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CONTENTS

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COVER PICTURE

Two half-full-size Allchin traction engines built by Severn-Lamb Ltd., of Stratford-upon-Avon.

NEXT ISSUE

The valve gear of the Allchin traction engine. A model locomotive efficiency competition in Rhodesia.

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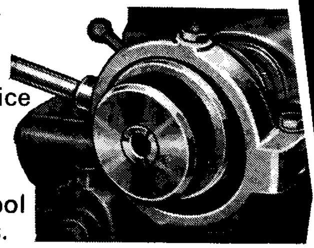

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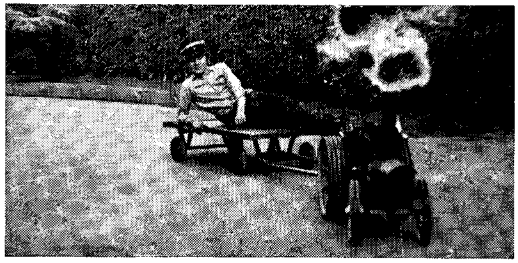

A $2\frac{1}{4}$" scale compound traction engine at work at Oakhill

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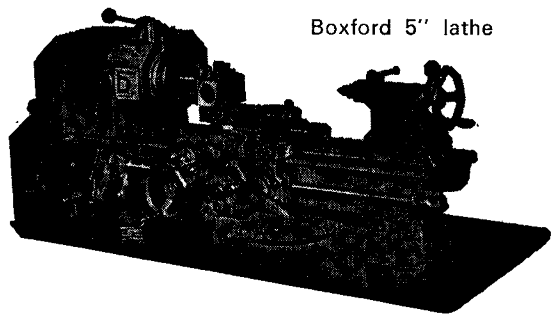

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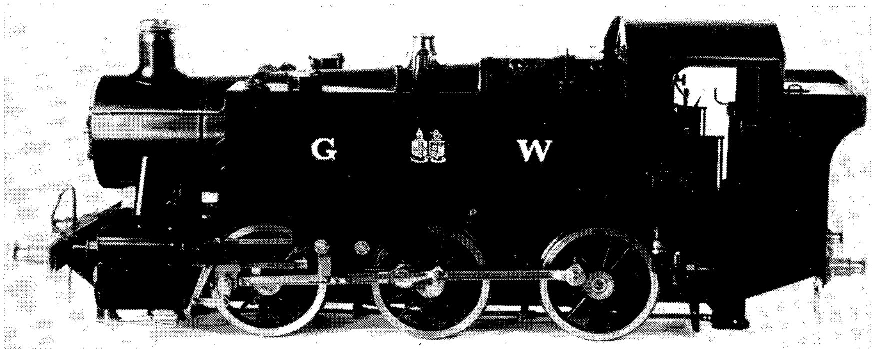

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A Commentary by the Editor

Exhibition at Tamworth

I hear that the Princess Elizabeth Locomotive Preservation Society is to hold an exhibition at the Youth Centre, Albert Road, Tamworth, on Saturday and Sunday, March 8th and 9th. The main object of the exhibition is to raise funds for the re-tubing of the former L.M.S. "Pacific" No. 6201, which is at present on display at the Dowty Railway Centre, Ashchurch, Near Tewkesbury, Glos. The exhibition will include a live steam track for 3½ and 5 in. gauge locomotives, working small-gauge railways, B.R. films, and a display of railway relics. Full details can be obtained from the Exhibition Organiser, 4 Minerva Close, Bolehall, Tamworth, Staffs.

New Museum

At Broomy Hill, almost on the banks of the River Wye in Hereford, an unusual Museum is being developed, largely by volunteers. When complete, the site will show a complete Victorian Waterworks, much of which dates back to 1856, and a collection of pumping engines, gas, oil, petrol and electric, also a turbine, a Cornish pump, a Lancashire boiler and a narrow-gauge railway. The Museum is centred on two fine steam pumping engines, a vertical triple-expansion engine of 1895 and a vertical two-cylinder condensing engine of 1906, both built by Worth, Mackenzie & Co., of Stockton-on-Tees.

It is hoped that the Museum can be opened in April; volunteer labour is urgently required to assist in the restoration work, and anyone able to help should contact Mr. J. L. Townsend, of Didley Cottage, New Mills, Clehonger, Hereford.

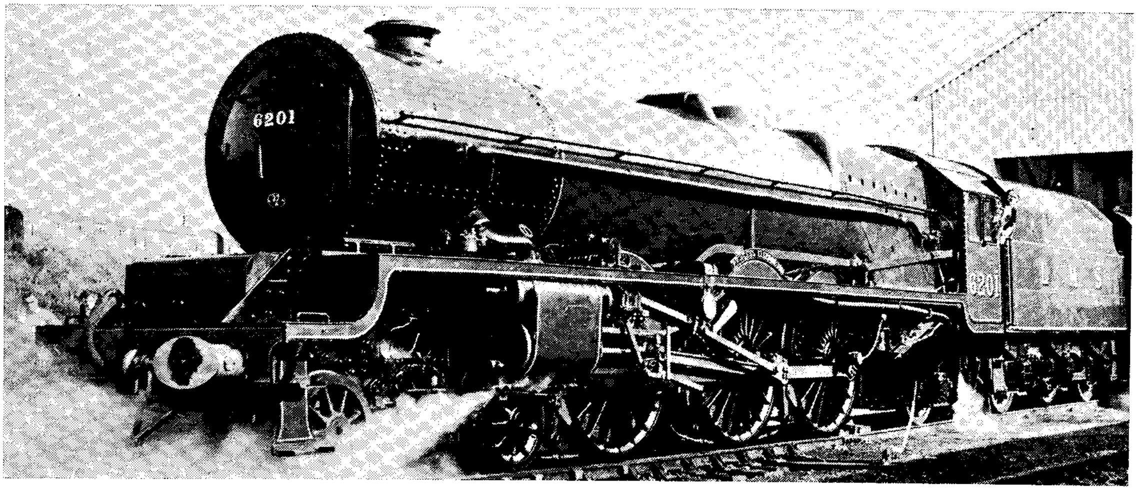
Steam Toy Collection

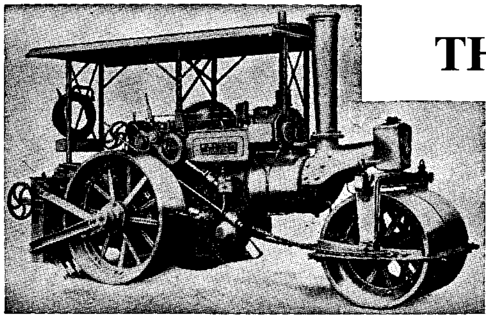
A collection of steam-driven toys and models will be on show at Blithfield Hall, Staffs, from Easter until October. The collection includes some "dribbler" locomotives from the 1880's, a Bing torpedo boat of about 1910, together with stationary engines, generating plants, traction engines and steam launches. A souvenir booklet will be on sale at the Hall. The collection is the work of Mr. B. W. Harley, an occasional contributor to *Model Engineer.*

New Society

A new model engineering society has been formed for the Mid-Cheshire area. Known as the Mid-Cheshire Society of Model Engineers, the Secretary is Mr. K. Bowley, 3 Moss Lane, Cuddington, Near Northwich, Ches. The Chairman is Mr. T. Robinson, 15 Beech Road, Hartford, Ches. New members will be welcomed.

The ex-L.M.S. "Princess Elizabeth" at the Dowty Railway Centre.





THE "M.E." STEAM ROLLER

An Aveling & Porter 2 in. scale Compound

Built and described by John Haining

Part X *From page 65*

THE DRIVE is transmitted from the brake boss keyed to the axle on the near side and the boss of the final drive road spur gear keyed on the offside by means of the driving pins extended through each hub. The only occasions on which the axle shaft would revolve inside the hub are when one drive pin is withdrawn to facilitate negotiating sharp corners (with no differential) or when the winding drum is in use, but I have nevertheless, on my drawings, called for bushes to be fitted as in full size practice. These should be H.T. brass, phos. bronze or gunmetal.

The spokes of both driving and steering rollers are, at their inner ends, cast into the hubs, and as with all models of engines with this type of wheel construction we have a choice of several methods of reproducing the appearance of the full size wheel. Taking the driving hub first, the two "lobes" may be turned back to form a reduced diameter at each outer edge and the fourteen spokes per wheel fitted as shown in my drawing with countersunk head screws through each spoke, screwing into 4 BA holes tapped in each lobe—seven spokes from each hub lobe running to the *inner* side of the single tee ring of each wheel. This method of construction, if it is to give the authentic "cast-in" appearance to the spokes and hub, requires a slotted circular plate to fill the space between spokes, and an outer circular plate to mask the countersunk head screws and bring each hub back to full width; and of course care must be taken to ensure that the plates fit with no excess clearance around the spokes, otherwise the effect is lost.

