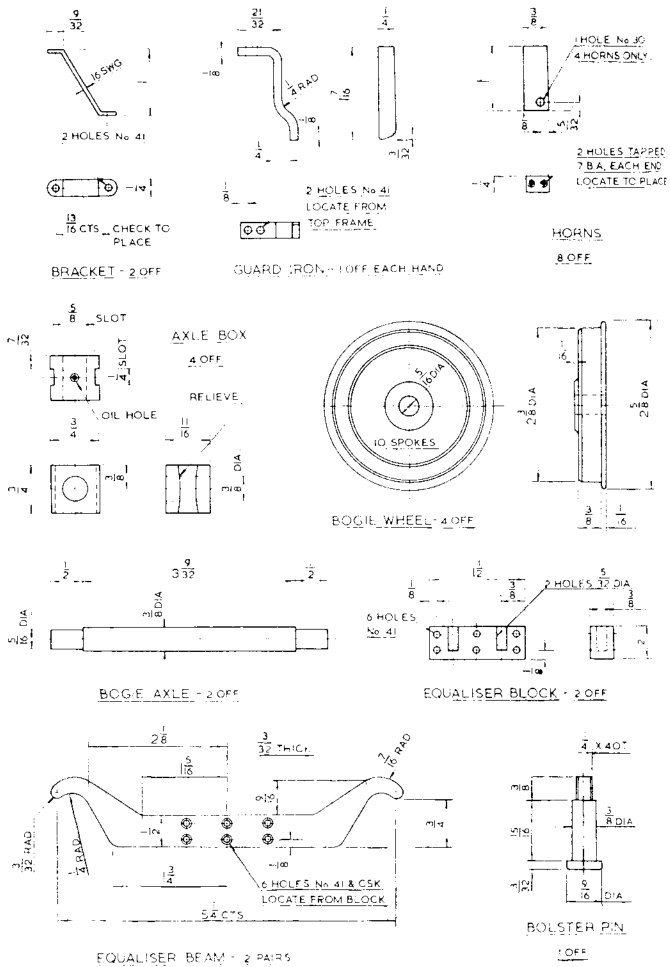
Most builders should possess a bench vice which opens sufficiently to press the wheels home. Fit soft jaws or clams to avoid nasty blemishes. My preference, however, is to drive the axles home. The wheel centre is supported on a block of hardwood and the axle given sharp blows with a wooden mallet. In this way one can judge better the fit of the axle, particularly if it is too tight, which can happen, in which case the wheel is supported on top of the vice jaws and the axle driven out with a centre punch, the centred end avoiding damage. The axle end can then be reduced by the judicious use of fine emery cloth, the lathe running at top speed. Remember to fit the axleboxes before pressing on the second wheel; it sounds elementary, but can easily be overlooked just once in that desperate rush to 'get the wheels turning.'

Side control

Attention had better be given to the bogie side control springing before this area becomes boxed in. Finish the bogie centre by drilling the $\frac{3}{16}$ in. dia. holes, again trying the 22 s.w.g. coil springs in position. The bogie retaining plate is a simple job, from 13 s.w.g. brass sheet. Its main function is to stop the bogie falling off when the locomotive is lifted from the track. Locate to the bogie centre with a piece of $\frac{3}{8}$ in. bar; then drill into the latter item, tapping 7 BA and fitting four countersunk head screws. Erect on the top frame.

Machine the side control spring blocks to a tight fit between the angles on the top frame. Spot through, drill and tap 6 BA and fit with hexagon bolts. Remove and drill the $\frac{3}{16}$ in. blind hole, flat bottoming same with a 'D' bit or end mill. Cut two coil springs, each a full $\frac{3}{4}$ in. long, refit the blocks with the springs in position. It is essential for positive operation that, when the bogie centre is at one end of the slot, the spring at the "slack" end is still slightly compressed. Check that this requirement is met.

The front end of the bogie is next on the list.



Make the guard irons from $\frac{1}{4}$ in. × $\frac{1}{8}$ in. b.m.s. flat. These are extremely elegant and being clearly visible, extra care must be taken to make them a matched pair. As they only bend in one plane this will not be too difficult—try them edge to edge. Bolt or rivet to the top frame, using the two outer holes of the group of three. The little 16 s.w.g. brackets are fitted in place, using the remaining holes in the top frame and the front hole in the bottom bars, and are bolted in position.

It now remains to produce the wheel springing: start with the equaliser block. The illustration is taken through the centre line of the $\frac{1}{2}$ in. × $\frac{3}{8}$ in. steel bar. Mark off and drill the holes, those nominally $\frac{5}{32}$ in. dia. being the same size as for the spring plates. Cut the equaliser beams from $\frac{3}{32}$ in. thick steel sheet and finish profile in pairs. Clamp a block to one of the beams and drill through the No. 41 holes. Clamp the second beam on, square up the whole assembly and drill through again No. 41. Countersink both sides and fit $\frac{3}{32}$ in. soft iron rivets.

Cut four 1 in. lengths from the selected spring, fit into the spring pockets in the blocks. Remove the bogie bottom bars, wheels and axles, lift the equalisers into position and reassemble. The spring lengths will have to be finally adjusted when the locomotive is completed.

Turn up the bolster pin from $\frac{5}{8}$ in. dia. bar, make a $\frac{1}{4}$ in. × 40-tooth nut to suit and the bogie is complete. Should you intend to run your "County" on a track with tight curves, say less than 35 ft. radius, check that there is sufficient clearance in way of the frames and slightly increase the cut-out if necessary. The 4-4-0 wheel arrangement is very flexible, providing attention is given to bogie side movement.

Whilst writing this article, I recalled a couple of occurrences. The first concerns an A3 'Pacific,' travelling at a fair speed, just north of Newark. For some unknown reason, a pair of bogie wheels derailed but the train continued on its way, the crew oblivious to what had happened. Over the Trent bridge and then the wheels miraculously re-railed—a lucky escape! The fireman recounted the story to me many years later, recalling that it gave him quite a turn, after a platelayer had found the damage and the engine was traced from the wheel flanges. Yet this same man, as a driver, did not bat an eyelid when running over a broken rail in Woodhead tunnel. I happened to be on the footplate that Saturday night, and to see the fall-plate leap in the air was very frightening!

The second story concerns 'fitter Bill' and a B1 bogie. Now Bill was not a credit to his trade and had to be fed on simple chores. As the new erecting shop was slack we were given a B1 in for a general repair and Bill was given the job of stripping down the bogie. The small guard irons on the bogie have to be removed before dropping the wheels, as they foul. Bill did not see this and had the bogie frame lifted on the crane. The rear set of wheels dropped and the remainder hung at a crazy angle. Out came a 4 lb. hammer and the offending axle received some heavy treatment, the sounds arousing a fair proportion of the rest of the shop. The platers, in the next bay, could not contain themselves and handed over their largest hammer, a 28 lb. job. After a couple of really terrific blows the chargehand stepped in to save the bogie from further punishment. I wonder how Bill is coping with the diesels?

To be continued.

The late Gems Suzor

Continued from page 527

game, and they served only to spur him on to renewed efforts. Even the wreck of *Nickie IX*, seen in the photograph, could not efface the characteristic Suzor smile! To him, the thrill of the chase was far more important than the trophy, and his attendance at Regattas, whether in France, Britain or other countries, was welcomed as an assurance of good sport in the best sense of the term. He did a great deal to establish friendly international relations between all enthusiasts—a really miniature *entente-cordiale* in fact—and in this respect, the part played by his wife, Madame Edith, deserves special mention.

In recent years Gems Suzor, in collaboration with his lifelong friend, the late Richard O. Porter, presented a new trophy for the encouragement of scale working model prototype boats. This is competed for annually, and is appropriately named the Friendship Trophy. It is significant that this gesture fulfils a particular need, and views the entire model power boat field in true perspective; it gives the lie to the prevalent idea that enthusiasts are obsessed by speed, and speed alone. This was never true so far as Suzor was concerned; his pursuit of speed was purely and simply a means of proving the success of intelligent design and conscientious workmanship in achieving efficient results. It is hoped that this fact and the motives behind it, should be remembered by all competitors who seek to follow the thorny trail which Suzor and other pioneers have laboured mightily to establish. *Edgar T. Westbury.*

John Benson writes:

"I was very sorry indeed to hear that our old friend Gems Suzor had passed on. I shall always regard him as one of the 'greats' in model power boats, his reign lasting over 40 years.

"I first saw Gems Suzor at the 1934 International Regatta held at Victoria Park when his 30 cc hydroplane *Nickie V* was entered together with such craft as *Oigh Alba* (A. D. Rankine) and *Betty* (Innocent Bros.). This exciting race gave the best speeds ever recorded up to that time, Gems being placed second to the Innocent Brothers, but by a very narrow margin.

"Later I came to know Gems Suzor well and in common with many other British power boat men enjoyed his hospitality on the occasion of a Paris International.

"His work on the development of model hydroplanes has been outstanding over the whole of the period that we have known him and many features now taken for granted were first intro-

Continued on page 553

The New Model Engineer
TRACTION ENGINE

PART XI

A one-inch scale model built and described by L. C. Mason

Continued from page 489

IF WE START with the off side components on the back axle, the first item is the driving gear. This is the big 80-tooth wheel, and there is very little work required on this. Press out the boss in the same way as before, and holding the wheel in the chuck with slips of soft aluminium over the teeth gripped by the chuck jaws, bore out the centre hole to $\frac{3}{4}$ in. dia., which loses the notch from the locking pin pressed into the boss. And that is all the work involved.

The centre for this wheel could be an iron casting, but I turned mine up from a stub of 2 in. b.m.s. shafting. Select the piece of $\frac{7}{16}$ in. rod from which you will make the axle itself and face up one end, removing any sharp burrs from the edge. This can be used as a gauge for the bores of the various centres and wheel hubs. Turn up the side of the centre with the long boss first to a press fit in the gear wheel. Bore out to a close fit on the axle rod and plane in the keyway, noting that this time the keyway is $\frac{1}{8}$ in. wide, not the $\frac{3}{32}$ in. of previous ones.

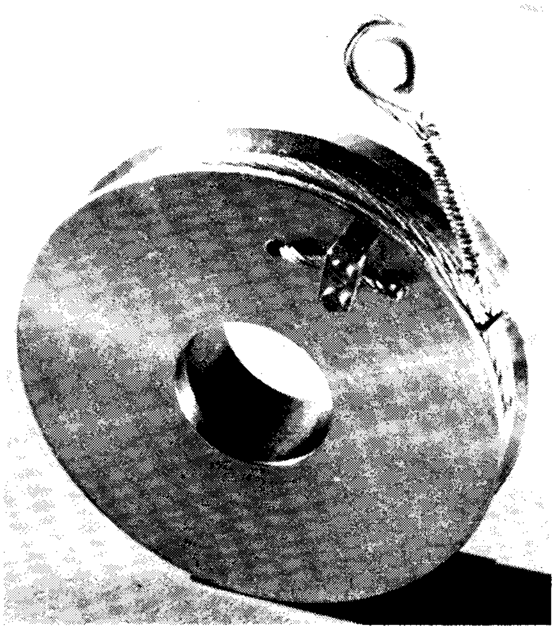
We can get away without a chucking mandrel for finishing the back of the centre this time, as the boss is long enough to be held safely directly in the chuck. Machine up the back and before removing from the chuck, fix up the dividing attachment and scribe four lines across the back flange. Locating from the edge, drill the four 4 BA clearing holes, countersinking on the back face. Press the wheel home, spot through the holes on to the wheel and drill through the wheel No. 34, tapping all four holes 4 BA. For extra security here, where the speed is low and the torque heavier, I fitted Allen socket-head screws. Run them in tightly and chucking the assembly gently by the edge of the centre flange, face back the screw ends flush with the face of the gear.

Here again, before removing from the chuck, scribe four equi-spaced lines on the face of the gear from the centre out to nearly the diameter of the back flange, spacing them by eye between the screws. On these lines, in due course, we can drill four alternative holes for the driving pin, spotted through the wheel hub. There is really nothing precise about the spacing here, as the lines will only be located by eye through the driving pin hole in the hub. Still, they may as well be reasonably symmetrical.

The brake drum, a gunmetal casting, is another straight turning piece, boring it out a free running fit on the boss of the 80-tooth gear centre. The groove for the brake blocks is square-bottomed, and can be turned in with a parting tool. Keep the tool really keen, take a very light cut, and keep it on the move sideways all the time or you will probably start the scream of fine chatter. Use quite a low speed in turning, too.

In turning the drum, face the plain side first, removing the minimum of metal. Leave the recess

Winding drum loaded with its steel cable.

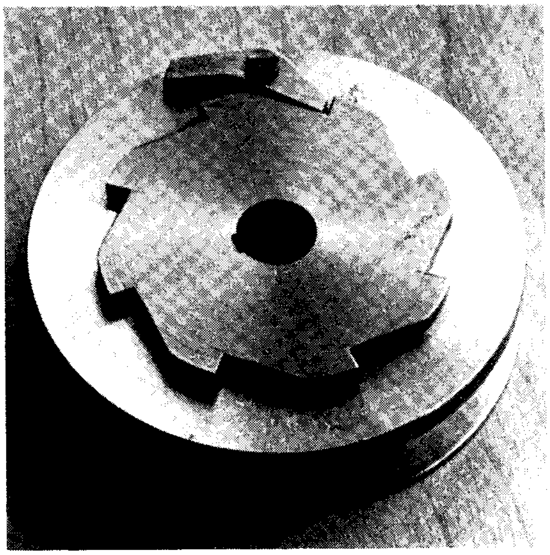


and grip the casting in the chuck by no more than half its thickness, so as to be able to rough turn half the rim. Reverse in the chuck and face the other side, leaving the centre raised portion unmachined for the moment on its face. This will leave as much thickness as possible there to be gripped in the chuck for finish turning. The casting should have enough on it to allow of some $\frac{3}{16}$ in. depth there. Finish turn to diameter, drill and bore out to size, then turn in the groove and the recess in the face. Skim up the rims either side of the groove, using light cuts for all these later operations, as it will not be too securely held. Reverse in the chuck again, holding it lightly by the edges of the rims, and finish turn the unmachined portion on the back.

On the near side of the axle we have—apart from the road wheel—the driving centre, the winding drum running on it, and a large washer to hold the winding drum up to the flange of the driving centre.

The driving centre can be an iron casting, or again like mine machined up from a short end of 2 in. b.m.s. shafting. It is all plain turning, bored a tightish push fit on the $\frac{7}{16}$ in. axle rod. This, like the big gear wheel centre, has a $\frac{1}{8}$ in. keyway planed in. With the piece finish turned and held in the chuck, flange outwards, there comes some more dividing. The edge of the flange has eight notches filed in to accept the tail of the winding drum latch. Mark a short line in from the edge on the face of the flange at each of the eight positions. Remove from the chuck and mark a point $\frac{1}{8}$ in. in from the edge on each line. I generally do this sort of marking with a depth gauge, setting the blade to protrude $\frac{1}{8}$ in., resting the stock against the edge, and scribing across the end of the blade. Mark a further eight points on the edge, each about $\frac{1}{4}$ in. behind the 'divided' ones; now if a short line is scribed from each of these second points to the one marked $\frac{1}{8}$ in. in on its right, the result is eight right-angled saw-tooth shapes marked out. File out the notches, rounding off the shoulders behind the tooth tips. Take care to get the teeth 'handed' the right way. With the centre held as it will go on the near side of the engine, flange facing you, the teeth must drive when the centre is turned forwards, i.e., anti-clockwise.

The winding drum is more plain turning of a gunmetal casting, and is tackled much like the brake drum. Face one side and rough turn half the rim; reverse and turn the other half of the rim. Drill through and bore out an easy running fit on the driving centre. Face back the second side till it is a shade thinner than the length of the sleeve part of the driving centre. You can judge this by

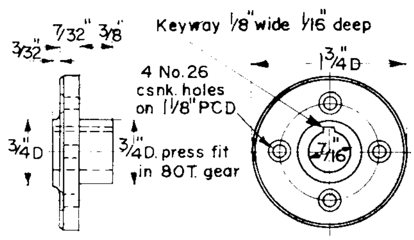

Winding drum with its driving centre and latch.

slipping the centre into the bore of the drum and when you can just feel the end of the centre proud of the back of the drum by a few thou—that's it. Re-chuck the drum by the thicker flange and machine out the cable groove by the alternate use of parting tool for the bottom, and right-hand and left-hand knife tools for the sides of the groove.

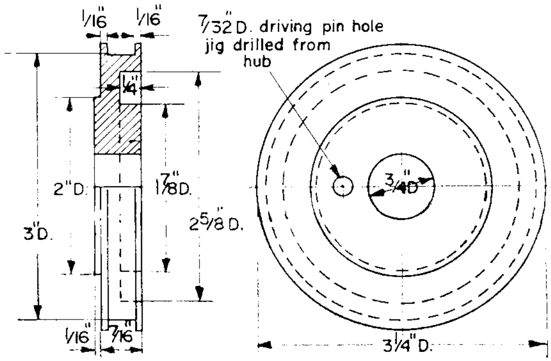
The latch or pawl is a filing job from a scrap of $\frac{1}{8}$ in. steel strip. Mark out its shape first and drill the hole No. 30—5 BA clearing. Start to enlarge the hole with a $\frac{3}{16}$ in. drill, and as soon as the drill is deep enough for a full $\frac{3}{16}$ in. dia. ring to be showing, stop. Exchange the $\frac{3}{16}$ in. drill for a $\frac{5}{16}$ in. slot drill or end mill, and run it into the hole deeply enough to produce a square-bottom counterbore $\frac{3}{16}$ in. dia. and $\frac{1}{16}$ in. deep. File the piece to shape to the marked outline.

Check from the job that the screw hole in the flange of the drum as dimensioned will let the latch swing clear of the driving centre teeth, and drill and tap the hole in the flange 5 BA. Turn up the screw from a stub of $\frac{3}{16}$ in. rod, adjusting the die so that the screw is distinctly tight in its tapped hole. The length of thread should be so arranged that when the screw is run in tight the latch swings stiffly enough to hold itself in any position. Face off the screw head to $\frac{3}{32}$ in. thick and saw in the screwdriver slot. When it is in position for keeps, file the end of the screw down flush with the inside wall of the groove.

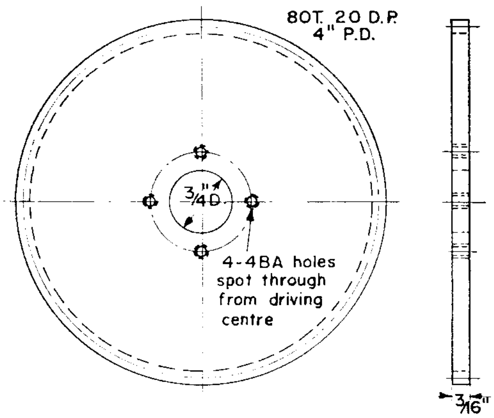
The full-size engine's cable is a heavy stranded steel affair, and there are various possibilities here, including motor-cycle throttle wire—if you can get a long enough length. Messrs. Reeves of Birmingham can supply a nicely laid scale flexible



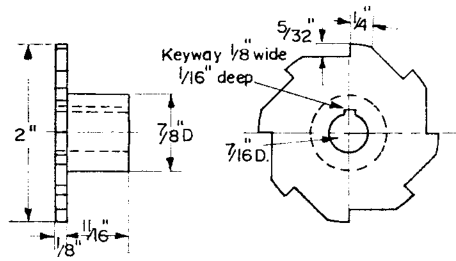
R.H. DRIVING CENTRE



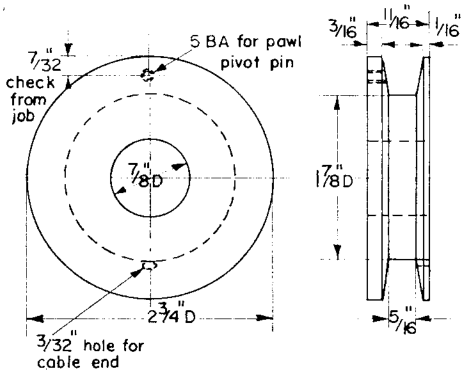
BRAKE DRUM



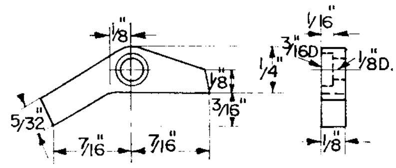
FINAL DRIVE GEAR WHEEL



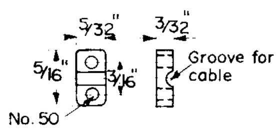
L.H. DRIVING CENTRE



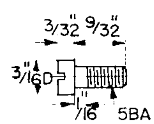
WINDING DRUM



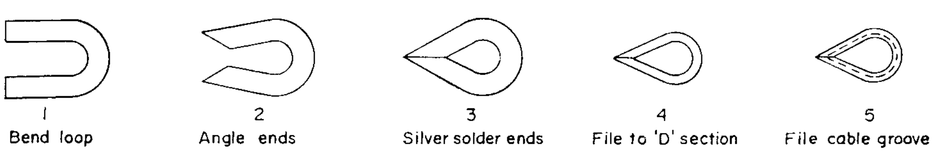
WINDING DRUM PAWL



CABLE CLAMP



PAWL PIVOT PIN

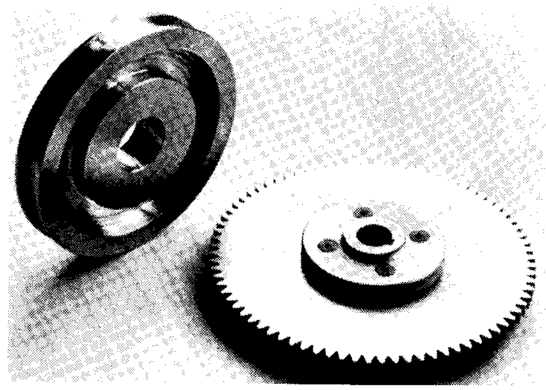


STAGES IN MAKING CABLE THIMBLE FROM ROD

steel cable intended for the $1\frac{1}{2}$ in. scale Allchin, in a nine yard length. This is very nice for *Minnie* too, and my winding drum accepted just about seven yards of this. The inner end passes through a $\frac{3}{32}$ in. hole drilled in the flange, level with the bottom of the groove, to be clamped down outside the flange. The clamp plate is merely a $\frac{5}{16} \times \frac{5}{32}$ in. scrap of $\frac{3}{32}$ in. steel, held in position by a couple of 10 BA cheesehead screws into the flange. A shallow half-round groove is filed across the plate to position and grip the cable end. Its position is not too precise, remembering that its corners must clear the $1\frac{1}{2}$ in. dia. washer locating the drum. The hole in the flange through which the cable passes should be angled in the direction giving the cable the straightest run, and a useful tool for this is one of the older 'milling-cutter' type dental burrs—one of the bigger cylindrical types.

Whatever you use for cable, the outer end is furnished with a thimble, enabling the cable end to be slipped over some suitable projection or to have a draw-bar pin prodded through it.

A nice-looking thimble is a bit awkward to produce from strip, so the best way to make one is this way: bend the end of a length of $\frac{1}{8}$ in. steel rod round something about $\frac{3}{16}$ in. dia., making the bend about $\frac{3}{8}$ in. to $\frac{1}{2}$ in. from the end. Squeeze the end right round till it nearly touches the rest of the rod and cut it off so that the two ends are level; then with a thin file, angle off the ends so that when they are further squeezed together they meet with a close joint between flat surfaces. Silver solder the joint so formed. Now file the piece all round to produce a 'D' section solid thimble. From here, the groove for the cable can either be filed with a small round file or shaped with an



Final drive 80-tooth gear wheel, fitted with its centre, and the brake drum.

Abrafile. This last does it very well but take care not to make it too thin, or it may bend and distort in use.

If you can do some mini-splicing, that is the way to fix the end. Failing that, bind a short length of thin wire tightly round the cable about an inch from the end, unlay the cable back to the binding and cut the strands progressively shorter to make a tapered end. Bind the end down to the main length with a close-turned binding of thin steel or iron wire.

Last component—a washer to hold the winding drum in place. This is merely a plain double-thickness washer $1\frac{1}{2}$ in. dia. and $\frac{7}{16}$ in. bore, turned up from a scrap of $\frac{1}{8}$ in. plate or strip. It slips on the axle between the end of the bearing and the driving centre.

To be continued.

BRITISH COMPOUND LOCOMOTIVES

By K. N. Harris

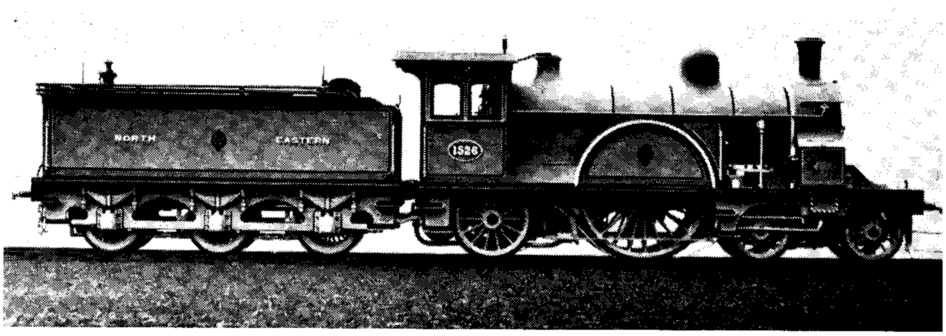
Part IV

Continued from page 433

Worsdell left the G.E.R. in 1886 to take over as Locomotive Superintendent on the North Eastern Railway where he continued his compounding on a much wider scale, but before dealing with this, there remains to be noted one more compound built for the G.E.R. by Mr Holden. This was an 0-6-0 goods engine and was built in 1887. The cylinders were 18 in. and 26 in. × 24 in. stroke, as in Worsdell's engines, but the valve gear was Stephenson's. I have no other particulars of this engine, except that the wheels were 4 ft. 10 in. dia.; it was a loner and no data on its performance is available. It would not be fair however to write it off as a failure just because no more were built. Smith's first three-cylinder 4-4-0 on the N.E.R. was never duplicated, but it was the direct progenitor of the huge Midland and L.M.S. brood.

The N.E.R. was a very much larger and financially stronger line than the G.E.R., and in consequence Worsdell had much greater scope to develop his ideas, and he took the fullest advantage of this, building express engines, goods engines, and tank engines on his two-cylinder system.

His first engine, built at Gateshead, was a 2-4-0 compound express, built in 1886 and followed in 1887 by ten similar engines. Generally these



T. W. Worsdell's 'J' class 4-2-2 with Von Borries type compounding system and outside steam chests.

engines were very similar to his G.E. engines (except for the bogie). There were, however, two important changes. Boiler pressure was increased to 170 p.s.i. and there was a differential adjustment of the quadrants or slides of the Joy valve gear to give a later cut-off in the LP than in the HP. For the 10 engines that followed the first one, Worsdell reverted to a bogie to carry the front end.

The cylinders remained at 18 in. and 26 in. × 24 in., a ratio of HP to LP of 1-2.09, which according to Von Borries' ideas was on the low side; however, to provide a ratio of 1 to 2.25-2.3 would have required an inconveniently large LP cylinder, so, as so often happens in locomotive design work, Worsdell compromised.

The starting arrangements were, in principle, the same as those employed on the G.E. engines, but the driver's control was now by a single handle, and relief valves, set to blow off at 100 p.s.i., were fitted to the ends of the LP cylinders. The coupled wheels were 6 ft. $8\frac{1}{4}$ in. dia., with 4 ft $7\frac{1}{4}$ in. dia. carrying wheels for the first engine and 3 ft. $7\frac{1}{4}$ in. bogie wheels for the succeeding ten.

Boilers, all alike, had 1,323 sq. ft. heating surface, with a grate area of 17.33 sq. ft., and as stated above, a working pressure of 170 p.s.i. The 4-4-0's and all the express engines which followed had tail rods to the LP pistons. There has always been considerable difference of opinion about tail rods. Whilst they do help to support the weight of the piston and save wear on the lower part of the cylinder bore, the bearing area of the bush carrying the rod extension is small and wears quickly, and in the days before mechanical lubrication, difficulty of keeping it oiled added to the trouble. Further, the tail rods added to the reciprocating weight, always something of a headache for the locomotive designer. On balance, probably tail rods were not desirable and they were rarely used in "modern" (it is sad to think that when we speak of "modern design" in connection with the steam locomotive, we are talking of something which has already been dead for around 12 years!) design.

The relative cut-offs in the HP and LP cylinders are interesting, at 70 per cent cut-off in the HP, the LP cut-off was $84\frac{1}{2}$ per cent, at 50 per cent HP cut off, LP cut-off was 73 per cent.

Immediately following these engines came 10 single wheel expresses 1888-90. Once again the cylinders were 18 in. and 26 in. × 24 in. stroke. Driving wheels were 7 ft. $1\frac{1}{4}$ in. dia., and the boiler, with a smaller dia. barrel than the preceding class, gave 1136 sq. ft. total heating surface with a grate area of 17.2 sq. ft. Working pressure 175 p.s.i.

The mechanical arrangements were generally similar to those of the 4-4-0's, but certain modifications were made to the HP valves, which were given $\frac{1}{4}$ in. exhaust clearance. In passing we have quite recently had a design for a simple two cylinder locomotive in *Model Engineer*, with the slide valves having an exhaust clearance of no less than a scale $\frac{1}{2}$ in.! It also included small drilled passages and would appear to indicate that the designer has at last found that these lead to excessive back pressure due to restricted exhaust; or is there some more subtle explanation?

The LP valve proportions are interesting; as compared with the previous engines, the lap was increased by $\frac{3}{16}$ in. to $1\frac{1}{8}$ in., while the lead was reduced from $\frac{3}{8}$ in. to $\frac{3}{16}$ in.

The full gear travel was $5\frac{1}{4}$ in., quite large for that period, when full gear travels of under 4 in. were quite common. It is of interest to note that in Gresley's first "Pacifics" the full gear valve travel was only $4\frac{9}{16}$ in. and they came over 30 years later.

It is really astonishing to realise how long it took British locomotive engineers to appreciate the virtues of long lap, long travel valves, for both D. K. Clark and Sinclair of the Caledonian, and later, G.E.R. had tumbled to this by 1860, and even after Churchward took it up and applied it to his Great Western engines with great success in the first decade of the 20th century, it still took another 20 years before its merits began to be at all widely understood.

At about the same period that this first batch of single wheelers was put in hand Worsdell started another ten singles of much larger dimensions. The HP cylinders were increased to 20 in. bore and the LP to 28 in. bore, with the usual 24 in. stroke. The HP-LP ratio was 1 to 1.96. To get these two large cylinders between the frames required some contriving, the HP cylinder was set much lower than the LP and was inclined *upwards* towards the crank axle, whilst the LP, set much higher, was inclined *downwards* towards the crank axle. This arrangement left no room for valves either above or below, and so the steam chests and valves were placed *outside* the frames. Joy's valve gear was still used, but the position of the valves necessitated this operating through rocking shafts (this must have been one of the few occasions on which rocking shafts were used in connection with Joy gear). The boiler heating surface was only 3 sq. ft. greater than that of the smaller class of "Singles" at 1,139 sq. ft., but the grate area was increased to 20.7 sq. ft., 20 per cent greater.

The driving wheels were 7 ft. 7¼ in. dia., the same size as the coupled wheels of the two famous 4-4-0 "racing" simple engines built by Worsdell in 1896.

All these compound express engines seem to have given satisfactory service and showed appreciable economies in fuel consumption.

Some trouble was experienced with the last series, through the outside steam chests cracking, presumably caused by their exposure to cold air causing warping. Wilson Worsdell, T. W. Worsdell's successor on the N.E.R., rebuilt all these compound expresses as simple engines. Probably the compounds were heavier on maintenance and repairs than the simple engines and this nullified the economies in fuel.

In 1886 Worsdell (T. W.) built the first of his 1-6-0 compound goods engines, incidentally, the first compound goods engine of this wheel arrangement ever to run in Great Britian.

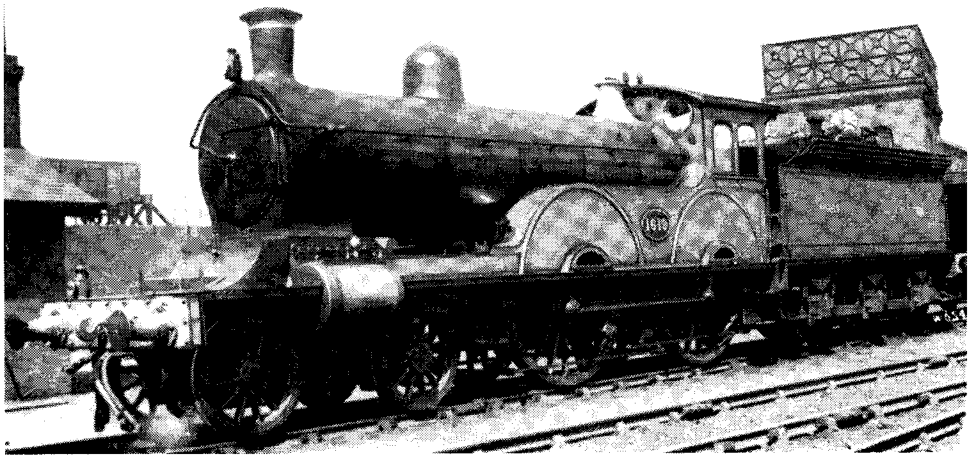
The cylinders once again were 18 in. and 26 in. × 24 in. coupled wheels 5 ft. 1¼ in. dia. The boiler with 1,136 sq. ft. heating surface and 17.2 sq. ft. grate area, was similar to those employed on the first express compounds, but carried a working pressure of 160 p.s.i. Again the mechanical arrangements were as before, of course in this case with the valves above the cylinders directly driven by Joy valve gear. The differential arrangement of the valve gear as between HP and LP was retained.