The second method, which is the one I am using, is to turn back the outer end of each "lobe" to form a reduced diameter sufficient to accommodate the spoke ends and of less depth than that required for the first method of assembly, followed by milling seven slots in each lobe to receive the spoke ends and completing the assembly by fitting an outer plate as in method one. The spokes should all be drilled and countersunk and the hub lobes drilled and tapped for 4 BA countersunk steel screws, but as a further alternative each spoke can be drilled $\frac{1}{8}$ in. dia. and hubs marked off and drilled from the spokes for $\frac{1}{8}$ in. dia. press fit steel dowel pins —which must not of course project through the outer edge of the spokes otherwise the outer or "keep" plate will not sit correctly, and besides being loose the job will look a botch up. This dowelling method, if carefully carried out, with the spoke ends sitting snugly against the reduced diameter of the hub, is quite sound and makes a strong enough wheel, but personally I favour the good old countersunk head screw through each spoke, with the spokes sitting snugly in their milled slots and the outer plate, retained by three countersunk head screws with filled in heads, merely making the external appearance right and not acting as a retainer for the spokes.

To mill the spoke recesses in each hub, mark out the seven equi-spaced spoke positions after turning the reduced diameter at each end—I did this by drawing the hub outline on Card Royal with a hole on centreline to fit over the end diameters, and then centre popping the centreline of each spoke through the card from the pencilled positions drawn on the template. Mount the hub on a flanged arbor bolted to the vertical-slide, preventing the hub from rotating on the arbor by drilling and tapping the hub for a $\frac{1}{4}$ BSF setscrew and dimpling the arbor spindle in seven equi-spaced positions to locate the setscrew nose—a setscrew with what is known as a "half-dog" point is the best type to use for this purpose.

Occasionally, someone asks me why I make up traction type wheels in the manner I have just described, instead of just turning the hub outer ends down, fitting spokes in position and then setting them in one of the modern epoxy-resin compounds to give the effect of cast-in spokes, and my only answer is always that, while these compounds are excellent for a very wide range of jobs, to use them in the constructing of an engine which was built nearly throughout of steel and cast iron or cast steel smacks in my opinion of "instant engine", and would produce a model quite out of character with the full size engine; in any case I try hard to keep the respective sub-assemblies of an engine to the same material as those used in full size practice *wherever possible*. Even aluminium I regard as an out of character material, although we are sometimes driven to use it in model work, for limited applications, by economic necessity.

This weekend Bill Carter and his wife kindly brought their superb class BB Fowler 2 in. scale ploughing engine, built to my drawings and with Colin Tyler's castings, to our local agricultural show in support of my "steam section", where it became, with Mabel Carter's "Simplicity" Roller, the centre of attraction and admiration.

Bill told me that the wheels of the Fowler, together with its accompanying living van and water cart, are all built up by the second method I have discussed with milled slots for the spokes, and I would defy anyone not in the know to tell that these were not wheels produced as in full size, by casting-in the spokes, so perfectly did spokes blend with hub and so truly did each wheel revolve upon its axle.

The hole, tapped in $\frac{1}{4}$ in. BSF, for the setscrew securing the hub on the milling arbor spindle should be positioned in the centre of the hub on the bottom centreline—that is opposite the pear-shaped lobe. This can then be utilized for the grease cup which is fitted to each roll, when the wheel has been assembled—incidentally, the hubs of the driving rolls on the full size roller are hollow and the coring involved was a neat example of the foundryman's art.

The equi-spacing of the rear roll spokes, seven in each hub lobe works out, if my arithmetic is correct, at 51°-25 ft.-42 in. between each spoke centreline, or if preferred 51.428°—an uncomfortable angle in any language to my mind!

I have left the spoke length to be checked on assembly. Preferably all the spokes should fit snugly at top and bottom, and the milled recesses should just allow the spoke to be pressed into place, with the tapped holes in the hub marked off from the spoke holes.

I use a flat smooth board with a projecting centrepin over which the hub fits, and three movable pins to locate on the outside of the wheel rim to assemble wheels; if the rim is clamped down firmly and tightly to the board with washers placed over the centre pin to bring the hub up to its correct relative position with the rim, the job of assembly becomes quite easy and no trouble should be experienced with these rolls, lacking strakes, and with bolted spokes to a single tee ring.

With the exception of the final drive to the road wheels and as mentioned in an earlier article, the drive to the boiler feed pump, all gears on the class AD rollers were placed between the hornplates, the makers claiming that this arrangement ensured smoother running and more even wear on gear wheels and bearings. All the gear wheels themselves were of cast steel, of special wearing surface quality, and all except the two gears of the final drive to rear axle were machine cut. The striking gear was so designed that in changing gear the driver had to pass through a neutral position where no gears were engaged, the crankshaft gears being totally clear of engagement with any second shaft gears when running "free engine", it being made quite impossible by this arrangement to deliberately engage both high and low speeds at the same time, with dire results to gear teeth!

This certainly resulted in a very compact and narrow gearing layout, and did away with the heavy combined twisting and bending moments which occurred at the overhung ends of shafts on engines with gearing external to the hornplates.

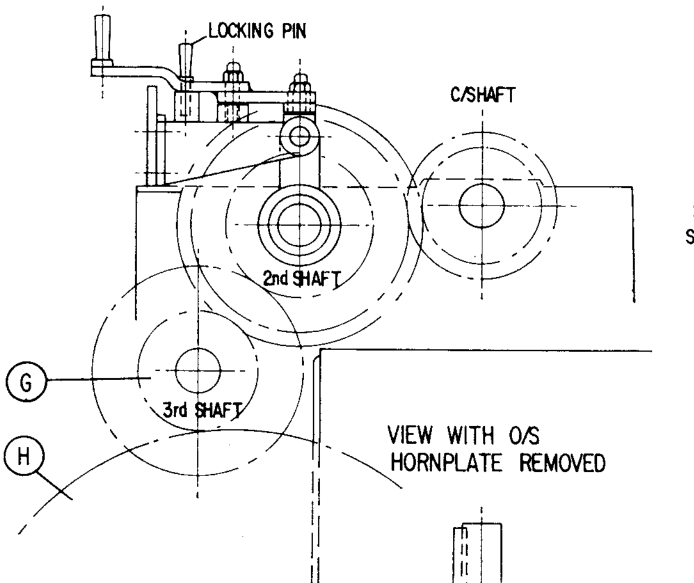
Due to the fairly restricted space between the hornplates—the boiler of the full-size roller is only 2 ft. dia.—the faces of the gears on crankshaft and second shaft are on the narrow side, and this characteristic is apparent to a more exaggerated degree on the two inch scale roller, owing to the crankshaft webs perforce having to be very slightly overscale in width, allowing even less room for the two low pressure cylinder eccentrics, between the gears keyed to the crankshaft, and the nearside main bearing.

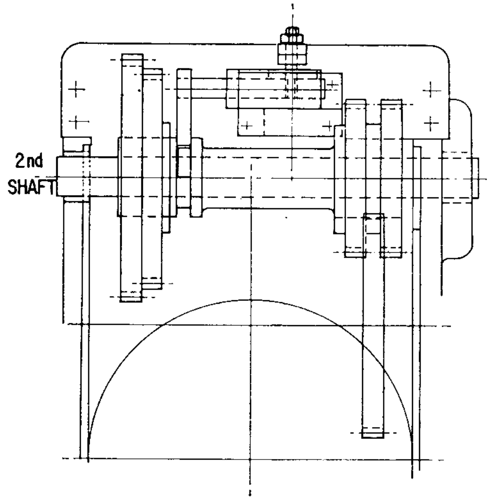
The second shaft does not normally revolve, as its only function is to carry the four gears mounted upon it, and consequently no bushes are needed at each end where the shaft rests in the horn-bracket thickening pieces; nevertheless I have called for bushes each side as, in the event of centre distances being slightly out, the bushes may be bored eccentrically to correct and bring shafts back to true centres—this, however, is a purely personal preference, and readers may prefer to leave the bushes out altogether.

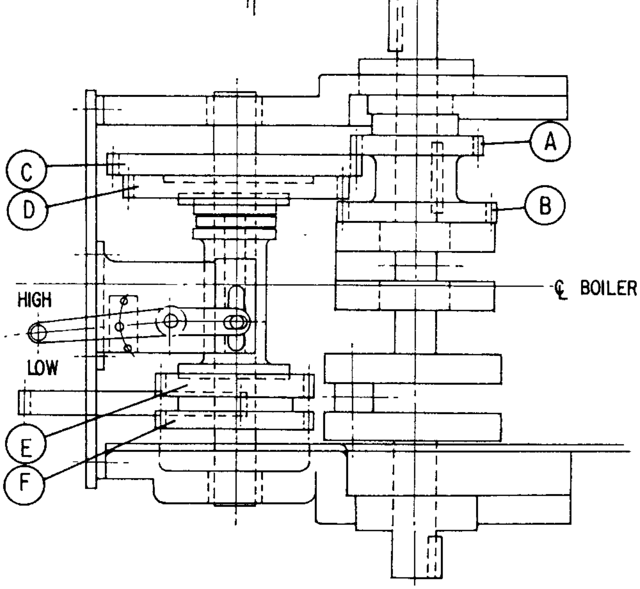
The second shaft should be a light drive fit in the bushes or alternatively in the holes through the thickening pieces, the third shaft revolving in bearings in each hornplate and increased in diameter at the offside end where the two road gears are carried. (See section through back axle of roller).