A drawback to this was that when working in reverse the LP cut off became *earlier* than the HP. Of course, this was of little moment for express engines which did all their serious work running chimney first, but it was disadvantageous to an engine which was called upon to do any great amount of shunting. However, the system must have been reasonably satisfactory for goods engines, for no less than 171 of them were built between 1886 and 1892.

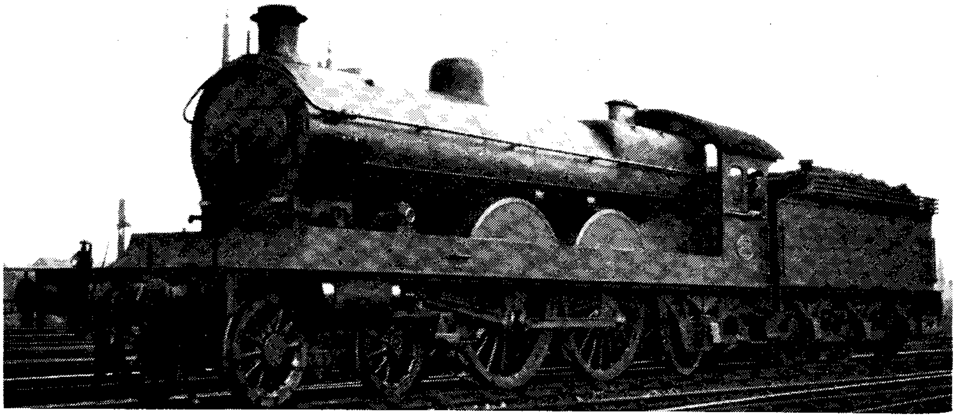
All the Worsdell compounds both express and goods were neat, nicely proportioned and good looking. Worsdell also built some 0-6-2 tank engines of similar proportions for coal traffic, but he never built any compound passenger tank engines. The single driving express engines were capable of, for the period, very high speeds, well into the "eighties." Generally it can be said that Worsdell's compounds were satisfactory, they were cheaper to build and considerably more reliable in working than any of Webb's engines.

In 1893 Wilson Worsdell designed a 4-4-0 two-cylinder compound express, the mechanical layout of which was very similar to that adopted by W. T. Worsdell for his larger singles.

The cylinders were 20 in. and 28 in. bore, with the stroke increased to 26 in. whilst the coupled wheels were 7 ft. dia. The steam chests were out-



Wilson Worsdell 4-4-0 of 1893, originally a two-cylinder compound with outside steam chests; rebuilt in 1898 as a three-cylinder Smith compound.



One of the two four-cylinder compound 4-4-2's designed by Walter Smith, and considered by the author the most efficient compounds ever to run in Britain.

side and the working pressure at 200 p.s.i. was then the highest in the country. This engine, in its original form, had a short life, as it was completely rebuilt as a three-cylinder Smith compound in 1898 and thus became the true begetter of the famous Midland L.M.S. series. This rebuilt 4-4-0 was not only highly successful, but a very nice-looking engine. The HP cylinder was 19 in. × 26 in. and the LP cylinders 20 in. × 24 in. (In the Midland and L.M.S. Compounds the HP cylinders were also 19 in. × 26 in., but the LP cylinder was 1 to 2.05.) The boiler was I believe a "one-off," different from any other N.E.R. boiler. The total heating surface was 1,328 sq. ft., grate area 23 sq. ft., high for the period (1898), and the working pressure 200 p.s.i.

Cross water tubes were fitted in the firebox; these were a patented invention of Walter Smith's, and were later used extensively by Dougald Drummond on the L.S.W.R.

This engine did very good work but was never duplicated, its controls were much more complicated and it required a higher degree of skill in handling than was at all generally available.

Like the early Midland Compounds, it had separate controls to the HP and LP valve gears (Stephenson's Link Motion) and it also had a variable reducing valve for admitting steam direct to the LP Steam Chest at the driver's discretion.

A feature common to both the N.E.R. and Midland Compounds was the placing of the connecting rods of the LP cylinders *inside* the coupling rods. The last compounds to appear on the NE were two very fine four-cylinder 4-4-2 compounds to the design of Walter Smith built in 1906. The four cylinders were in line, the low pressure being inside and under the smokebox, all four driving the leading coupled axle. The HP cylinders were 14¼ in. × 26 in. and the LP cylinders were 22 in. × 26 in. Piston valves were applied to all four cylinders, and one engine had Stephenson valve gear, the other Walschaerts. HP and LP ratio was 1-2.38 and the working pressure was 225 p.s.i., an unusually high pressure for the period. The driving wheels were 7 ft. 1¼ in. dia. The total heating surface (they were built before the days of superheating) was 2,096 sq. ft. and the grate area 29 sq. ft.

The weight, engine only, in working order was 73 tons 6 cwt.,

It has always been my personal opinion that the two four-cylinder 4-4-2 Compounds that Walter Smith designed for the N.E.R. were the finest and most efficient compounds ever to run on British rails. They were very handsome engines to look at with beautiful proportions and they had excellent boilers, incidentally I believe the only Belpaire boilers ever fitted to N.E.R. locomotives. These engines had only two sets of valve gear, in one engine Stephenson's and in the other Walschaerts. The HP cylinders were 14¼ in. × 26 in. and the LP 22 in. × 26 in., a ratio of 1-2.34. Both had piston valves, overhead, the HP were 7½ in. dia. and the LP 10 in. dia. The HP valves had "inside" admission and the LP outside admission, the cranks of each pair of HP and LP cylinders being at 180 deg. This arrangement avoided complication in the rocking gear, and exhaust to the LP cylinders. W.P. 225 p.s.i.

Mr O. S. Nock, in his book on the North Eastern Railway, says that the Walschaerts-fitted Compound was the only N.E.R. engine to have Walschaerts valve gear, but he inadvertently overlooked the Uniflow 4-6-0 No. 825 built in 1913 which also had Walschaerts gear, and of which incidentally, there is a very pleasing coloured plate in the said book.

These engines did excellent work, but like the original three-cylinder Smith Compound, were not multiplied. They were powerful, fast and economical.

To be continued.

A MOST SUCCESSFUL model engineering exhibition, organised by the Cheltenham Society of Model Engineers, was held in the Shaftsbury Hall, Cheltenham, from April 5 to 12.

The Exhibition was opened by Lord Robertson, late Chairman of the British Railways Board, and among those present were Sir George Dowty, President of the Society, the Rev. C. Markham, Mayor of Cheltenham, and Mrs. Markham, and Martin Evans, editor of *Model Engineer*.

Mr A. H. W. Bowling, who won the Duke of Edinburgh Trophy at the recent Model Engineer Exhibition with his $3\frac{1}{2}$ in. gauge *Green Arrow* had his locomotive on display, and this engine also took its turn on the passenger track, as can be seen in our pictures.

One of the most outstanding locomotive models was the unfinished 5 in. gauge L.M.S. Stanier 2-8-0, under construction by Mr P. Taylor of Cheltenham. The boiler and smokebox was exhibited and the completed tender—a perfect example of super-detail work. Another interesting unfinished locomotive was a 5 in. gauge Tilbury

CHELTENHAM SHOW

Admiring some of the models at the Cheltenham Exhibition: Left to right— ***Mr Greiffenhagen (Hon. Sec.),*** *Lord Robertson, Sir George Dowty, Rev. C. Markham Mayor of Cheltenham.*

Photographs courtesy "Gloucestershire Echo."

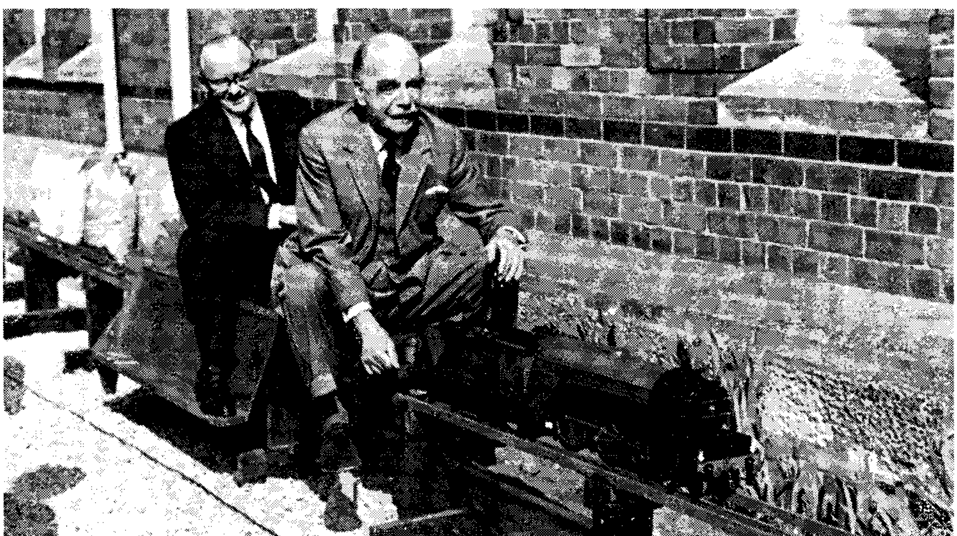
0-6-2 tank with Joy valve gear, made by Fred Payne of Bishops Cleeve. There were however so many railway locomotives at this exhibition that it would be impossible to mention them all. Perhaps it is not surprising that Great Western engines predominated, C. J. Goulding of Newport and H. Richardson of Cheltenham showing no less than six between them—A " King " 4-6-0, a " Saint " and " Grange," a " Firefly " 2-6-2 tank, a Pannier and a " Dukedog."

There was also plenty of variety among the stationary and marine engines and boilers, and Mr Charles Blazdell's beautiful compound paddle engine was outstanding here. H. Linck of Cardiff showed a very fine Scotch marine boiler with feed

pump and also a Marshall portable engine to 1 in. scale, circa 1900.

Among the ship models, a model Fleetwood trawler *Doreena* by R. Crawford of Swindon was notable. This was powered by a centre-flue boiler and a $\frac{5}{8}$ in. × $\frac{5}{8}$ in. double-acting engine.

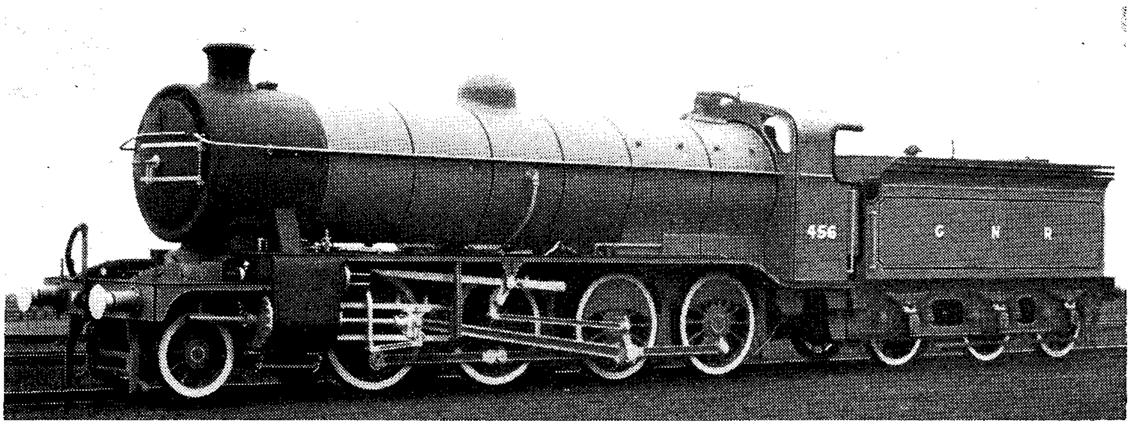
An outdoor passenger-carrying track and a model boating pool completed a fine exhibition, of which the Cheltenham Society should be proud.



Top left: Lord Robertson about to start Mr Bowling's " Green Arrow."

Top right: A general view of the Hall.

Left: Lord Robertson, with Sir George Dowty as passenger applies the brakes.



"NIGEL GRESLEY"

A 5 in. gauge Great Northern Railway 2-8-0 goods locomotive

Built and described by Martin Evans

Continued from page 443

WE NOW COME to the valve spindles, which are made from $\frac{3}{16}$ in. dia. stainless steel. These are cut to a length of $5\frac{11}{16}$ in. and one end is threaded $\frac{3}{16}$ in. × 40 t. for the valve crosshead. At the other end, a slight flat is filed, for a length of about 1 in. I am often asked what is the purpose of this flat. If the valve spindle was made a good fit in the front end of the steam chest, sooner or later, water would get into the blind recess beyond the end of the spindle, and it would then be trapped. Of course it would in most cases leak round the spindle, back to the inside of the steam chest; nevertheless the valve gear could easily be strained due to the compression involved.

The valve spindle guides can be made from round bar material, either silver steel or mild steel, $1\frac{1}{8}$ in. dia. At first sight, they may look rather complicated, but they should not be too difficult to make.

Start by chucking a suitable length of the material sufficient for one guide at a time. Face off the end and recess to a depth of $\frac{1}{32}$ in. to a close fit over the rear boss of the appropriate steam chest, which is nominally 1 in. dia. Now centre deeply, drill right through about $\frac{3}{16}$ in. dia., then open out with suitable drills to about $\frac{1}{2}$ in. (right through) then bore and ream to $\frac{9}{16}$ in. dia.

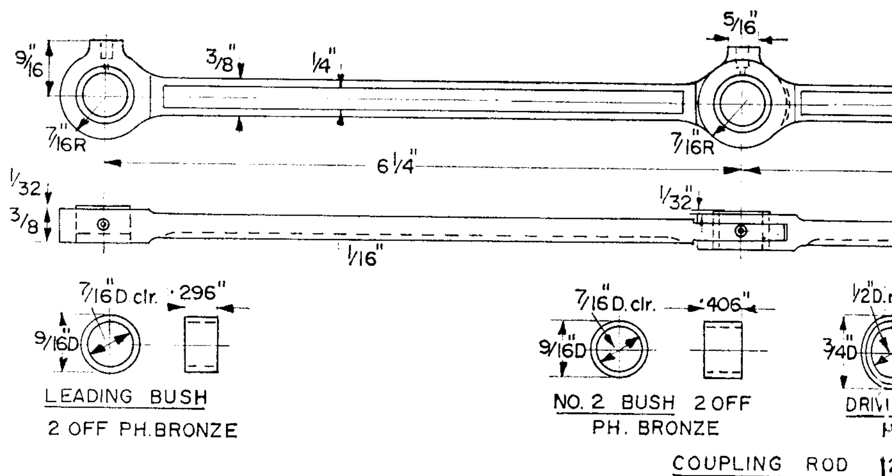
Reverse in the chuck, set to run truly, and face the other end to the exact length ($2\frac{3}{8}$ in.). We now have to mill two slots, both $\frac{3}{8}$ in. wide, the first slot horizontally, down to $\frac{3}{16}$ in. from the steam chest end, but not right through, the cutter must be stopped at a point $\frac{11}{32}$ in. from the longitudinal centre-line, so as to leave some material at the back of the guide as seen in section CC on page 339 (April 4). This is not difficult to do, using either a Woodruffe cutter, or a face milling cutter $\frac{3}{8}$ in. wide, and not too large a diameter.

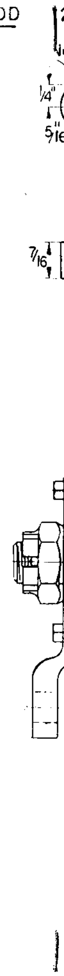
Note that it is not possible to reach quite up to the left-hand end, but the remaining metal can easily be removed by filing afterwards, as the dimension is not critical here, it is only critical in the part where the valve crosshead works. The second $\frac{3}{8}$ in. wide slot is now milled vertically, at right-angles to the first slot, and this time, the cutter must not cut deeper than $\frac{1}{32}$ in. beyond the first slot, as seen in section CC and in section BB.

The next operation is to file out the $\frac{9}{16}$ in. wide recess on the left-hand side again, this is to provide clearance for the valve spindle gland. The guide can now be drilled for fixing to the steam chest boss, two No. 34 holes being drilled from the back, at a pitch of $\frac{25}{32}$ in. Clean off any burrs, and we are then ready for the final operation—turning the outside to shape.

At first sight, it may seem rather difficult to hold

SOME OF THE MOTION DETAILS FOR NIGEL GRESLEY





the guide firmly enough for turning, but this is how I suggest it can be done: cut a piece of b.m.s. ¾ in. × ⅜ in. section and 2 3/16 in. long, and place this inside the guide. Cut another piece 1⅜ in. long × ⅜ in. wide × ¼ in. thick and insert this inside the guide in the vertical slot, at right-angles to the first, thus forming a Tee-shaped piece. The guide can now be held firmly in the four-jaw chuck, leaving about 1½ in. protruding and setting it to run truly, using a d.t.i. if available.

Most of the surplus metal can now be turned away, rotating the top-slide to produce the tapered part. Finally, draw the guide further out from the chuck, so that a bare 3/16 in. is left to hold it by. The outside can then be finished off, using very light cuts, and finally finishing with a dead smooth file to blend the two cuts into one another.

It will be noticed from the drawing of the valve spindle crosshead (page 339) that one "arm" of its fork is thicker than the other, making the crosshead "handed." The idea of this is to bring the outside of the valve crosshead nearer to the outside of the valve spindle guide, making the attachment of the lubricator driving rod easier.

However, the spindle guide tapers outwards towards the cylinder end quite considerably and it is therefore advisable to file the guide parallel on this side, otherwise the end of the lubricator driving rod would have to be offset considerably to clear it.

The valve guides are held to the steam chest bosses by two 6 BA screws, which should be in stainless steel for strength. As it is not possible to place these screws above and below the valve spindle (which would have been better from the strength point of view), it is most important that the recess in the valve guide fits the steam chest boss closely.

To complete the cylinders, we need the two piston rod glands and the valve spindle glands. The former are of the plain studded type, with the studs arranged at 45 deg. I expect some builders will ask why these studs have not been arranged at each side of the piston rod, on the transverse centre-line. But if this is done, it is difficult to get a spanner on the nuts on the inside stud, when adjusting the glands.

The valve spindle glands are the more common screwed type, so the threads should be cut with care, to maintain concentricity. It is really well worth while screw-cutting them. They are turned from 9/16 in. dia., or the nearest larger, drawn phosphor-bronze, and their overall diameter must not be more than 33/64 in., otherwise there will not be much clearance for them inside the valve guides.

Valve crossheads

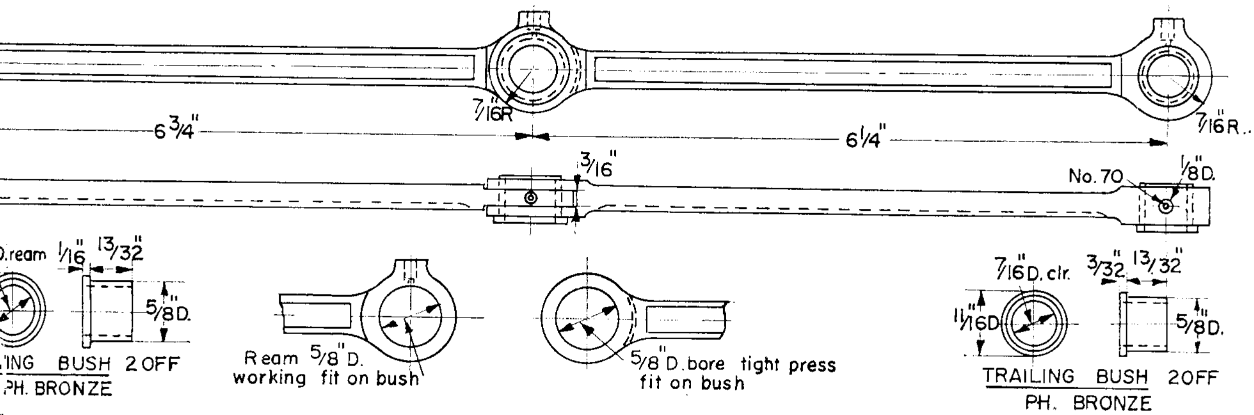
The valve crossheads are made from ¾ in. × ⅜ in. b.m.s. Reduce a suitable length to a width of 13/32 in., mark out, drill and ream the 3/16 in. dia. holes (one at each end of the bar), then mill the ⅜ in. wide slots. Saw off the two pieces, hold in the four-jaw chuck (allowing for the necessary off-set) centre, drill 5/32 in. dia., and tap 3/16 in. × 40 t. for the valve spindle; finally turn the outside of the boss to 0.360 in. dia.

After valve setting, a 1/16 in. dia. pin or a small taper pin should later be fitted, through the boss, and to make the drilling operation easier, this hole can be drilled half-way through the boss at this stage. To allow plenty of clearance for the swing of the combination lever, file away the inside of the fork as shown.

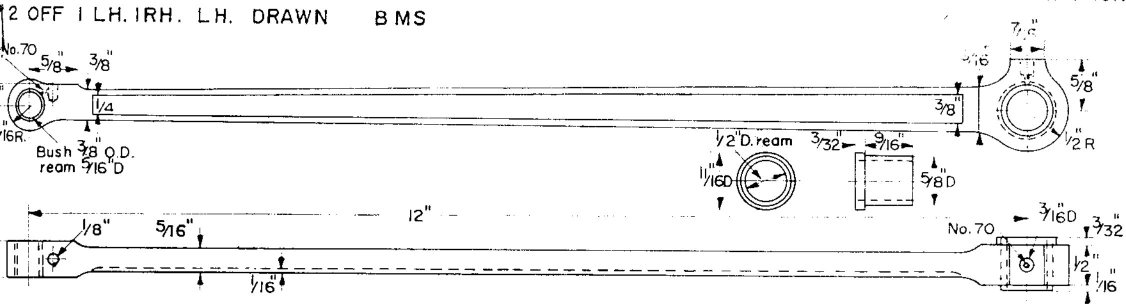
The whole valve crosshead should be case-hardened eventually, but this must not be done until the remainder of the valve gear has been made up and assembled, and valve setting completed.

Coupling rods

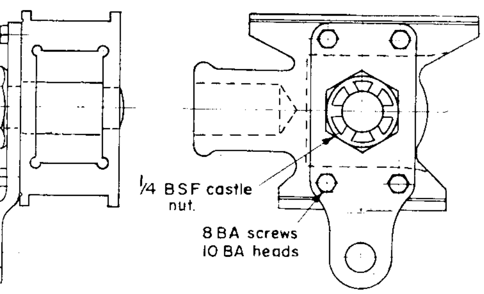
If the coupling rods were made strictly to prototype, there would be no less than six bearings or joints to cope with, which is perhaps why so many builders seem scared of eight-coupled locomotives!



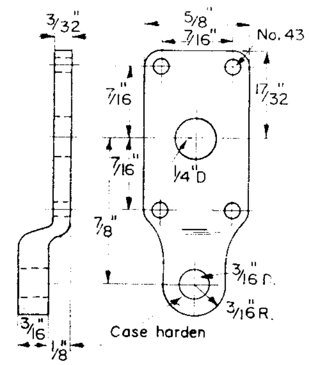
2 OFF I LH. I RH. LH. DRAWN BMS



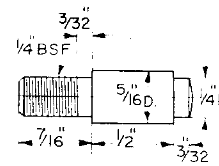
CONNECTING ROD 2 OFF I LH. I RH. LH. DRAWN BMS. BUSHES PH. BRONZE



CROSSHEAD ASSEMBLY

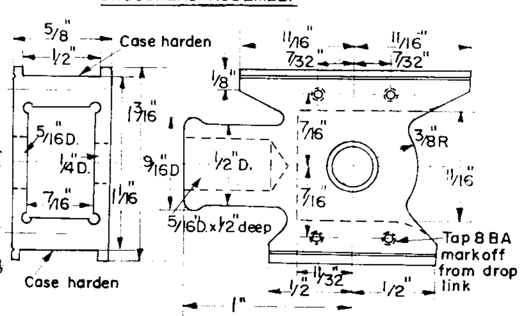


DROP LINK 2 OFF BMS

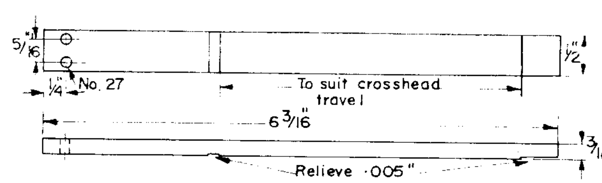


CROSSHEAD PIN

2 OFF SILVER STEEL OR MS CASE-HARDENED



CROSSHEAD. 2 OFF I LH. I RH. LH DRAWN BMS



SLIDE BAR 4 OFF BMS

So I am departing from Great Northern practice here, and am eliminating the intermediate or "knuckle" joints as I did with *Simplex.* This makes marking out and obtaining the correct centres much easier. Nevertheless, I think it is worth the extra trouble to make up some kind of jig.

The jig I described for the coupling rods of *Springbok* should serve very well. It consists of a long piece of flat b.m.s. about $1\frac{1}{4}$ in. wide and say $\frac{3}{16}$ in. thick. Half-inch dia. holes are drilled in this in the four places corresponding to the actual spacing of the driving and coupled axles. For marking out the location of these holes, the use of dividers is sufficiently accurate.

The three holes representing the positions of the second coupled axle, the driving axle and the trailing coupled axle are then elongated slightly in both directions, on the longitudinal centre-line of course; 0.010 in. each way is sufficient. The first hole is left truly circular.

Four drilling bushes are now turned in the lathe, from $\frac{3}{4}$ in. dia. silver steel, though mild steel would do at a pinch. All are drilled and reamed $\frac{1}{4}$ in. dia., this hole being truly concentric.

One bush is made a press fit in the plain $\frac{1}{2}$ in. dia. hole; the other three are extended and threaded and fitted with nuts, so that their position in the jig can be adjusted.

The jig is then applied to the locomotive chassis. The axleboxes are put into the horns and set exactly level, and the jig slipped into place, the heads of the four bushes being inserted into their respective axleboxes. The nuts on the adjustable bushes are finally tightened up, when we have a drilling jig which should be accurate to a thou or two, assuming no slop in the axleboxes.

To be continued.

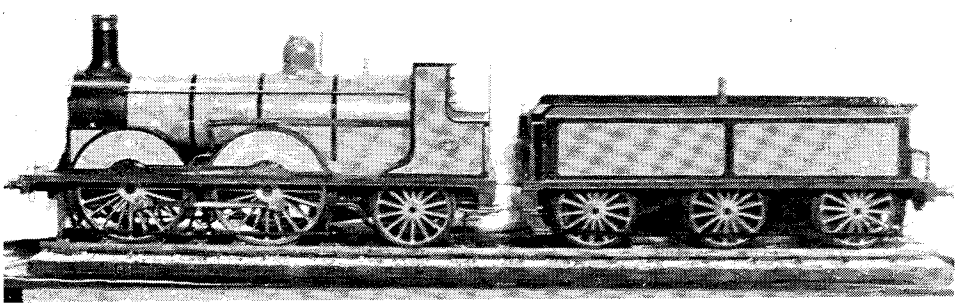
JUBILEE AT HUDDERSFIELD

by W. J. Hughes

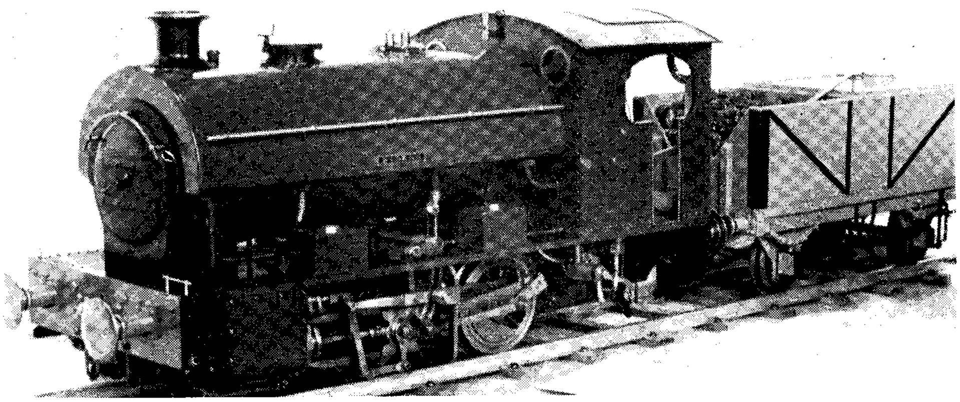
There are few model engineering societies which can boast an existence of half-a-century, but the Huddersfield S.M.E. has just celebrated its Golden Jubilee by holding a very fine exhibition. There were more than 80 exhibits from the home club alone, together with very many more from other societies in Yorkshire and Lancashire. Further interest was added by model railway layouts, aircraft, hydroplanes, Roy Brook's 7 mm. scale tramway, railway preservation societies, and slot-car racing.

The only competition was for the Amos Barber Trophy, which was awarded to the 5 in. gauge Stroudley 0-4-2 tender locomotive built by J. K. Scarth of the Brighouse and Halifax Club. There were at least a couple of close runners-up, but probably the deciding factor was the excellent set of patterns for wheels, cylinders and other components which was displayed with the 'Grosvenor' class engine.

Tom Briggs of Huddersfield was well represented by his $3\frac{1}{2}$ in. gauge 'Royal Scot' and 'rebuilt Scot' both of which I have seen running, and also by his unfinished 'Britannia' and G.N. 'Atlantic' to the same scale, but I was also fascinated by his free-lance undertype steam wagon, based on Sentinel practice, with vertical top-fed boiler, two cylinder engine, and single-chain drive. Talking of Sentinels, Charles Robinson of the home club is making a nice job of his 500 h.p. Sentinel Shunter. It is based on Jack Constable's design as published in *Model Engineer*, but Charles has described his own two-cylinder double acting engine which is to be fitted with Marshall valve gear. I shall look for-



5 in. gauge L.B.S.C.R. 0-4-2 locomotive and tender built by J. K. Scarth of Brighouse and Halifax S.M.E.



As sturdy as the prototype: Mr R. Buckley's 1 in. scale Bagnall saddle tank locomotive.

ward to seeeing it at the Highfields track in due course.

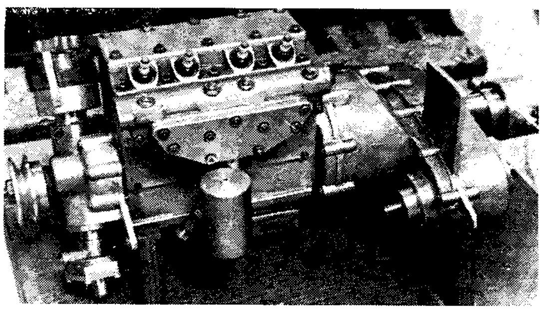
Another nice job was R. Buckley's 1 in. scale Bagnall industrial saddle-tank, a good solid job with plenty of detail including an oil-kettle and a tea-can carried on a small shelf on the back-head.

Three-inch scale traction engine

A 3 in. scale Burrell general purpose traction engine by Mr P. Robinson showed a good promise, but Mr Robinson had found trouble in that the rim of the flywheel and that of the winding drum were touching when in assembly. He assured me that he had checked the relevant centres, and diameters, which were correct, and he wondered if any other builders of this particular design had had similar trouble. As a point of interest Mr Robinson had turned his wheel rims from solid steel, having bought 'very reasonably' an 8 in. centre lathe specially for the job.

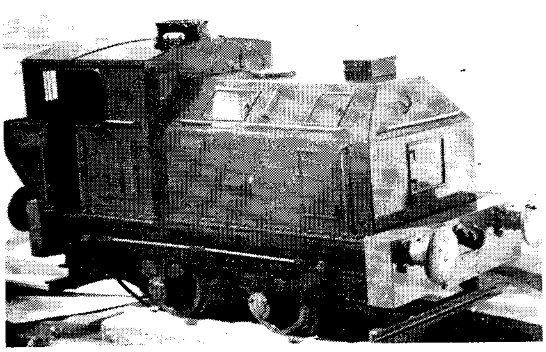
From Rochdale, Bill Ogden had brought his special scenic Burrell, that beautiful $1\frac{1}{2}$ in. scale replica (except for added exciter) of No. 3434 *His Lordship* owned by Tom Alberts of Bolton. (I wrote about this and other models built by Bill, in *Model Engineer*, May 15, 1965.) Also from Rochdale were Eddie Hinchcliffe's $3\frac{1}{2}$ in. gauge Great Eastern *Pandora*, D. Woolfenden's $3\frac{1}{2}$ in. gauge *Duchess of Buccleuch* (which I remember with pleasure driving on its home track) and a $3\frac{1}{2}$ in. gauge free-lance 0-10-0 tank engine by V. Beswick.