I have allocated each gear a letter, tabulating them in the accompanying panel.

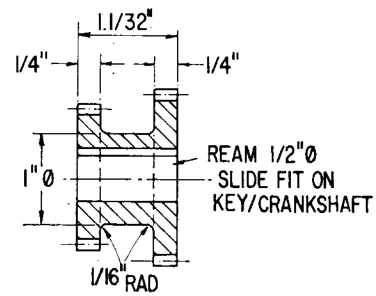
Gears A and B are fixed, being keyed to the crankshaft, while C and D slide on the second shaft, joined by means of a sleeve to the twin gears E.E. which according to the Aveling &







ARRANGEMENT OF ROAD GEARS



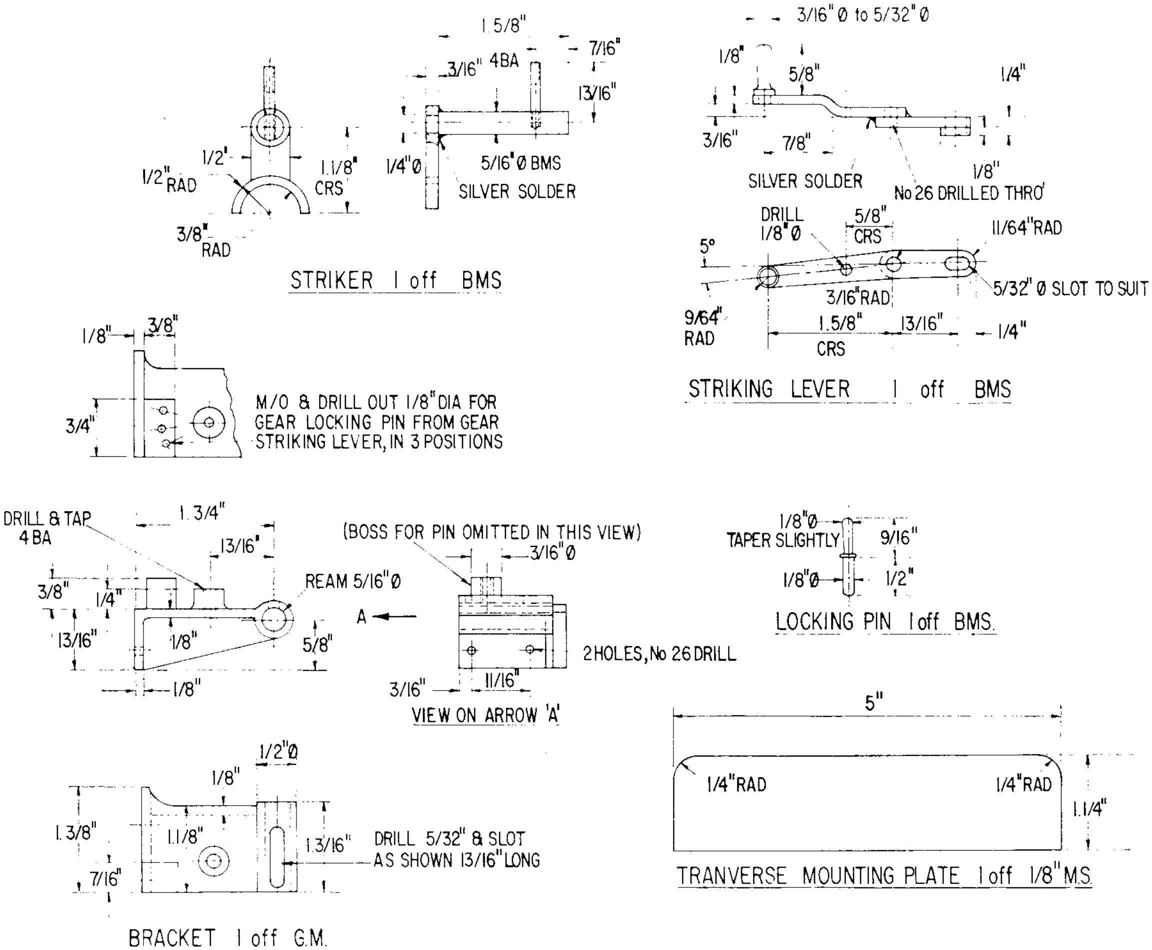
GEARS A & B 1 off STEEL

Porter works drawing are just in constant mesh with the larger gear F. keyed to the third shaft, and being fully meshed when either C or D are moved into engagement with A or B. All these gears are 12 D.P. and whilst this is a little finer pitch than I would have liked, it does enable anyone who doesn't want to cut his own gear blanks to use proprietary gears. Gears G and H are the final drive gears, G being keyed to the outer end of the third shaft, it being the large gear with special boss to receive the offside driving pin, and itself keyed to the rear axle shaft.

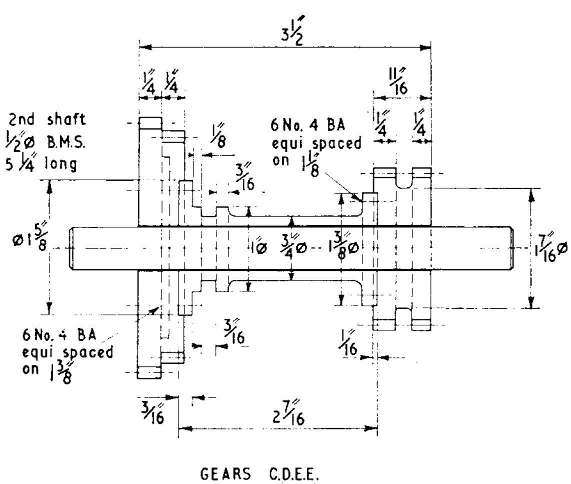
Both these two final drive gears are 8 D.P. and while they may both be proprietary items, they will require modifying, to incorporate the driving boss as shown on my section through the roller on the rear axle (Part VII, 15th November 1974).

One of the great advantages of the gear layout on this particular roller is that all gears may be solid, except the pump drive already covered in a previous article, and there is no necessity to carve out tee or cruciform section spokes as on our Fowler engines, with their exposed gearing.

Even the gears of the final drive are almost totally enclosed by guards, behind the O/S rear wheel. It is planned to make all gears available as castings i.e. cast iron blanks in due course, and this will enable C.D. and E.E to be produced



2-SPEED GEAR DETAIL



GEARS C.D.E.E.
1 off steel

integral with their joining sleeve; for those readers who intend either to use proprietary gears from the Trade or to machine their own from either cast iron or mild steel bar, I have shown the sleeve (upon which the striker fork runs, to select "high", "low" or "free engine") dimensioned and joined to the two gears, to make the one assembly. The sleeve should be a sliding fit on the second shaft, but relieved in the bore for about one third of its length, about the middle. The double gears E.E. on the full-size roller slide along the shaft and into the concave housing incorporated in the offside thickening piece, when high gear is engaged, but on the model the outer gear E does not actually enter the concave housing, the gear fully engaging with gear F before it reaches the edge of the concave boss. This is because the gear E is slightly larger pitch diameter proportionally than the full-size gear and I have maintained the true scale external dimensions of the concave housing in the thickening piece, for appearance's sake.

The two gears C and D, being "stepped" or compound gears, will have to be separate items, whether two trade gears or two cast iron blanks are used. Gear C spigots into D, the sleeve end flange registering in the same way into gears D and E and the six 4BA countersunk screws passing through both the sleeve flange and gear D, gear C being drilled and tapped to suit.

The striker has a 4 BA stud screwed into the bar itself and as my drawing shows, this connects with the striker lever to move the gear sleeve along the second shaft in or out of gear; this stud must be screwed into the bar after it has been assembled in the bracket, as the stud must pass through the slotted hole in the top of the bracket. A minute application of Loctite applied to the bottom of the stud is a good idea, to prevent it working loose under running conditions.

The striking gear bracket is mounted on the forward side of the transverse plate running across between the two cast facings on top of the thickening pieces and is purposely left to overlap the facings slightly at each side. It is best to drill the plate and facings on assembly for the two 4 BA hexagon-head setscrews each side. For those readers who intend to cut their own gears the following notes may be of some assistance.

The gear teeth are cut by a formed cutter, preferably in a milling machine, but otherwise in the lathe.

The blanks should be accurately turned and bored a light press fit on each respective shaft, and the keyways cut. Upon the accuracy of these first operations depends the accuracy of the finished spur gear, of course. Mount the gear blank on a keyed mandrel in the dividing head with the tailstock centre supporting the other end. The keying of the blank to the mandrel will help to prevent "creep", and the length of the necessarily small diameter mandrel should be kept to the minimum, to prevent deflection and bending. It is absolutely essential that the gear blank be perfectly central with the cutter when mounted on the mandrel, so that the tooth form shall be identical on each side of the tooth. Care must be taken to make sure that the involute cutter form is accurate and that the cutter has suffered no distortion during the hardening process.