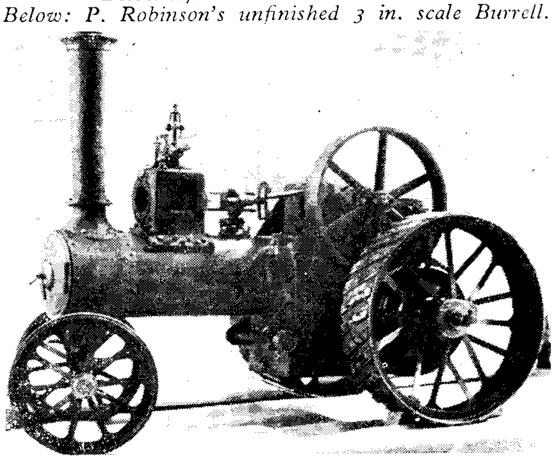
A first attempt was a good example of the old inch-scale M.E. traction engine, built by G. Mason of the Bradford and Shipley Club in 12 months. The mechanical finish was very good, especially for a beginner, and the paintwork was very reasonable too. Certainly the model showed great promise for the future.



A 15 cc four-cylinder engine and gearbox by L. Forbes.

Below left: C. Robinson's Sentinel.
Below: P. Robinson's unfinished 3 in. scale Burrell.



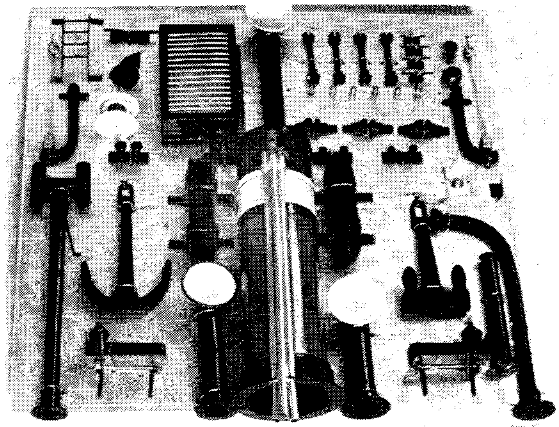


Excellent marine models

A model of which I felt sure E. T. Westbury would approve most heartily was based on his 15 cc *Seal* four cylinder design. It was built by L. Forbes, President of the Huddersfield S.M.E., with a three-bearing crankshaft instead of two. The enclosed flywheel drives forward to a gearbox, the outside stub shafts of which will be coupled to contra-rotating propeller shafts passing sternwards at each side of the engine crank-case.

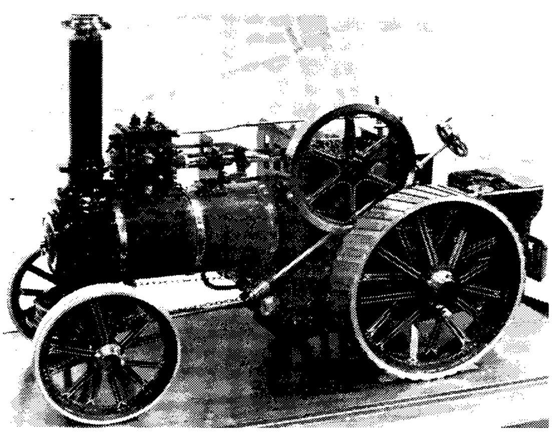
But the gearbox also contains a pair of hydraulic clutches, and under radio control these will enable forward, neutral, or reverse to be engaged at will. The clutches are fed by a hydraulic pump attached to the box.

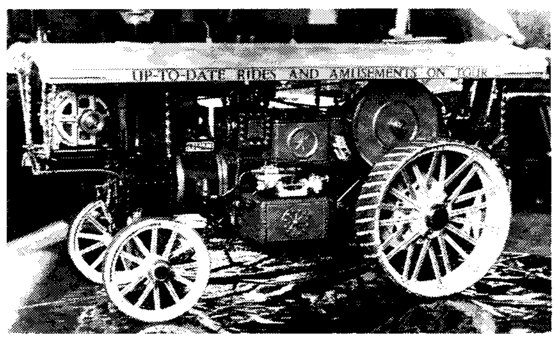
This whole unit is to be fitted into a scale model Vosper Personnel Launch as used by Shell, and meantime, as Mr Forbes likes to ring the changes, he is well on with an exceedingly fine $\frac{3}{4}$ in. scale Evening Star—chassis, smokebox, footboards, cab, and tender with impeccable mechanical and plate work.

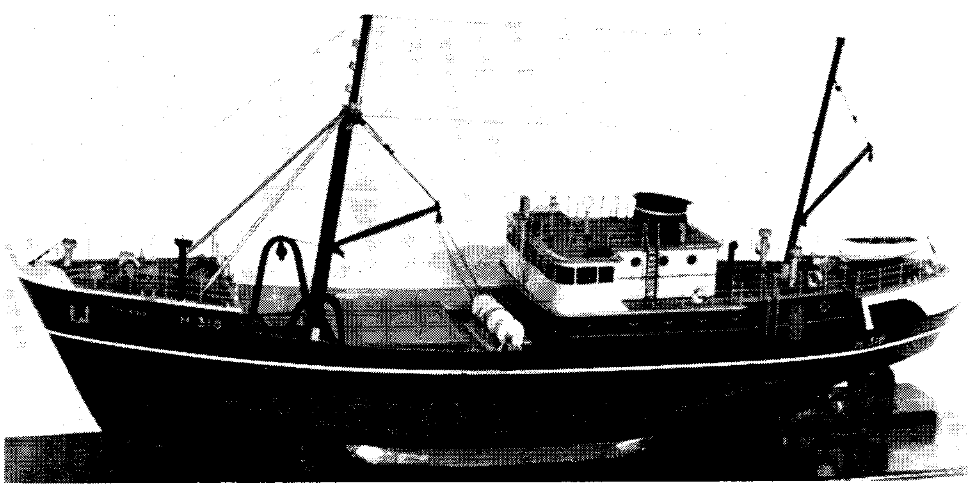


Fittings for a West Highland coaster made by C. Ledwidge of Huddersfield.

This, then, is a very small selection of models from an excellent Jubilee Exhibition. I do not expect to be present at the Centenary one, but feel sure that whoever does report it for *Model Engineer* will find the standards of work, friendship and hospitality as good as those which I enjoyed. I wonder what the models will be ? ■





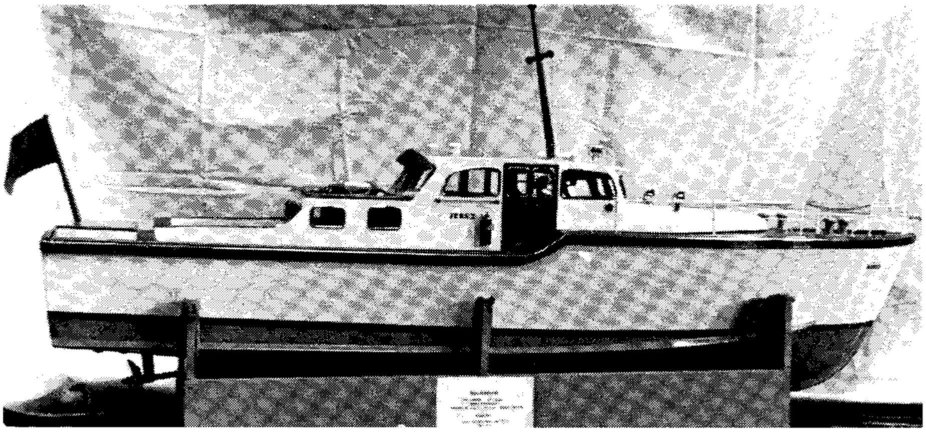


Above: A fine 1½ in. scale Burrell by Bill Ogden of Rochdale.

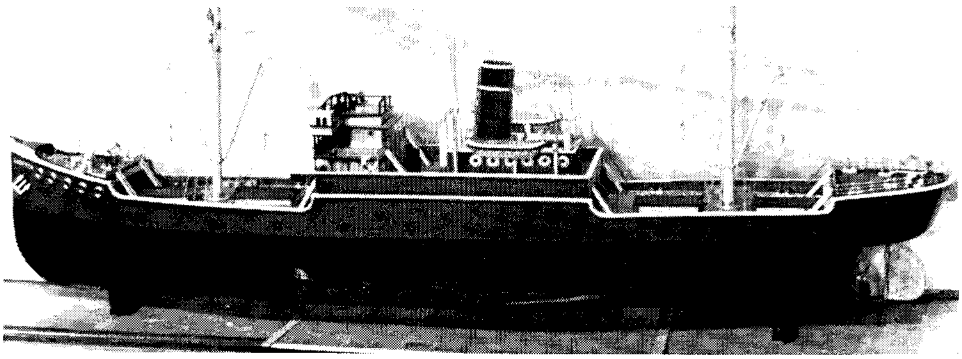
Left centre: A 1 in. scale M.E. traction engine by G. Mason.

Left: A model Icelandic fishing vessel by Jack Lee.

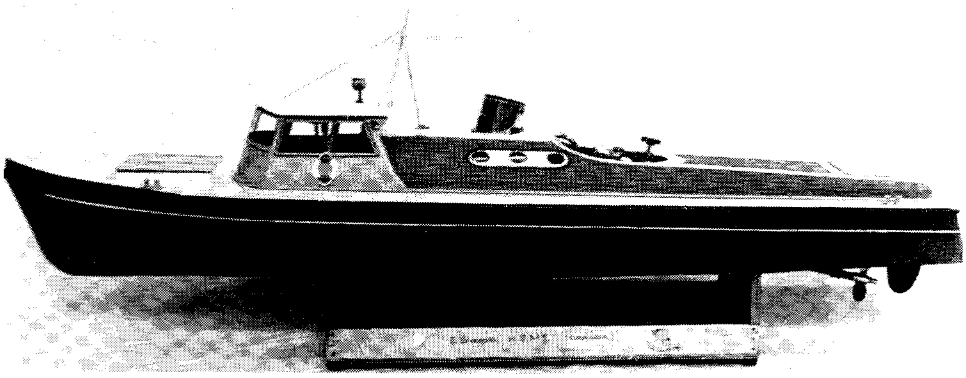
John Barraclough's 54 in. cruiser Jerez powered by a 35 cc engine.



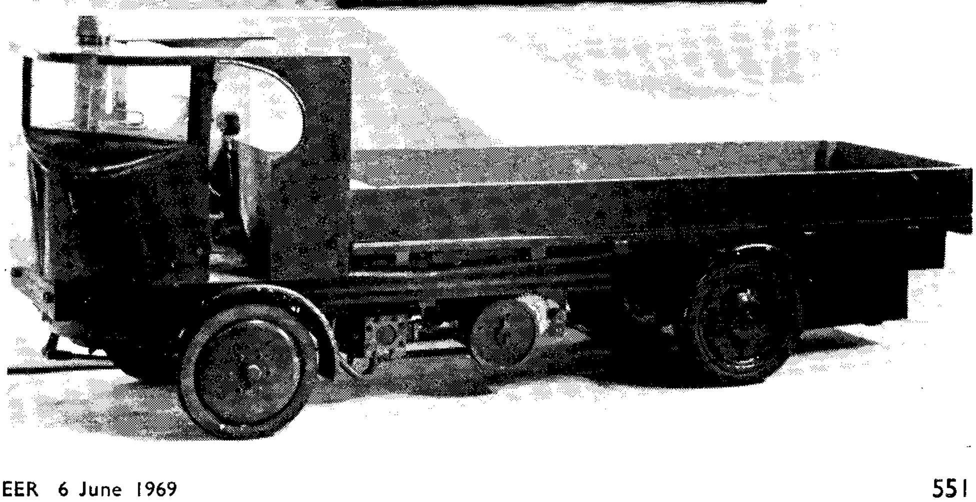
A metre-length cargo boat by J. H. F. Gray, 20 years old and powered by a clockwork motor.



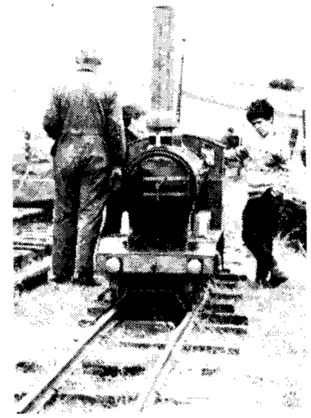
Free-lance steam launch by Tony Emerson of Huddersfield.



Tom Sykes' Sentinel steam wagon was an interesting and unusual model.



JEYNES' CORNER



Right: The first large scale model designed by Henry Greenly in 1904, getting up steam at the 1965 North of England Steam Traction Engine Rally.

Below: Another view of Little Giant *raising steam with improvised method or increasing draught.*

E. H. Jeynes on Henry Greenly's Atlantics

I QUITE AGREE with the Editor's remarks in "Smoke Rings" January 17, 1969, on the subject of the late Henry Greenly, and especially with his concluding remark in the last paragraph. I was rather surprised than no mention was made of Henry Greenly's successful design for a petrol driven locomotive, which omission I was glad to see made good by Mr C. R. Weaver of Kenilworth, in his letter to "Postbag" of February 21, 1969.

The first large-scale model steam locomotive *Little Giant*, a 15 in. gauge Atlantic 4-4-2, was designed by Henry Greenly in 1904, and the petrol driven locomotive to the same outline in 1909. I recently had the pleasure of spending an afternoon in the company of both these locomotives, now in the ownership of Mr T. E. Tate.

Built at the works of Miniature Railways of Great Britain Ltd., for use on the South Shore at Blackpool, and covered by the general arrangement drawing No. 218 signed by Henry Greenly and dated 1904, the first had the following specification:

Adams type bogie, wheels 9¼ in. dia., 10 spokes.

Coupled driving wheels, 18 in. over tread.

Trailing wheels, 11 in. dia.

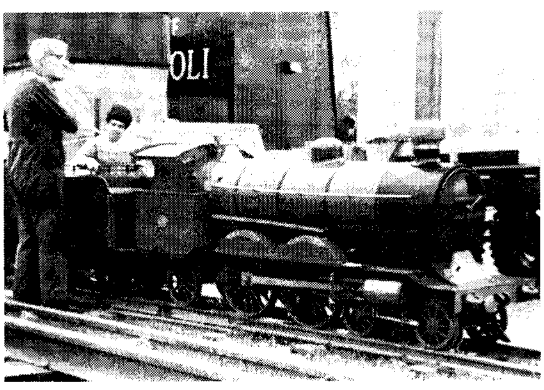
Cylinders 3⅜ in. bore (I believe rebored to 3½ in.) by 6 in. stroke.

Boiler, tested to 210 p.s.i. hydraulic pressure. Steam 120 p.s.i.

Barrel 15 in. dia., having 37 brass tubes 3 ft. 3¾ in. long.

Total Heating Surface 5,000 square in.

Boiler Fittings, "Klinger" type water gauge, 1¼ in. Safety Valve, Blower Ring cast with blast nozzle, Stroudley pattern Regulator, Whistle, two Injectors, Check Valves, and Steam Cocks.



Steam Brake, three positions: "Warming," "Brake On," and "Brake Off."

Overall length 15 ft. 3¾ in. Weight 1½ tons.

The locomotive was erected by Mr James Mackenzie, who was works manager and was finished off in Midland Railway colours.

The Duke of Westminster loaned his 15 in. gauge railway for the running trials, during which a load of 12 tons was moved from a dead start. In the speed test, 26½ m.p.h. was averaged over a half-mile stretch; while 30 m.p.h. was reached at points, with a scale speed of 100 m.p.h. (regulator not fully open, and engine well linked up).

The locomotive was driven at Blackpool by Fred Smithies, and after two years running the Blackpool Railway closed down, and the locomotive was transferred to Sutton Coldfield. After running a fantastic mileage, the engine was returned to the works, now owned by Bassett Lowke, for an extensive overhaul, and was rebuilt with a new steel boiler (see *Model Engineer*, May 17, 1923). The original tender was a six-wheeler having wheels 11 in. dia., but during the overhaul an eight-wheel double bogie tender was fitted.

Having up to this time carried the name *Little Giant*, the engine was renamed *Baby Bunce* after one of the showman's daughters at Hipper Holme near Halifax where the engine went to work. Later passing to various resorts, in about 1947 the engine came into the possession of Mr Dunn of Bishop Auckland, who fitted a new gunmetal chimney, and copper tubes. Billy Noble, the well-known Shields showman, bought it, but discarded it when he found it was not siutable to run on his small circular railway. Some years later, it was bought by Mr Kerr of the Model Railway, Dishlandtown, Arbroath. On discovering that it was a larger gauge than his own railway, he did not bother to remove it from the funfair, where it languished in a corner.

When the funfair was scheduled for demolition, the engine was lying derelict, and was rescued by Mr Tate; had he been just two weeks later, the engine would have gone with the scrap, and possibly would never have been recovered. The overhaul of the locomotive has included a new firebox and a new smokebox and extensive repairs to the tender. A new ¼ in. steel plate bottom and two new steel side plates were required, and all the bearings have been remetalled by the Buma Engineering Works, Byker, Newcastle, so everything is now in real "apple pie" order. The locomotive has appeared on television, and ran up and down a short track at the North of England Steam Traction Engine Society's rally in 1965. On September 11, 1965, the locomotive was tried out on the Ravenglass 15 in. gauge railway, and was renamed *Little Giant* by Ernest Steel in a short ceremony.

Mr Tate is laying down about half-a-mile of 15 in. gauge track in his grounds, and the running shed is now complete with two roads, one for each of these products of Henry Greenly's versatile brain. Being the fortunate owner of a steam roller, Mr Tate has not had much difficulty in consolidating the roadbed for his track; some of the line will pass through cuttings which have been excavated by bulldozer.

The petrol driven locomotive is at present undergoing a complete overhaul in readiness for the season when it will be very convenient to have a locomotive which is practically ready for use at any time, as visitors might arrive when *Little Giant* was not in steam. I think quite a lot of people will be interested to see these two locomotives at work, and will carry away with them the thought that Henry Greenly's work, with this size of locomotive at any rate, was first-class and enduring. ▪

The late Gems Suzor

Continued from page 535

duced by him—one example being the outside universal joint employed in the propeller shaft.

"The model power boat world has suffered a great loss and we shall not see his like again. Nevertheless his influence and the memory of his stature remain with us and will never be forgotten."

Peter Lambert writes:

"The place, Olympia, London, the time—early 30s, the occasion—Schoolboys Exhibition. A large oval tank complete with pole and hydroplanes in action. News went round the vast crowd watching: "The Frenchman is going to run again." It was then, sitting on my Father's shoulders, I first saw the man I had already read about—Monsieur Gems Suzor from Paris. Little did I know then how a friendship would spring up between us and the sadness that would surround my family and myself with the news of his passing.

"Although Gems first came over to this country in 1925, I did not meet him until about 1936 at Victoria Park, after one of the fine performances of his famous family of *Nickie* hydroplanes.

"The world went mad but in 1945 I was on leave in Paris and rang Gems: "You must come along at once to number 97 Boulevard Montmorency—we are running boats this afternoon." That very hot afternoon in Paris saw a small convoy of push-bikes going through the streets of Paris headed by Gems complete with hydroplane over his back followed by Madame Suzor, a young American Lieutenant with hydroplane and myself coming up astern. What a wonderful afternoon and evening that was; Gems was running a flash steamboat Quackey Duckey, the American a Brown junior engine rebuilt by Gems—for a few hours the war was forgotten by us all. In the evening I dined with the Suzors. I also met one of his two charming daughters, Nickie. Gems told me—'Nickie as a very small baby was noisy—so are hydroplanes—so my boats were all named "Nickie".'

"After the war I went several times to the Paris International, usually as the only representative from this country. I always stayed with Gems and Edith. Although I enjoyed every minute of the regatta, my greatest pleasure was in the quiet of their home of an evening, talking. Those regattas used to coincide with their indoor club meeting on a Friday evening. So many occasions when there were quite heated discussions going on between members and no agreement, Gems would speak quickly—conversation would stop, Gems would make a decision on the issue and all present would accept it. Such was his personality and the respect he commanded.

"In this country at our Regattas he had so many friends, winning was of no importance to Gems, but coming over—meeting old friends and running a boat was. To have Edith and Gems as our guests at home was always a great pleasure to myself and my family, they were indeed just part of the family. How does one really find words to describe a man who led model engineering in France for so many years, who by his visits here brought the two countries together with their models, who achieved so much in his own workshop and helped fellow model engineers equally?

"We in this country have lost a great man—to myself and other people who knew him well, a friend with all the meaning that word has. We offer you dear Edith and your family our deepest sympathy; so many of us share your grief."

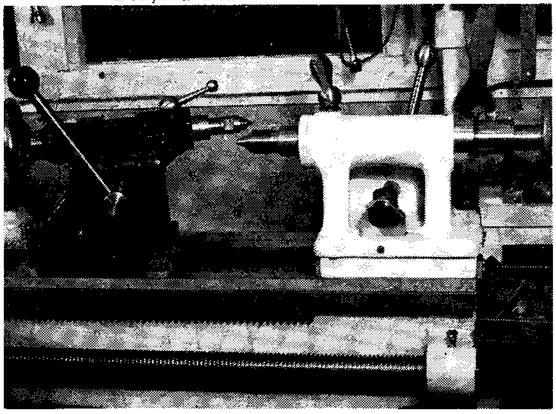
LEVER CLAMPING for the TAILSTOCK

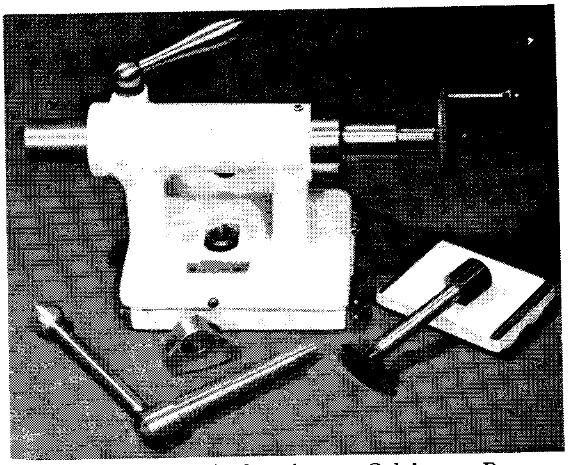
by D. H. Downie

and D. H. Culling

THE AUTHORS, with many years of experience in Technical teaching, realise the little problems which cause loss of time during workshop periods which always seem too short for both teacher and student. Spanners and equipment special to a particular machine are borrowed by students anxious to make the most of their workshop lesson. The lever clamping on a tailstock is a real timesaver, owing to the continual adjustment of the tailstock during centre turning, drilling, tapping and die screwing operations. School lathes do not suffer the heavy loading of industrial work and hours, and are long lived in their service. We have improved many of these older machines by adapting the tailstock to lever clamping. The conversion is simple if followed in the sequence shown. It must also interest readers who have machines they could adapt. All is described and made clear by the drawings of a 4½ in. Boxford conversion and the photographs taken during the conversion of a vintage Colchester 'Bantam' lathe and sufficient information is provided to enable adaptation to any particular machine.

Showing each side of two converted tailstocks: 4½ in. Boxford and Colchester Bantam.





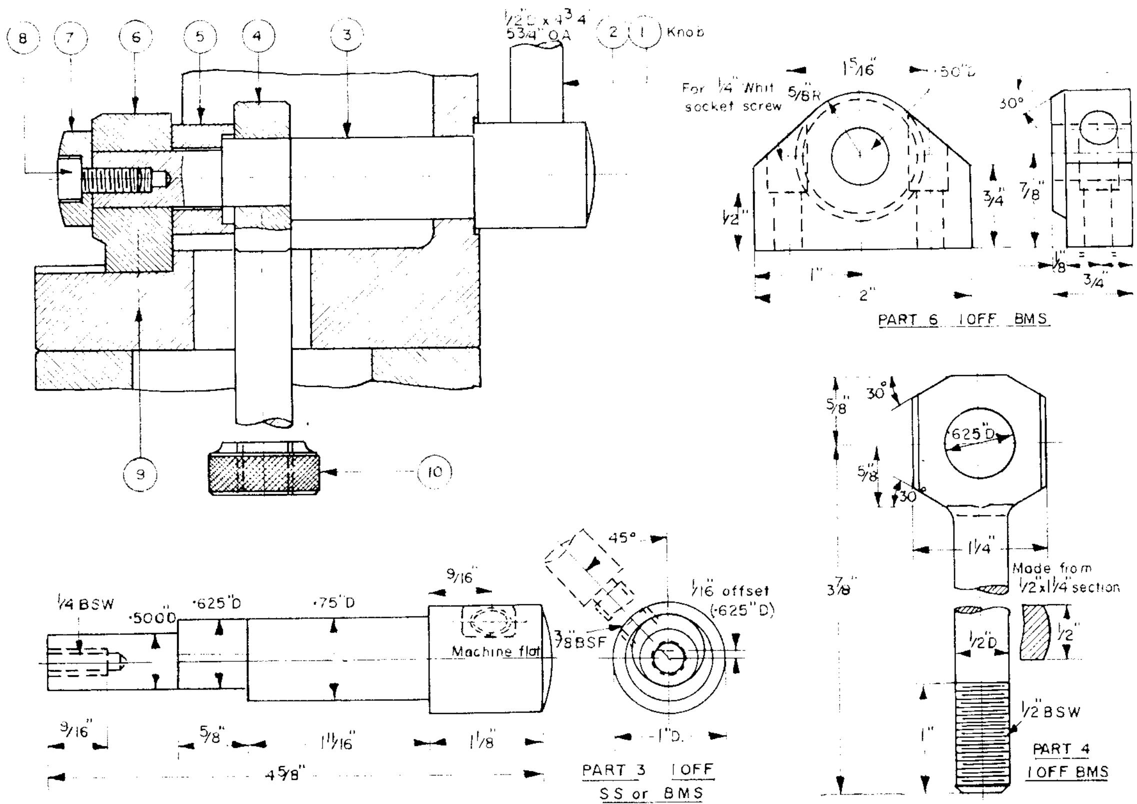
Conversion parts of the vintage Colchester Bantam lathe.

The tailstock

A landing must be machined to take the outer bearing block: a simple milling job if a machine is available, but it is also easy to accomplish on the lathe itself. Pack and bolt the tailstock on to your cross-slide, the face to be machined about ½ in. or ⅝ in. below the lathe centre line. A short stiff bar is set in the chuck, the tool adjusted for the first cut, and each successive cut applied by adjustment of the chuck jaws. Traverse the cross-slide until you have machined a flat about 2 in. × ¾ in. wide. You will probably find that not more than $\frac{1}{16}$ in. of metal is removed to achieve this.

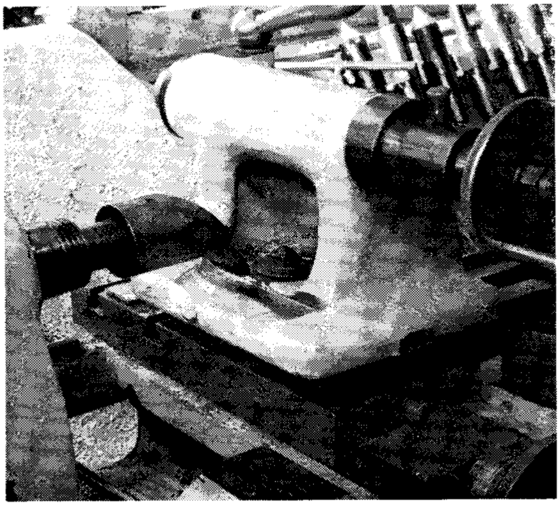
The outer bearing block

Prepare this from 2 in. × ¾ in. m.s. flat and machine the base. Set out the ½ in. bearing hole, the two bevelled sides, but do not machine these at this stage. Mark out the two ¼ in. holes for the Allen fixing screws and drill and counter-bore these two holes. Set the block on to the machined landing of the tailstock, with the centre line of the block passing through the centre of the existing clamp bolt hole. Mark off, drill and tap the two ¼ in. Whit. holes for fixing. If the drill does not clear the barrel body of the tailstock, you may have to mark off carefully and drill from the underside. At the bench, remove all sharp edges and machining burrs, and fix the block in its position on the tailstock; then set the tailstock up again on the cross-slide, this time packing up closely to the height of the centre of the ½ in. hole marked on the block. Check that the tailstock barrel lies parallel to the edge of your cross-slide ways, and clamp securely. Bring the centre of ½ in. marked bore on to the lathe centre line by aligning its centre with a centre drill held in the s.c. chuck. Lock the slide against any movement while machining.

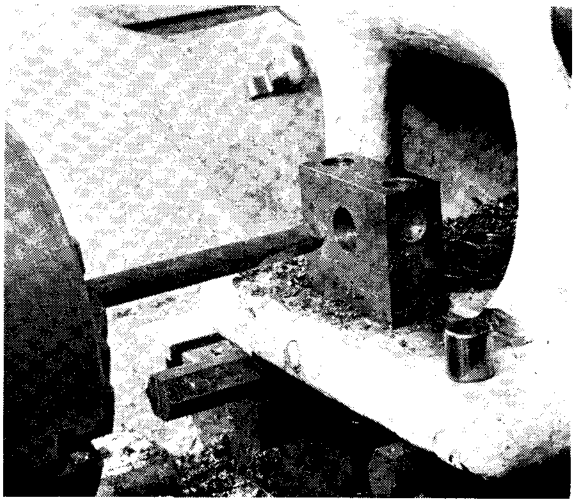


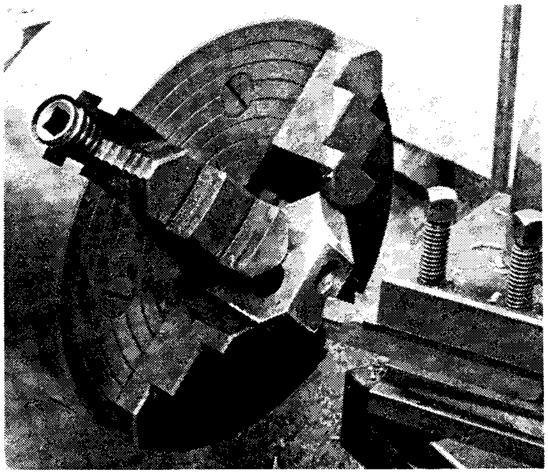
Drill through the block, $\frac{7}{16}$ in. dia. and then, with a boring tool held in the chuck, finish the bore to $\frac{1}{2}$ in. dia. Now remove the block and prepare to bore through the wall of the tailstock body, first drilling it to $\frac{11}{16}$ in. dia. If the distance is too great to be spanned by a standard drill, and no extended drill is to hand, use the author's method which is to take a length of $\frac{3}{8}$ in. dia. s.s. and forge a flat drill on the end. Grind to approximately $\frac{11}{16}$ in. dia. and harden and temper to a brown colour and use this to drill through the outer wall of the tailstock. A $\frac{1}{2}$ in. dia. boring bar held in the chuck will be needed to bore the hole in line and to the finished diameter of $\frac{3}{4}$ in. But the ratio between the diameter of the hole and the length of bar required is such that an outer support bearing for the bar is

A landing is machined to take outer bearing block.



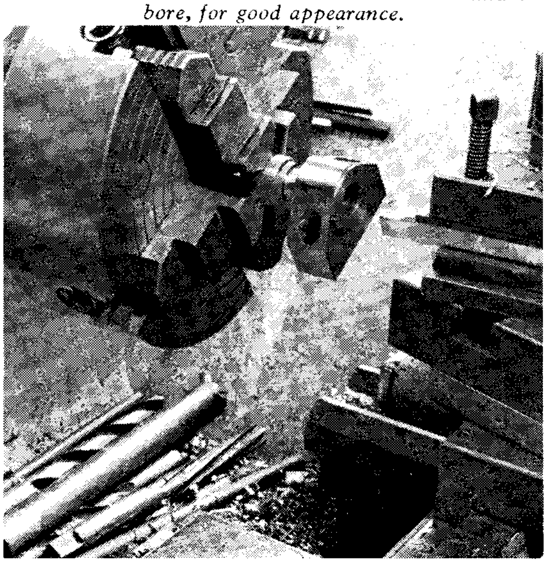
Bore finished to $\frac{1}{2}$ in. with boring tool in chuck.





Above: In the four-jaw chuck, bevel the two corners of the block . . .