The correct setting for the depth of tooth is obtained by movement of the vertical adjustment screw and index of the table movement by scribing a line on the blank to indicate the depth to which the cutter must be set.

It is not advisable to take the full depth of cut at one operation, but to leave a small amount of metal for a finishing cut. The rate of feed, approximately 70 ft. per minute for cast iron, should be reduced if necessary to avoid tool chatter. In practice it will probably be found better to take three cuts, leaving .005 in. to be taken out on the finishing cut, and dividing the remainder into two equal cuts. Where a gear normally has no keyway, it will be found advantageous to cut a shallow keyway through it, to key the mandrel during cutting operations; this will not affect the gears on final assembly.

GEAR DATA

Gear	Pitch Dia.	No. of Teeth	D.P.	CRS
A	1.500 in.	18	12	2.250 in.
B	1.833 in.	22	12	2.250 in.
C	3.000 in.	36	12	2.250 in.
D	2.666 in.	32	12	2.250 in.
E	1.833 in.	22	12	2.250 in.
F	2.666 in.	32	12	2.250 in.
G	1.500 in.	12	8	4.120 in.
H	6.750 in.	54	8	4.120 in.

Note:— The above gears give numbers of teeth on each gear nearly identical to the full-size prototype roller, with comparable ratios in both high and low gear.

MAKING SPRINGS

Sir,—Regarding my letter on springs, December 20th 1974, the procedure I described is not unreliable as Mr. Whitehead suggests, indeed it has been used by armourers for centuries and still is. *Thin* sections or *light* diameters can be quenched in water quite safely so far as ordinary spring steel is concerned at any rate, if done in oil they are not usually hard enough for tempering by the burning off method. The annealing and sand tempering he describes is more usually applied to tools and is a bit time consuming. Particularly so should the spring shape subsequently require slight alteration to move the lockwork properly. Personally, I would not use steel of unknown composition for gunlock springs, they are tricky enough to make without risking breakage by incorrect heat treatment. As regards nicks and cross filing, I have seen plenty of these on old gun springs and they did not appear to be affected in any way. I have welded a broken flintlock main spring, afterwards hardening and tempering in whale oil and it functions perfectly. Mr. Whitehead seems to be luckier than I am with coil springs, I seldom manage to get the size I want, and nails by the way, are wrought iron, not mild steel.

Plymouth, Devon. W. Tait.

"DERBY 4F"

A simple 0-6-0 locomotive for 3½in. gauge

Part 3

by Don Young

From page 120

NEXT CUT TWO 15/16 in. lengths from 1 in. × 1 in. × ⅛ in. bright steel angle and reduce one leg of each to ¾ in. width, so that it is finally hidden by the front portion of the valance. Take the frame stay and hold a piece of the frame material, an odd piece sawn off when profiling them earlier, against each of the machined side faces of the stay; this will give us the required 3.125 in. between the pieces of angle. Cramp over the whole and offer up to the buffer beam, clamping the angle in turn to the beam. Drill through as many of the No. 41 rivet holes as you can, the clamps will prevent you drilling them all at one go, and fit the rivets as for the horns. Remove the clamps, drill the remaining rivet holes and fill them. Drill through the angle, from the 9/32 in. holes and tap 5/16 in. × 40T for the buffers. Leave this beam aside for the moment whilst we tackle the drag beam.

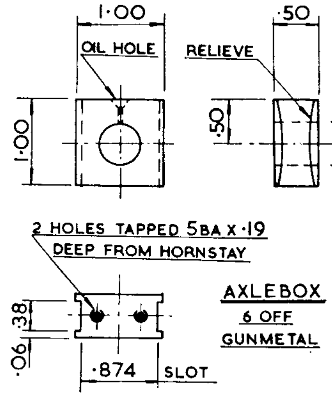
The rear, or drag, beam starts life as a 6¼ in. length of 1¼ in. × 1¼ in. × ⅛ in. square root and corner bright steel angle; trim the bottom corners and relieve the top edges by 3/32 in. to allow the valances to fit snugly later on. Mark off and drill all the holes specified, save for the 8BA tapped ones for the valance. For the drawbar slot, first drill four 3/16 in. holes along the centre line and open out gradually until they begin to break into one another. With a small round, or square file, take away the remains of the holes to form a rough slot. With a flat file, continue to the top and bottom scribed lines, using a piece of ¼ in. bar as a gauge; finish the ends of the slot with your square file. The fixing angles are 1 1/16 in. lengths of 1 in. × 1 in. × ⅛ in. steel angle, clamp them to the beam using the frame gauge to get them the correct distance apart; drill through at No. 30 and secure with ⅛ in. soft iron snap head rivets.

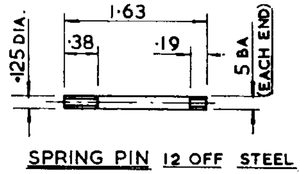
Mark off for the two ⅛ in. slots in the top face of the beam and fit two blades in the hacksaw frame. A word about hacksaw blades for the sake of beginners; invest in a packet of Eclipse 'super speed' or a similar brand of high speed steel blade at the outset, it will pay dividends as, with proper use, each will give years of service. Improper use consists of twisting the blades when sawing, the effect being a nasty snap and probably rapping your knuckles against the workpiece; most painful for your person and pocket! A short blade allows more control, so choose a 10 in. length rather than 12 in.

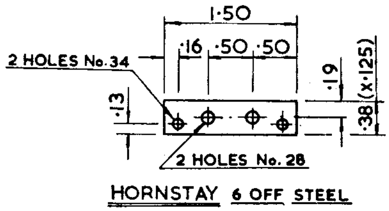
Right, the saw is loaded, so begin cutting down each slot, keeping just clear of the pieces of fixing angle, which act as a further visual guide. If you do happen to run into the fixing angle, or veer the other way, stop, select a file which will enter the bare 3/32 in. wide sawn slot, and tidy up the end of said slot to bring it back to the straight and narrow. Carry on and saw down to the back face of the angle. With the file mentioned above, the correct title for which I believe is a key cutting file, being about ½ in. wide and 3/32 in. thick, file down the inside face of each slot until it arrives at the face of the fixing angle. All you have to do now is file away at the other side of the slot until a piece of frame steel is a push fit therein. It is most important that the back edge of the frames abut against the vertical face of the beam, so make the slots too deep rather than too shallow at their bottoms.

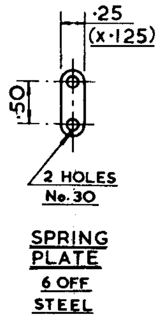
For the drawbar blocks, there are two to make as one is for the tender front beam, start with a length of ¾ in. × ⅝ in. b.m.s. bar. At ⅜ in. from one end, on the centre line of a ¾ in. face, centre pop and with dividers scribe a semi-circle for the fancy end profile, which can be omitted. Saw and file to shape, cut off at ⅞ in. overall and file the sawn face square. Or you may prefer, if you are machine-minded, to grip the piece in the machine vice, on the vertical-slide, and clean up the face with an end mill. Clamp under the top face of the beam and drill through at No. 11; lower the block to its correct position below the drawbar slot and clamp in position, to try a length of 3/16 in. rod through the pair of No. 11 holes. When it slides freely spot through the two No. 34 holes in the rear face of the beam, drill the block No. 43 to about ⅜ in. depth and tap 6BA; secure with ⅜ in. long countersunk head screws. We are ready to assemble the frames.

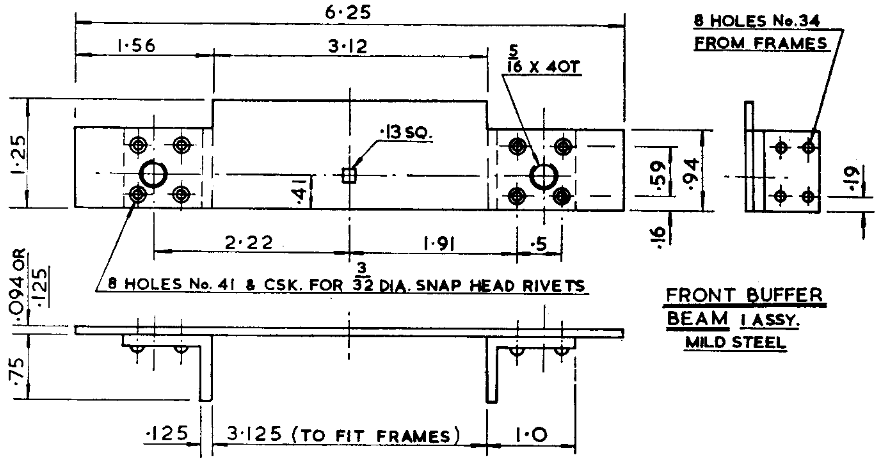
The front beam is easy to locate as it takes up position against the 1¼ in. front edge of the frames. The bottom edge of the rear beam is 7/16 in. above the bottom of the frames at that point; clamp both beams securely to the frames and stand on your lathe bed, or a sheet of plate glass as a surface table. The whole will probably rock like a baby's cradle, so locate the offending corner(s) and adjust until the frames sit snugly on the surface table. Check for squareness in as many places as you can, the most important at the moment being to check that both frames are

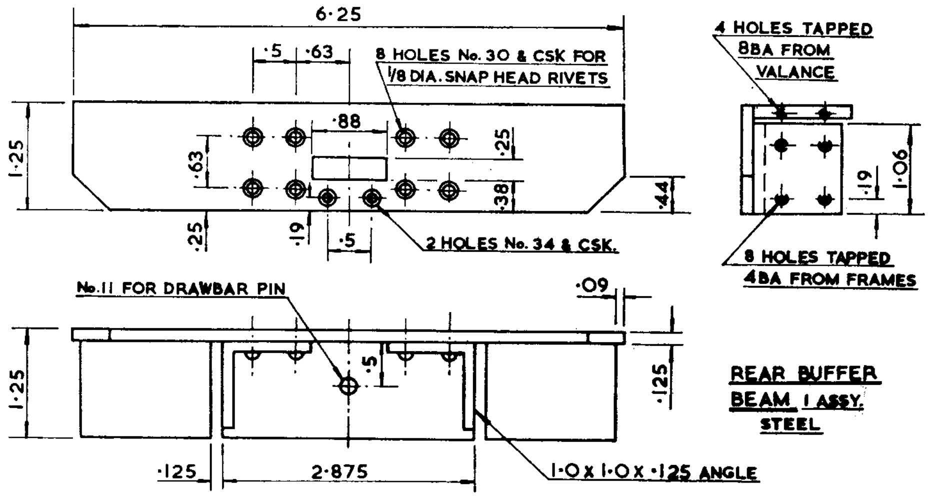






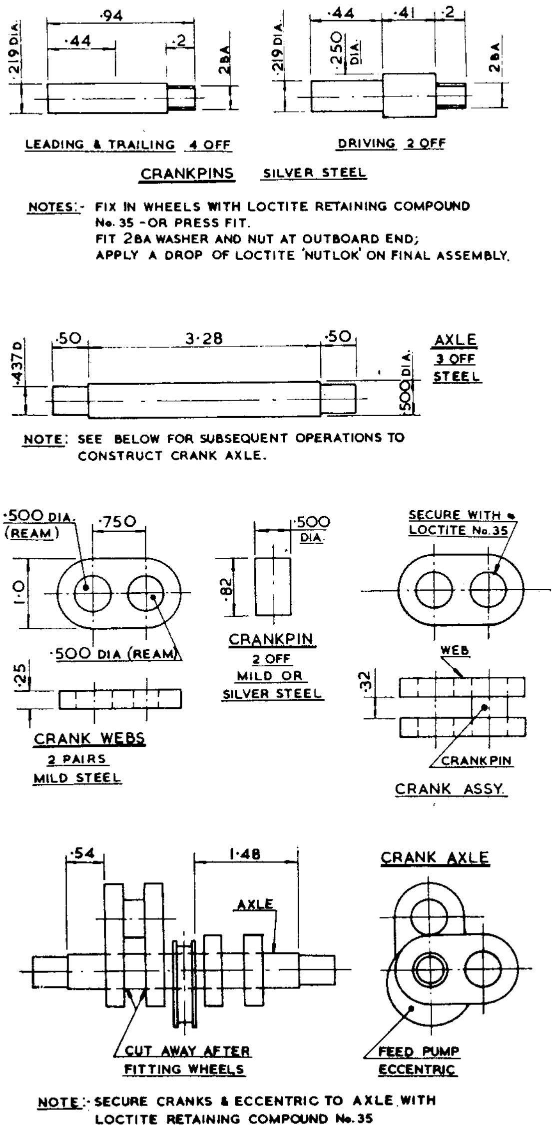






vertical and that the buffer beams are square to the frames.

For the moment, spot through two of the No. 34 holes for the front buffer beam fixing at each side, drill through the angle at No. 43, tap 6BA and secure with hexagon headed bolts. Do



the same for the rear beam, only spot through No. 27, drill No. 33, tap 4BA and use the bigger size bolts. For the frame stay, secure with the top and bottom screws only on each side; the frames are reasonably rigid in this state so let us make more pieces to confirm the alignment.

Last year I wrote of a procession of locomotives parading across the mantlepiece, well the new abode does not boast the latter, no coal fire to stoke and rake through any longer! In any case I know of no mantlepiece capable of supporting the vast cavalcade of steam power that poured through the letter box in the form of Christmas greetings cards, they stretch nose to tail across the lounge. There is sufficient inspiration for a lifetime of future projects, with a marked leaning towards the Narrow-gauge; should yours truly take the hint?

Each evening when retiring I enjoy nothing better than about 30 minutes perusal of a book on some aspect of steam railways, notably those overseas. During the years I have built up a small collection of recordings of British steam locomotives, including quite a few classes which I never heard in action. These sounds, allied to my readings, add to one's knowledge of particular engines. It was therefore a great thrill to receive tapes of overseas locomotives which has further enhanced my limited knowledge of this vast subject. For instance I was able to gauge the track speed and the sheer power required for the NA Class locomotives working the Puffing Billy Railway in The Blue Dandenongs, very impressive! The recording was made by Bruce Herbert of Victoria in Australia, who also sent me snippets of other locomotives at work. At last I am aware of the reason for the popularity of the New South Wales C38 'Pacifics', their exhaust note is very individual, almost hypnotic, whilst the Victorian Railways Class D3 have a galloping gait, due to the setting of the valves with Stephenson Link gear, syncopated I believe is the musical term, sweet music indeed! With that I must move on before incurring our worthy Editor's wrath.

The axleboxes come next in line for treatment, being in the form of a cast gunmetal stick. Cut the stick into three pieces, each about 2⅛ in. long; each piece will subsequently become a pair of axleboxes. Chuck in the 4-jaw and face across one of the wider faces; reverse in the chuck and add a packing piece between the first machined face and the chuck to bring the exposed face clear of the jaws, lightly tighten the jaws, tap the block hard down onto the packing piece and firmly tighten. Machine across the face to give the required overall thickness of ½ in., now we must achieve the required 1 in. width.

Rotate the casting through 90 deg., tighten up the jaws once more, only this time fit small pieces of packing between two of the jaws to prevent them marking our nice new machined faces; face across. Reverse in the chuck yet again, this time the block should stand proud of the jaws without the need of a packing piece; machine across to finish at 1 in. width. Face across the ends, using pieces of packing against all four jaws this time, just removing enough metal to clean up.

The method of setting up vertical-slide and machine vice has already been described; yours truly will specify this set-up for many operations and astute builders will carry out batches of machining whilst the equipment is rigged, saving valuable time in the process. For me there are two distinct types of model engineer, and the balance between them is very finely gauged in *Model Engineer*. On the one hand there are those that will manufacture every tooling aid imaginable to produce the finished article, whilst on the other hand some builders are content with the most primitive devices in order to attain the same end. Yours truly is very much in the latter category, even more so as the years progress and time becomes ever more precious.

Grip a piece of the gunmetal bar in the machine vice, with one of the ½ in. wide faces towards the chuck; this time the latter is of the 3-jaw variety, holding a 5/16 in. end mill. For the operation which follows a graduated handwheel fitted on the end of the leadscrew, one of Myford's most useful accessories, will come in very handy although it is by no means essential. If you have the luxury of said handwheel, wind the casting up to the end mill, taking up any slack in the lead-screw nut by holding the carriage back by its traversing handwheel, when very light marks from the end mill teeth become apparent on the bright face to be machined.

Advance the carriage by .035 in., still holding said traversing handwheel, and lock the carriage. With the vertical-slide, set the height so that the cutter will pass centrally along the ½ in. face: any qualms about this and you should use a ¼in. end mill to give more margin for error. Feed the embryo axlebox onto the cutter, running the lathe at top speed, right through the block and back again at the same setting. Advance the carriage exactly as before, by another .027 in. and take a further cut. Our first slot is to the correct depth, now it has to be increased in width, but before doing this yours truly had better tell builders without the facility of a leadscrew handwheel how to reach this stage.

Advance the carriage to give a cut as close as you can judge to 1/32 in. and take a cut across, then, in small stages, increase the depth of the slot until a piece of ¼ in. x 1/16 in. b.m.s. strip sits in the slot, flush with the top of the slot; not too difficult.

Gradually widen the slot, top and bottom, keeping the two tongues of equal thickness as close as you can judge by eye, until a piece of ⅜ in. wide bar slides into and along the slot. Take a note of the micrometer dial readings on the vertical-slide when the last cuts to obtain the correct slot width were taken; jot them down on a scrap of paper. When using an end mill in the lathe there is a natural tendency for the tool to draw itself out of the chuck and produce a deeper slot as the cut proceeds; the only answer is to really tighten the chuck jaws and stay alert.

Rotate the block horizontally, that is important, through 180 deg. and begin to repeat the procedure on the second ½ in. face, only this time the aim is to finish with the distance between the slots at the required ⅞ in., to fit in the horns. Use your micrometer to measure the exact thickness of the ⅞ in. bar that was used as a gauge when the horn gaps were machined and mill the second slot in the axleboxes until this dimension is repeated. Open out to width using the vertical-slide readings previously recorded then deal with the other two pieces in like manner.