Below: . . . and machine a shallow boss around the bore, for good appearance.



indicated. Normally this outer end would be supported by the tailstock centre but since this is not now available, a simple and effective outer bearing is readily supplied by using the three-point steady to carry the end of the boring bar. The $\frac{1}{2}$ in. dia. boring bar is drilled and tapped in a suitable position to carry a $\frac{1}{4}$ in. dia. tool and a $\frac{3}{16}$ in. grub-screw. Pass the bar through the roughed out hole, holding only about $\frac{1}{2}$ in. in the chuck, to avoid that 'greedy grip' which can distort the straightness of a light bar gripped at one end and supported at the other. When adjusting the steady on the outer end of the boring bar, take particular care that the bar is located along the lathe centreline. Remember that if there is any appreciable error here, the bar, when revolving, will tend to work itself out of the chuck jaws, an experience which has surprised many lathe operators on its first happening to them. Using a slow to medium speed, and adjusting the tool for each cut, bore the hole to $\frac{3}{4}$ in. dia. You need not lose any time boring to accurate standard sizes: this is optional since you have in any case to turn the spindle to fit later. Since the outer side of a tailstock is often curved, it may be necessary to face and partly counterbore the face of the hole to allow location of the head of the spindle. This is quite easy by inserting in the bar a knife-edged tool with a cutting edge long enough to machine the face required in one operation.

In the four-jaw chuck, bevel the two corners of the bearing block, then mount it on a $\frac{1}{2}$ in. stub mandrel and machine a shallow boss around the bore (this just for neat appearance). Smooth and polish all over ready for the final assembly. Replace the tailstock with its usual clamping accessory on the lathe bed ready to turn the spindle, handle, and eyed clamp bolt.

The spindle

Machine this from 1 in. dia. m.s. or s.s. Face each end and take a good grip of the head end, centre and support the other end by the tailstock. Finish the two diameters but leave the centre portion of the spindle oversize to allow for its eccentric machining. Withdraw the tailstock, drill and tap the end $\frac{1}{4}$ in. Whit. for a cap washer. Now by movement of two opposite chuck jaws offset the spindle $\frac{1}{16}$ in. Check the setting by touching the tool against the high side of the spindle, making a half-turn of the chuck and testing the gap with a piece of $\frac{1}{8}$ in. thick packing. When correct, check that the spindle is also square to the chuck face. With light cuts and a fine feed, turn the eccentric portion of the spindle. Any final error of squareness to chuck will be shown by the machining lines left by the tool before size is attained, and final correction of setting can be made by a light blow or two with a soft hammer. Scribe a line along the head denoting the high side of the eccentric part of the spindle. This will assist in correct location of the handle when you come to drill and tap the $\frac{3}{8}$ in. BSF fixing hole. Polish to a good finish and machine a simple recessed cap washer for the small end of the spindle. Counter bore this for a $\frac{1}{4}$ in. Whit. Allen screw.

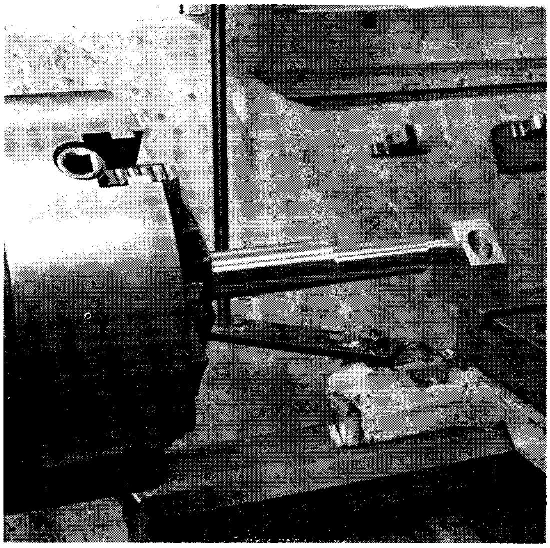
The eyed clamping bolt

This is a simple turning job from $\frac{3}{4}$ in. dia. or $1\frac{1}{4}$ in. × $\frac{1}{2}$ in. flat m.s. After turning the body, face each side of the head and bore through to $\frac{5}{8}$ in. dia., a working fit to the eccentric portion of

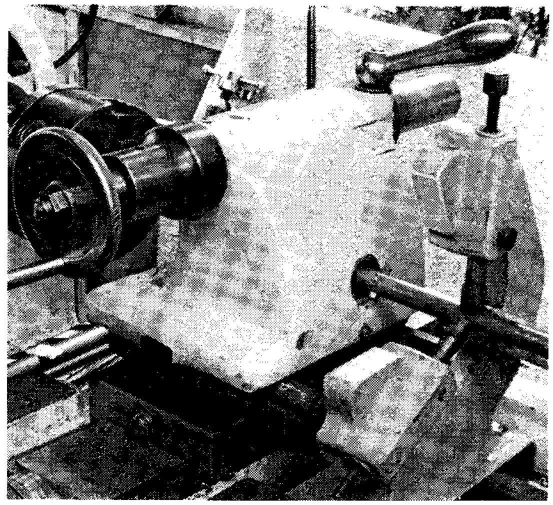
Right: An outer support bearing for the bar is indicated and is provided by a three-point steady.

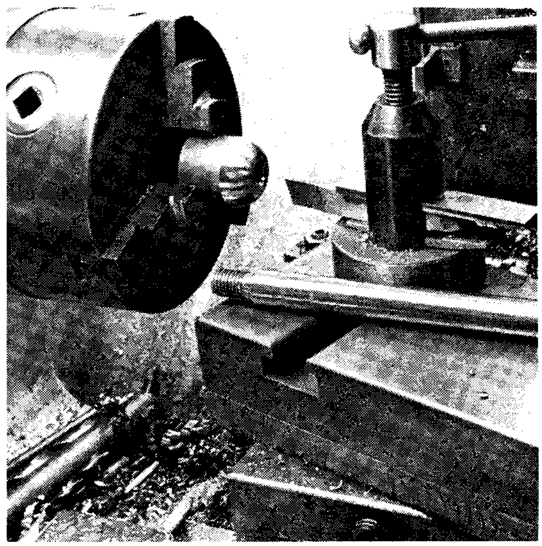
Below: Finish the two bearing diameters, then offset $\frac{1}{16}$ in. to machine the eccentric portion of the spindle.

Below right: Face, drill and tap, then rough out to semi-spherical shape.



the spindle. Under clamping stress when in use, some scoring of the eye bore could occur and this short bore could be case hardened. This has not been found necessary if they are assembled with a little 'Molyslip' grease and smooth operation is assured. To complete this part the clamp nut should be flanged and coarse knurled, making for easy adjustment under the tailstock and no spanner is required.





The handle and knob

A short length of $\frac{1}{2}$ in. BMS with a $\frac{3}{8}$ in. BSF thread on each end makes the handle. A 1 in. dia. plastic knob, preferably black, will finish this off nicely, but if none is available it is easy to make one from a short end of aluminium alloy or brass. The operation is interesting both to the modeller and student in introducing the use of a tubular tool to produce an accurate spherical form. Here is the sequence to follow. Make the tool from $\frac{3}{4}$ in. or $\frac{7}{8}$ in. dia s.s. rod drilled up for a short distance, $\frac{1}{8}$ in. less than the outside diameter. The outer edge of the hole is bevelled at 60 deg. Harden this end in oil and temper to a brown colour. Material required for the knob is a minimum length of $1\frac{1}{8}$ in. Chuck the material leaving $\frac{5}{8}$ in. protruding from the chuck. Face drill and tap $\frac{3}{8}$ in. BSF for $\frac{3}{4}$ in. deep and rough out to a semi-spherical form. Now screw the prepared knob on to the handle. Chuck the handle truly, knob about 2 in. clear of the chuck jaws, and rough out again this side to spherical shape. Now you are ready to apply the tubular tool to finish the knob. Supported by a short length of $\frac{1}{2}$ in. dia. m.s. rod held in the tool post, the tool is gently applied to the prepared knob with a sweeping radial motion whilst rotating it by hand at the same time. An accurate spherical shape will result and should be polished to a high finish. Complete the assembly and apply a little 'Molyslip' grease on the bearing surfaces. Mount the tailstock on the lathe bed and adjust the knurled clamp nut so that the handle locks at about 30 deg. to the vertical.

As a time saver, shop teachers and readers will find that if the instructions are followed conversion is easy and well worth while. ■

New Track at Hull

by

J. M. PROUD

FOR OVER 20 YEARS, members of the Hull S.M.E. have yearned for a continuous, passenger carrying railway and now they have at long last achieved their ambition. After much hard work and planning, a track of one-tenth of a mile in circumference has been built in the short space of seven weekends, that is from Easter 1968 to Whit-Monday, 1968.

Perhaps an account of their first real effort, a 200 ft. long, straight track (which has been included in the new continuous track) will help to put the reader in the picture.

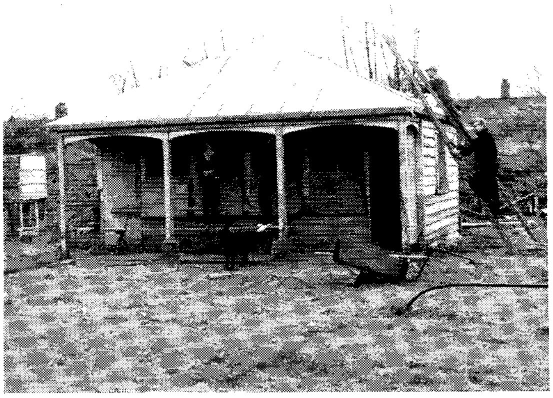
In 1949 we built what we think is the strongest and most reliable portable track ever described. This had gauges of $7\frac{1}{4}$ in., 5 in. and $3\frac{1}{2}$ in., the outer rails for the use of passenger trucks being of 2 in. $\times$ $\frac{1}{4}$ in. m.s. whilst the 5 in. and $3\frac{1}{2}$ in. gauges were of alloy rail. This rail was held to $\frac{5}{8}$ in. square steel sleepers by means of 2 BA cheesehead screws, the sleepers being tapped $\frac{3}{8}$ BSF at the ends for the attachment of the outer rails.

The legs were of 2 in. $\times$ 2 in. angle iron and could be adjusted to give 18 in. of varying height on any uneven ground. These legs were finally tied by means of diagonals of 1 in. $\times$ $\frac{1}{4}$ in. mild steel. Extensive use of jigs for the various parts were used and the track was easily erected and exceptionally strong.

One of the greatest assets of the track was a fitment to stop the derailing of trucks when passengers stood on the footboards. The axlebox horns on the bogies were extended downwards to approximately $2\frac{1}{2}$ in. below rail level and brass rollers were hung in line with the bottom of the outer rail and about $\frac{1}{4}$ in. clear of same; this checked the side movement of the trucks.

The advantages of this scheme will be fully understood by club members who have at various fêtes and exhibitions and have had to cope with impatient youngsters who clamber over the passenger trucks and cause derailments.

Perhaps at this stage it should be mentioned that the whole design of both tracks was the work of our



Completion of pavilion roofing.

dynamic President, Mr W. H. Lee, without whom the new track could not have been completed so swiftly as it was.

The site of the new track was on a disused grass tennis court on a British Railways Sports Ground; actually an embankment of the original Hull & Barnsley Railway forms one of the boundaries and is still in use for all traffic for the Eastern Docks.

We found that we had available a plot of land 220 ft. $\times$ 110 ft. so we decided to keep the curves as near 50 ft. radius as was possible. This meant by using 80 ft. on each side of the original straight track all we had to do was to build two semi-circles on each end. The actual circumference on the centre line of the track was 542 ft. We were fortunate in that the ground was reasonably level so we had no troubles in that direction.

On the site was an old cricket pavilion which amongst other things wanted a new roof. This was our first job and we managed to make this weather tight before starting on the manufacture of the track. The intention was that we should do all the drilling of the rails in this pavilion, so electricity had to be laid on. The nearest power point available was in the workshop of one of our members, Harold Young, but the 400 ft. cable loaned by Stan Bell just made the distance and he did all the wiring up, making provision for Jeff Hawkins' heavy drilling machine and the writer's power saw. We had thought that we should get a big voltage drop over this distance but this proved to be negligible. A 4 ft. high bench was erected the length of the pavilion from old timber and the drill mounted on the right-hand side of same. Later we found that we could feed the lengths of rail through the windows

First run on the new track.

Driving home the bolts.

at each end.

The work on the pavilion and preparing for materials took us till the end of March and we started building the new track on the Good Friday, April 5. Incidentally, at our previous club meeting, our President had prophesied that, if all went as he had planned, we should be able to have our first run on the Whit-Monday. Actually he had a 'maiden-trip' on the Whit-Sunday behind my 'Petrolea' and fulfilled all our expectations. I am certain that none of our members had thought this possible in such a short space of time, but, as was usual with anything he planned, it came out dead right.

A great deal of thought was given to the mode of construction of the track: at first we planned to use full-size sleepers cut in half as the supports but finally decided to use concrete blocks of a suitable design. We actually needed 136 supports, about 18 in. high, for the track alone and a price was obtained from a well-known firm at 9s. each, far too expensive for the funds available. At our next meeting, two of our members, Stan Bell and Bob Burns, brought along two concrete blocks they had made in the interval between two meetings, just to prove that the blocks could be made by members at a quarter of the cost.

A compromise on the design to suit the track was made and Bob Burns volunteered to make the whole lot as his contribution to the project. He made six wooden moulds and filled them every day till the job was completed. This was all hand work, no mixer being available, and done at his home, a really creditable effort, especially from one who has no locomotive to run. We decided to use the spacer and tie bar method of construction and we found that with a $7\frac{1}{4}$ in. × 2 in. × $\frac{1}{4}$ in. length of packing placed on the top of each concrete support, the old part of the track would match up perfectly with the new curved sections.

Our designer, Mr Lee, had by this time completed a set of jigs for each rail, lettered A, B, C, D and E and made from b.m.s. in 2 in. × $\frac{1}{4}$ in. and $1\frac{1}{4}$ in. × $\frac{5}{16}$ in. sections each four feet long. A similar set was made for the transition curves giving the 114 ft. radius. The hole centres in all these jigs were accurately marked off with the use of slip gauges and drilled and reamed $\frac{3}{8}$ in. Real accuracy here made all the difference when the track was finally assembled as we found out later.

First of all, the rail lengths were cut off in excess of 16 ft. and then spot drilled from the master jig, using a special tool made up from $\frac{3}{8}$ in. silver steel with a shortened $\frac{1}{8}$ in. drill pressed into same, a portable drill being used for this operation.

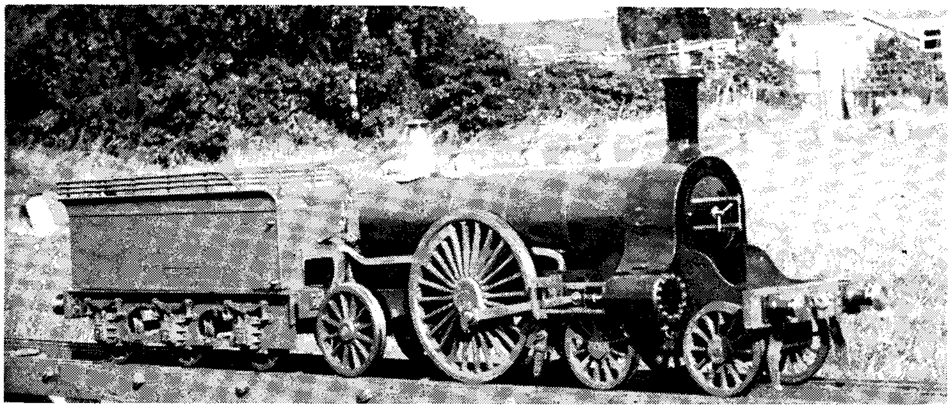
The requisite jig was laid on the rail length and clamped in position, across the width as well as on the flat (black mild steel is by no means true when bought!). The ends were scribed and the holes spotted; then the rail was once more put into the power saw and cut off to the scribed length. The $\frac{3}{8}$ in. holes were then drilled, the first length off being used as a jig for the rest of that letter rail. All the rails were placed on one side and care was taken to mark each with grease crayon with its special letter (viz. A, B, C, D, E), and kept in separate piles.

In between the weekends the locomotive enthusiasts' workshops were busy turning out 2,030 spacers to various sizes and over 600 tie bars screwed $\frac{3}{8}$ BSF.

It was realised that the 46 ft. radius curved sections would take quite a lot of effort to assemble and towards this end Mr Lee designed a special set of rolls, through which to run the outer and inner rails, but this was not used, however. Another similar effort was designed, which has a hammer action while the rail is slowly put through.