There will be slight dimensional differences between individual blocks so it is important now, when halving them into singular axleboxes, to maintain the pairing. Take the last machined slot for each block and call this the front face of the axlebox; mark off and saw into halves, marking the first pair Nos. 1 & 2, with number stamps or pop marks. These boxes are for the leading axle, Nos. 3 & 4 for the driving and 5 & 6 for the trailing axles. Chuck each pair together in the 4-jaw, saw cut faces towards the tool, and face across to give the required height of 1 in. The boxes are progressing well and the only major operation left is boring, literally!, to suit the axles, which we will tackle immediately.

For identification we will say that odd number boxes will be used on the L.H. side of the engine and even numbers on the right, so stamp the horns to agree with this. Mark diagonal lines across the outside face of No. 1 axlebox, you will now have a cross which is known, at least in yours truly's parlance, as centring by the 'X' method. Centre pop where the lines cross, deeply, and you have the centre of the axle. Next cut four 1 in. lengths of ⅜ in. x ⅛ in. b.m.s. flat and drop one into each slot of the forward pair of axleboxes. Chuck the pair, together, in the 4-jaw with two jaws clamping on the packing pieces just fitted and the other pair holding the ends of the boxes. The outside face of the R.H. box will be hard against the chuck face, whilst the outer face of the L.H. box will be facing towards the tailstock. Get the pop mark running as true as possible to the tailstock centre as you can manage by eye and then advance the centre into the pop mark. Adjust the job by feel, this is quite good enough, then remove the centre and replace with your tailstock drill chuck. Centre deeply with a Slocombe drill and open out, in easy stages, to either ⅜ in. or 7/16 in. diameter by drilling. Remove the tailstock chuck and replace with a ½ in. machine reamer, if you have one ; if not don't worry.

MODEL ENGINEER EXHIBITION 1975

Reports from the Seymour Hall

Duke of Edinburgh Trophy

by Martin Evans

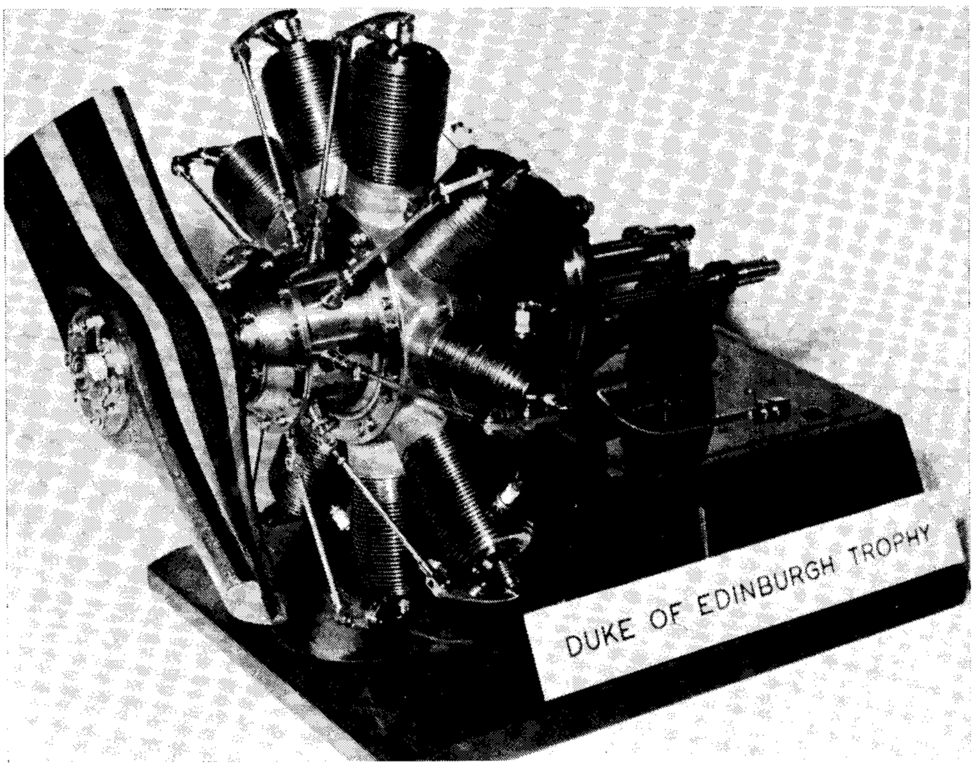
ONLY THREE ENTRIES were received for the premier trophy at the Model Engineer Exhibition. This was most disappointing, and is rather difficult to understand, as the winner enjoys the temporary possession of a very fine trophy, plus the permanent award of a nice "replica". I wonder if all competitors realise that any previous winner of a Championship Cup or Silver Medal is eligible for the "Duke of Edinburgh"?

L. W. Chenery of Edgware had entered his Gnome 9-cyl. rotary engine, and T. Morris his well-known "C" type Foden steam wagon. A. Norman of Warrington showed a Stuart No. 7a engine.

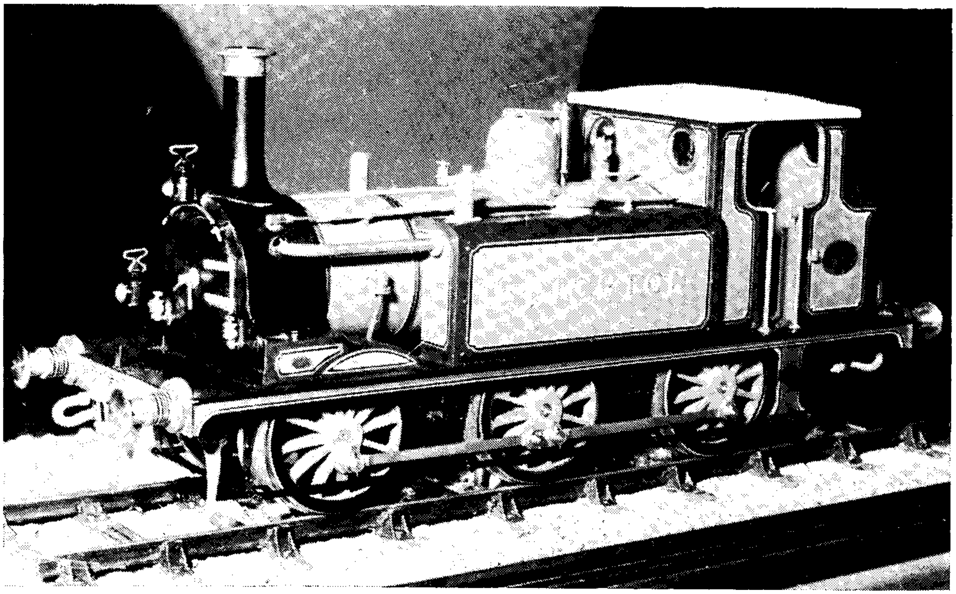
The Duke of Edinburgh section is often one of the most difficult to judge, owing to the very wide variety of models that may be entered, and in this case, the judges (three) had some difficulty in deciding between the aero engine and the steam wagon, but eventually came down on the side of the former. Both these models have been well described by other contributors, so I will pass straight on to the small scale railway models.

Class B

In this class, which is for gauge "I" and "O" locomotives, there were two outstanding exhibits—J. S. Bremner's Gauge "I" Brighton "Terrier", and J. Brierley's Gauge "O" L.N.E.R. "Pacific". I mentioned in "Smoke Rings", last issue, how highly I regarded the little "Terrier", one of my favourite locomotives. If Mr. Bremner could slightly shorten the cotters in his coupling rod retaining collars, and also use a slightly thicker wire for the links of his screw couplings, then he would have an almost perfect replica. Nevertheless, this model well deserved both a Silver Medal and the Model Railways Bowl.



A very fine example of craftsmanship and winner of the Duke of Edinburgh Trophy: The nine-cylinder rotary aero engine by L. W. Chenery.



Left: Mr. T. S. Bremner's Gauge "I" L.B.S.C.R. "Terrior" tank: Silver Medal & Model Railways Bowl.

Mr. Brierley's model was unpainted, so that one could see how clean was the plate-work and the soldering employed. The characteristic but difficult shape of the boiler and firebox had been reproduced exceptionally well, and the valve gear was a fine effort, and although the lack of painting was bound to lose some marks, the model gained a Silver Medal and also the H. C. Wheat Challenge Cup.