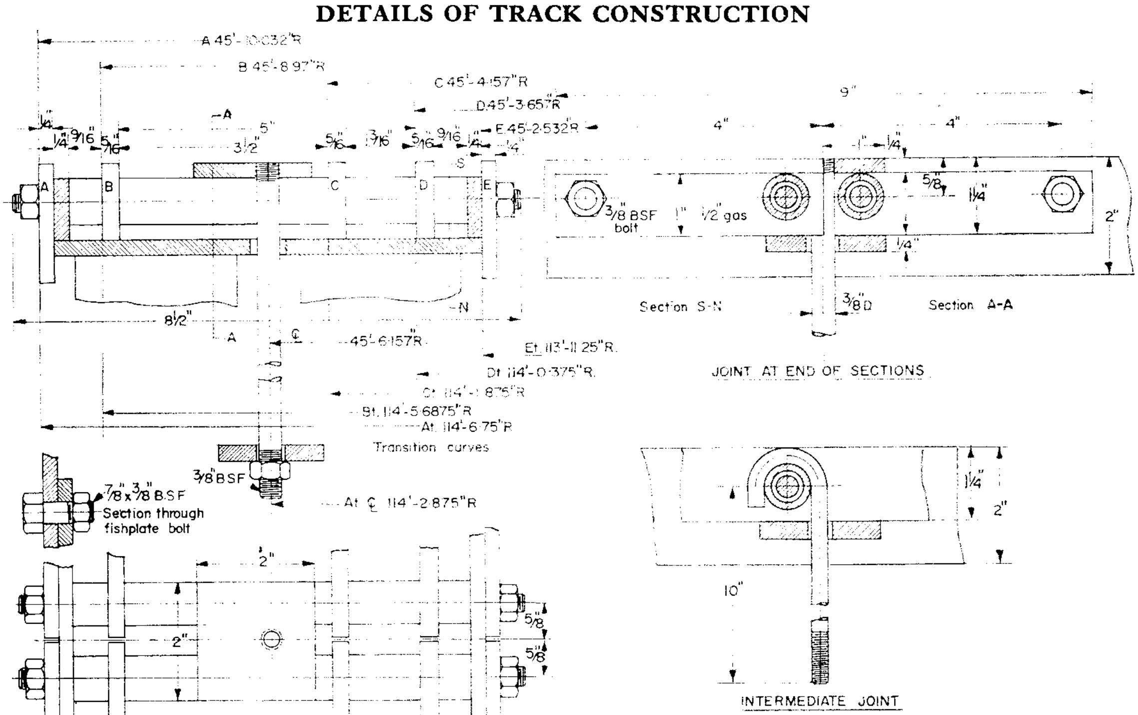
That the sections were made in the pavilion and not assembled until the week before the Whitsun holiday, speaks well for working to a definite plan—no trial and error here! The whole track went together like

Jeff Hawkins with his 4-6-0 "Black Five," watched by secretary Turnbull. Mr E. Haswell can be seen behind with his "Cock o' the North."



J. M. Proud's Stirling single. It is still under construction and may be ready for steaming this year.

DETAILS OF TRACK CONSTRUCTION



a Meccano set and except for the final trimming of the ends of the track, no real difficulty was experienced. The sharpest curves actually work out at 45 ft. 10 in. radius, while the transition curves are 114 ft. 6$\frac{3}{4}$ in. radius, giving very sweet running. We had no trouble with the concrete supports, which were placed at four foot intervals and the hook bolts tightened up from underneath (we had to go round and check these after about a month). Also, a little super elevation was given to the sharper curves.

We have not yet made a turntable or proper steaming bays but intend to do something about it this year. We intend to leave a gap of 16 ft. to enable a motor mower to get through; otherwise the grass becomes unmanageable.

DRAWINGS FOR

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Postage extra.

POSTBAG

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

South African engines

SIR,—Regarding the articles "South African Safari" by Mr Bertie Green, late Chairman of the Stockport M.E. Society, recording his experiences in South Africa and Rhodesia when on a recent visit, of model engineering activities there.

I think that Mr Green has been led into making one or two statements relating to the prototype of the beautiful model so superbly constructed by Mr J. Scott, the President of the Cape Town Society of Model Engineers, which I believe are incorrect. Chiefly one must join issue with the statement that this locomotive, used in the building of the Capetown to Wellington railway, was the first steam locomotive to be brought south of the Equator.

The history of the locomotive concerned is, I believe, fairly well known and this, and that of events connected with it, can be set out as follows: The turning of the first sod of the Capetown to Wellington railway (the first in Cape Colony, and in southern Africa) took place on March 31, 1859, and for the construction of the line the contractors, Messrs. Pickering of London, obtained from the Leith Engine Works of Messrs. Hawthorn, the 0-4-2, inside cylinder tank locomotive, having 48 in. dia. coupled wheels, which is the one now preserved at Cape Town of which Mr Scott made his fine model, and which is the first that ran on what, in due course, became South African Govt. Railways.

Following the opening of the line the railway secured eight more locomotives to work the traffic, and then acquired from the contractors the first one that, as mentioned, had been used by them in its construction, placing it after the eight then at work as No. 9 in the railway stock list.

This engine, however, cannot be accorded the distinction of having been the first steam locomotive brought south of the Equator, it having been preceded, in some cases by a number of years by quite a number of others. The following list of steam locomotives, and dates of arrival of same, which were actually sent to countries south of the Line before March 31, 1859, is I believe correct:

In 1854—By R. and W. Hawthorn Ltd., to South America, a 4-4-0 type locomotive for the Arica and Tacna railway. By Manning, Wardle and Co., to Argentina an 0-4-0 type outside cylinder tank locomotive, the first there. By Robert Stephenson and Co. (in December) to Australia, for the Melbourne and Hobson's Bay Railway Co. in Victoria, two locomotives.

In 1855—By Robert Stephenson and Co. (in January) to Australia, for the New South Wales Railways, four 0-4-2 type inside cylinder tender locomotives (one preserved in Sydney, N.S.W.). By the same firm, in the same month, two more locomotives for the Melbourne and Hobson's Bay Railway Co. in Victoria. Also, later in the same year, by the same firm, two 2-2-2 type, outside cylinder tank locomotives for the Geelong and Melbourne Railway Co. in Victoria, followed in the same year for the same railway by locomotives from Stothert and Slaughter, and from R. and W. Hawthorn Ltd.

In 1858—By Kitson and Co. to Chile, four very fine 4-4-0 type outside cylinder tender locomotives for the Copiapo and Caldera railway.

In 1859—(in January). By George England and Co. to Australia for the Victorian Railways, a 2-2-2 inside cylinder tender locomotive, and also a number of 0-6-0 type inside cylinder locomotives.

The locomotive preserved at Cape Town, No. 9, is recorded as having come from Hawthorn's of Leith, having, presumably, been built at their works there. The name of Hawthorn is, of course, a famous one in the locomotive world, the firm of R. and W. Hawthorn of Forth Banks Works, Newcastle-on-Tyne, being almost as well known as that of Robert Stephenson and Co. of the nearby Forth Street Works in the same City, with the firm in later years becoming R. and W. Hawthorn, Leslie and Co. and, finally, joining with the famous Stephenson concern, when the joint enterprise became known as Robt. Stephenson & Hawthorns Ltd. The point therefore arises as to who actually were Hawthorn's of Leith. I understand that there is some controversy as to what was the real connection or, indeed, if in fact there was any between the Forth Banks and Leith firms, as some hold that the Leith Works, being a subsidiary to Forth Banks, was allowed only to undertake the construction of very small locomotives, along with small portable engines and light marine work. Perhaps some reader better informed on this matter than myself might help to clear up this question of the actual connection between the two Hawthorns.

Sydney. C. A. CARDEW.

Compound locomotives

SIR,—K N. Harris's concise account of F. W. Webb's compound locomotives raises a few points worthy of further consideration.

First, was Webb the originator of compounding on the L.N.W.R. ? Sir Richard Moon was always on the lookout for anything that would bring further economy to the operation of his Company, and may well have suggested to Webb that he might look into the Mallet system of compounding—the polite way of telling him to build compound locomotives, or else! The similarity between Webb's 2-2-2-0 and David Joy's proposals of 1866 suggests similar managerial influence, for Joy's valve gear had received its first trials on the Furness Railway through similar channels.

Secondly, people have been a little hard on the "Experiment" class. These were designed under Moon's instruction that express trains should average 40 m.p.h. and never exceed 60 m.p.h.; having superior tractive powers at low speed over simple locomotives of the same size they were doubtless capable of meeting their design requirements under these conditions. Unfortunately for the "Experiments," not only were schedules accelerated shortly after they were built, but they were compared with one of the most outstanding 2-4-0 designs of all time. Had the "Precedents" been no more powerful than the average 2-4-0 of that time, the "Experiments" would have had a better reputation. The very success of Webb's simple designs was the downfall of his compounds.

Thirdly, it is not widely known that the tank locomotives were the forerunners of a complete range of such locomotives which were to replace tender locomotives for all duties on the L.N.W.R. Webb announced this in 1885, the reasons given being that separate tenders incurred unnecessary expense, as did turntables. One can imagine Moon suggesting *this* economy to Webb. The 2-2-4-0T was probably the replacement for the 18 in. 0-6-0 ("Cauliflower"). Perhaps the 2-2-2-2 wheel arrangement of the *Greater Britain* had its origin in a tank version of the *Teutonic*?

Fourthly, Webb was criticised for using too large low-pressure cylinders in his three-cylinder designs (i.e. of keeping the receiver pressure too low), and although the success of the slip-eccentric gear on the "Teutonic" class should have disproved this, he may have been influenced by this criticism when designing the four-cylinder classes—hence the small low-pressure cylinders in the latter. Had he allowed independent adjustment of cut-off, or better still fitted slip-eccentric gear to the low-pressure valves, these would have been successful right from the start and would have saved his reputation. When Whale made this obvious modification shortly after Webb's retirement, the results were striking, and indeed the modified locomotives, despite their smaller boilers, could rival Whale's own "Precursors" when it came to uphill work at moderate speeds. If only Whale had fitted "Precursor" boilers to the Webb chassis, as G. R. S. Darroch did in 2 in. scale!

F. W. Webb was a pioneer of compound propulsion, but has been all too often criticised for making mistakes that later engineers could avoid because they were following a beaten path. John Logie Baird is regarded —rightly—as the originator of television, despite the inherent faults and consequent abandonment of the Baird system. Surely it is time to regard Webb in the same light?

Kenilworth, Warwickshire. C. R. WEAVER.

Model boiler design

SIR,—After reading your second item in "Smoke Rings," April 18, may I offer you my sympathy for the trials of an Editor and designer, and a little supporting evidence.

I have made some 20 boilers to M.E. designs, ranging from *Tich* to *Britannia* as well as others for stationary engine purposes and I have not as yet had a failure due to unsafe design. I always test to 170/200 lb. depending on the intended working pressure. Much higher test pressures are apt to strain the boiler and actually reduce its safety at working pressure. Mr Charles Kennion has probably made as many boilers to M.E. designs as anyone in the country; I doubt if he could afford to put any unsafe job on the market.

There are two possible causes of failure which might be wrongly diagnosed as due to design:

1. Insufficient heat for brazing, and
2. unsuitable brazing materials.

Abergele. D. J. R. RICHARDS, Brigadier.

Diesel locomotive

SIR,—In the *Model Engineer*, February 7, Mr D. F. Holland, while rightly emphasising the long life of steam locomotives commented that "British Rail's first Deltic Diesel became a museum piece after only five years service."

With respect, this statement is incorrect. The Deltic locomotive in the Science Museum in London was an experimental prototype which remained the property of the manufacturer throughout its working life and was therefore not British Rail's first Deltic Diesel. In its seven years of operation, the prototype covered 450,000 miles, hardly the performance of a failure.

The 22 production Deltics ordered by British Rail entered service in 1961/62 and have replaced about 55 steam locomotives on the East Coast Route. In their first five-and-a-half years of operation, the 22 Deltics ran 21 million miles, or the equivalent of each locomotive in the fleet running 500 miles a day, every day during that time. I believe that the 22 Deltics have now covered over one million miles each.

Mr Holland asks which gives the better return for the expenditure the 70-year-old steam locomotive or the Deltic Diesel. I submit that it is impossible to make a comparison. Economic criteria, technical and service conditions are entirely different.

There is much to admire in both engines, but for different reasons.

Glasgow. C. D. WILSON.

Lubrication

SIR,—With reference to the very interesting article on the lubrication of miniature steam locomotives, by Group Captain Law—April 18; I would question his recommendation for using Extreme Pressure oils.

I had occasion to go into this in an entirely different context—the lubrication of the final drive of my Vauxhall motor-cycle, which has a bronze worm wheel —and Messrs. Castrol definitely advised against the use of E.P. oil, and further enquiry of a highly qualified friend brought the information that the Extreme Pressure ingredient contains a percentage of sulphur, which is released at certain temperature, and causes considerable corrosion to any bronze or other non-ferrous metals with which it comes into contact. I would certainly want a definite statement as to the safety before using this at steam temperatures.

Perhaps one of the oil companies will put our minds at rest?

Ramsey, I.O.M. R. D. THOMAS.

Old railway book

SIR,—Mr J. Horne (M.E. May 21, 1969) will be interested to know that I have in my possession the two volumes of Colburn's "Locomotive Engineering and Mechanism of Railways" purchased in London about 20 years ago. I agree entirely with what Mr Horne has to say about this work.

Whilst on the subject of old railway books, some years later I discovered on a bookstall in the Farringdon Road a book that may be of interest to your American readers: "The Pennsylvania Railroad System at the Louisiana Purchase Exposition. Locomotive Tests and Exhibits, St. Louis, Missouri, 1904." It was published by the Pennsylvania Railroad Company in 1905. Therein is a description of the locomotive testing plant, description of the instruments employed, methods of conducting tests and the selection of the locomotives for that purpose. The work includes pull-outs of locomotive drawings and details. They comprise three 2-8-0's, a 2-10-2 and four "Atlantics"; one of which is a "de Glehn." Since the work runs to 734 pages, very little has been neglected to put the tests on record. Doubtless the locomotives themselves have long since disappeared.

Teignmouth. ELENORA H. STEEL (Mrs.).

P.T.F.E.

SIR,—With reference to the warning of the risk to health when machining P.T.F.E. contained in Mr A. Ward's letter (M.E. February 7, may I quote from

I.C.I.'s publication "Medical Aspects of Polytetrafluoroethylene" ?

"'Fluon' (polytetrafluoroethylene) is an inert, non-toxic thermoplastic polymer—it has a working temperature range of +250 deg. C (+482 deg. F) down to at least liquid nitrogen temperature—it is being used in this and other countries for surgical uses. The polymer produces no skin irritation or sensitisation and no reaction when implanted in living tissues. It is harmless when ingested daily by experimental animals over a period of months.

"When heated to temperatures above 250 deg. C (482 deg. F) it begins very slowly to decompose—above a temperature of 400 deg. C (752 deg. F) the amount of decomposition products increases more rapidly but, until the temperature reaches 450-500 deg. C (842-932 deg. F) is still insufficient to make possible accurate identification of all the substances so formed.

"People inhaling the fumes develop a characteristic syndrome with influenza-like features. The signs and symptoms follow a latent interval of a few hours, are always evanescent in character and invariably subside within 24-48 hours with no after effects.

"Workmen can be affected, however, by smoking tobacco contaminated by the powder—a few particles of the powder on the end of a lighted cigarette may be sufficient to produce the illness. High speed machining of the polymer is an unlikely way of producing the fumes since it is improbable that sufficient polymer is subjected to a high enough temperature to produce enough localised fumes for this purpose. Most of the cases previously thought to be due to machining were almost certainly caused by smoking at work or by contaminating hands or clothing with powder subsequently transferred to the tobacco.

"The National Advisory Council for Aeronautics in the U.S.A. issued a memorandum on the safety regulations for machining 'Fluon' P.T.F.E. and this document mentioned the death of a machinist who had smoked a cigarette contaminated by the polymer. Detailed and intensive investigation—has shown that the assertion was completely without foundation—in this country the Minister of Labour stated in the House of Commons that H.M. Government had no knowledge of such an incident.

"The plastic has been used for surgical appliances with encouraging results. It has been subjected to a more thorough investigation than many comparable materials and the facts suggest that its hazards have been misinterpreted and exaggerated."

I hope this information will be of use to readers, and allay any unnecessary fears. In conclusion I would like to state that I have no connection whatever with I.C.I. or any other plastics manufacturer, but I have been a reader of M.E. since 1929, and in common with many other readers miss the "Column of Live Steam." Best wishes to those who are carrying on with the good work.

Enfield. P. A. Wood.