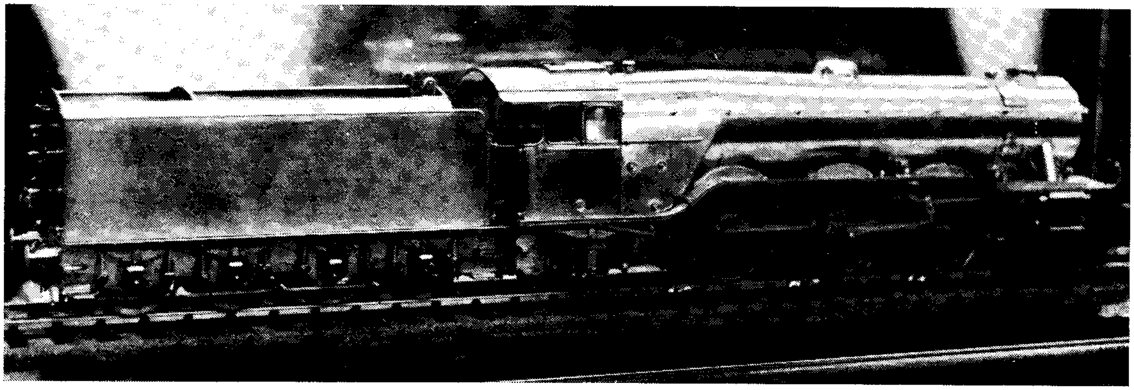
Mr. F. E. Hemming showed a nice G.W.R. dock tank in this section, correctly finished in the Company's livery and this gained a V.H.C. Certificate.

In class BA, for locomotives smaller than Gauge "O", my eye was quickly taken by a very fine unpainted G.W.R. 4-6-0 "King" class, by M. J. Smith of Lambeth. Mr. Smith is no newcomer to the M.E. Exhibition, and this model was well up to his usual high standard, the riveting particularly being a fine effort, also the outside motion. This locomotive also gained a Silver Medal.

A V.H.C. went to Mr. C. J. Verdon for a case containing a selection of hand built models, while H. R. Heng was awarded a H.C. Certificate, for a Southern Railway 4-4-2 tank locomotive for "OO" gauge. This was nicely finished and the lining was a good effort, being very close to scale. J. Brierley showed a "OO" gauge Southern Railway 0-8-0 shunting tank locomotive which was a very good effort, though not to be compared to his "Pacific". This model was Commended.

In Class C, we had an unusual entry in the form of a $7\frac{1}{4}$ in. gauge all-steel mineral wagon by A. Burn of Gosforth. This was very well made throughout, with proper springing and full brake gear. The painting was right too, not too shiny, yet not too "flat": Bronze Medal

Below: Mr. J. Brierley's fine Gauge "O" L.N.E.R. "Pacific": Silver Medal.



Although not in the competition classes, I must mention a very fine $7\frac{1}{4}$ in. gauge G.W.R. shunters' truck, a most unusual model, which I understand was mainly the work of K. J. Woodhams, who carried off the Championship Cup for locomotives at the 1974 Exhibition.

Locomotives, Class A

by Peter Dupen.

FOR SOME YEARS we have become accustomed to an Exhibition with a Locomotive Section comprising several models of outstanding workmanship and finish, but this year the quality of the exhibits failed to reach the high standard set in previous years. Against this gloomy note it was most welcome to see a number of unusual prototypes, and out of a total of 15 exhibits at least four fell into this category.

This years' lucky winner of the Championship Cup and the J. N. Maskelyne Memorial Trophy was Mr. S. W. Baker of Ringwood, Hants. with a 5 in. gauge model of the famous G.W.R. Star Class 4 cylinder 4-6-0, one of the masterpieces of G. J. Churchward.

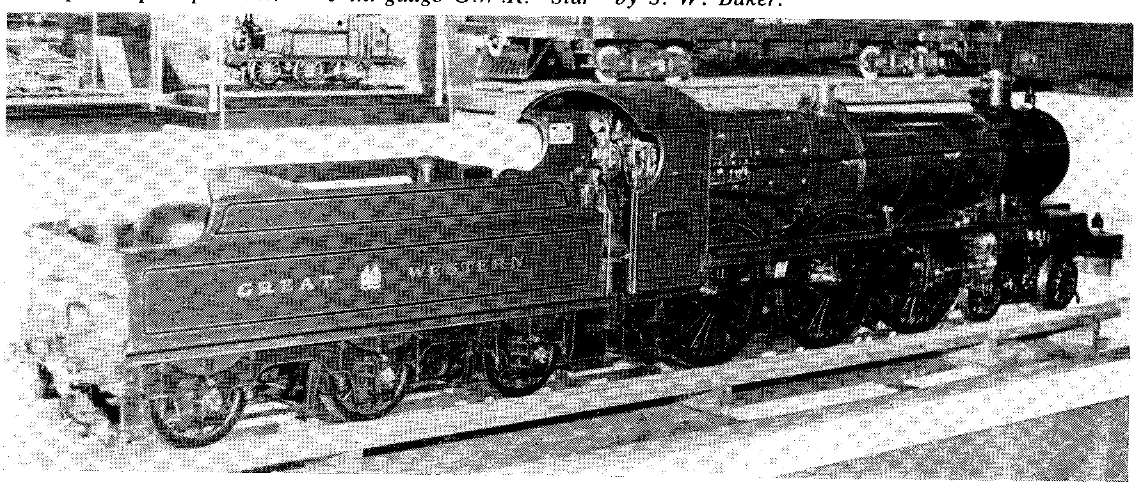
The prototype chosen was *Polar Star,* and the model was certainly an excellent replica and a delight to G.W. fans, but some of the details and workmanship were not quite up to the standard we have seen in past years. The paintwork and lining was very good, also the safety valves and casing true to G.W. practice, the cab layout and fitting a prominent feature on this type of locomotive was well carried out, but the motion work could have been improved and there were a few too many roundhead screws visible.

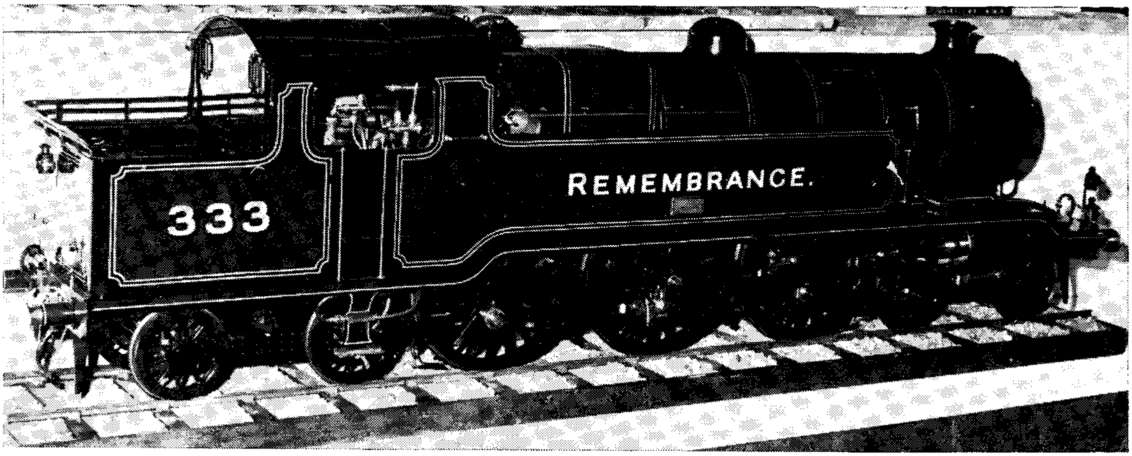
Of all the large tank engines built by the railways of this country I think the Baltic tanks of the L.B. & S.C.R. would take pride of place. These magnificent locos. built by L. B. Billington appeared in 1914 and had the rather unusual arrangement of outside Walschaerts valve gear operating inside piston valves. Remembrance No. 333 was a particular favourite.

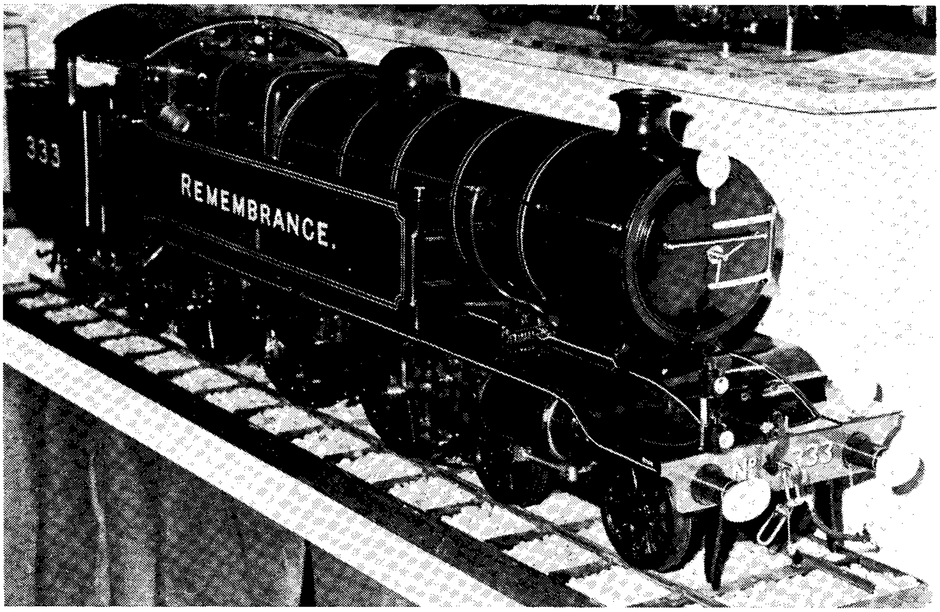
A 5 in. gauge model of this locomotive gained Mr. A. C. Perryman of Lancing, Sussex a Silver Medal and the Crebbin Memorial Cup, and very resplendent it looked in the deep umber livery. The motion work on this model was very good and included the correct taper key to secure piston rod to crosshead, but unfortunately a screwed gland was used for the piston rod. The cab fittings were neat and functional, but a scale layout would have enhanced the appearance considerably. The paintwork was finished in high gloss, probably too glossy, and in places the lining could have been improved, and some of the platework was not in keeping was the high standard of the model generally. An excellent locomotive but a little more attention to details and laminated springs on the leading and trailing drivers would have made it an outstanding model.

Another Silver Medal went to Mr. G. R. Wallace-Sims of Reading, Berks. for a very unusual model of a Southern Railway Bullied Pacific in $3\frac{1}{2}$ in. gauge, a "Battle of Britain" class. This was a very worthy effort, for the model included the chain driven valve gear complete with oil-bath, as the prototype, together with 3 cylinders 1 in. x $1\frac{1}{2}$ in. The piston valves of the outside cylinder were operated by rocker levers through the exhaust ports. Also included was a steam operated reverser with oil dashpot, a turbo-alternator under the cab and steam brakes on the locomotive with vacuum for the train, the brakes

Championship Cup winner — 5 in. gauge G.W.R. "Star" by S. W. Baker.







Two views of the 5 in. gauge L.B.S.C.R. 4-6-4T. "Remembrance" by Mr. A. C. Perryman: Silver Medal and Crebbin Memorial Trophy.

on the engine being of the correct clasp type as fitted by Bulleid.

Mr. Wallace-Sims is to be congratulated in producing such a complicated locomotive to such a small scale, some of the details were well worth a close study, the rear cylinder covers complete with ribs and studded gland, the separately mounted guide bars and the complicated brake gear. The paintwork, a prominent feature on this class of locomotive, was well carried out and as the model has run approximately 120 miles one would not expect the paintwork to be in mint condition.

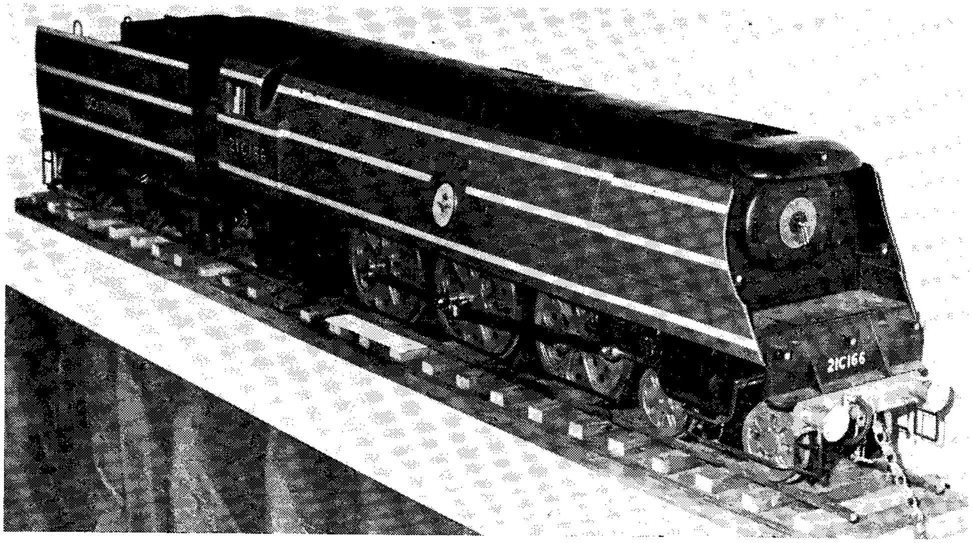
The L.N.E.R. was represented by a Gresley A 4 Pacific *Wild Swan* in B.R. Livery. The 3½ in. gauge model, the work of Mr. B. H. Dunster of Dover, certainly captured the streamlined appearance of the prototype and was awarded a Silver Medal.

The paintwork and lining on the model was very good and only emphasized the fact that the platework under the paint was of a high order. What a pity the rivet heads on the cab, smokebox and cylinder lagging were rather on the large side.

The motion work was excellent but again spoilt by the screwed glands on the piston and valve rods, also by the fact that the piston rod was screwed into the crosshead and the thread still visible. The cab layout was simple but practical and did not detract from the general appearance of a very nice model.

A 7¼ in. gauge G.W.R. "Castle" by Mr. A. W. Eve of Manchester was awarded a Bronze Medal. A large model, and in this scale it is not difficult to

A 3½ in. gauge Bulleid "Pacific" by Mr. G. R. Wallace-Sims: Silver Medal.

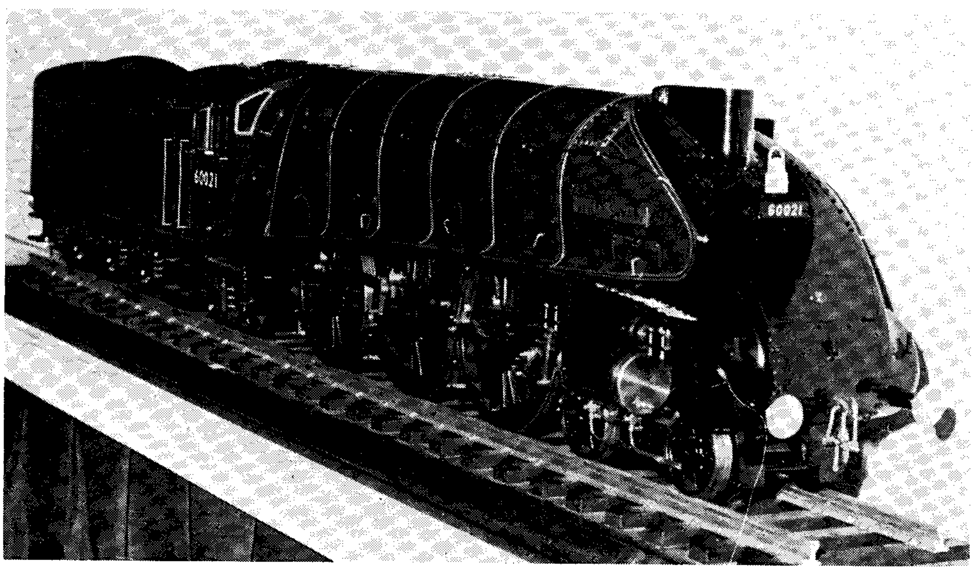


include a vast amount of detail work, but this was not evident; a typical example being the safety valves, standard G.W. design could have been used, but two small pop valves were visible at the base of the casing, with steam-ways so small it is doubtful if they would pass the steam a boiler of this size is capable of generating. The bolts on the regulator flange would appear to be rather on the small side for the spacing adopted. The paintwork was well carried out but the metal needed more preparation to do this justice.

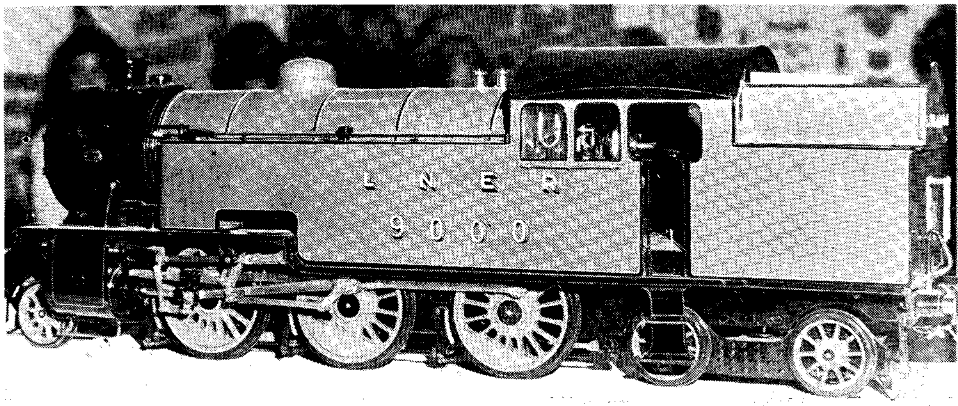
Another 7¼ in. gauge locomotive was by Mr. P. Filby of Humberside, *Rainhill*, a good example of a small engine to a large gauge and no doubt produces an excellent working model. The general workmanship was good, particularly the platework and riveting on the tender; another commendable feature was the rectangular keys used for locating the driving wheels. The boiler was lagged with wood and brass bands, the paintwork well carried out including the "Filby Crest" on the tender. This model was awarded a V.H.C. certificate.

Mr. P. A. Hawley of Derby was awarded a V.H.C. for a 3½ in. gauge G.W.R. County Class 4-6-0. The paintwork and lining were good and a fair amount of detail had been included. The cab was neat but simple, but the motion and buffers could have been improved.

Another L.N.E.R. locomotive, a Thompson L.1. 2-6-4 tank in 3½ in. gauge by Mr. J. C. Bye of Ipswich was also awarded a V.H.C. Workmanship,

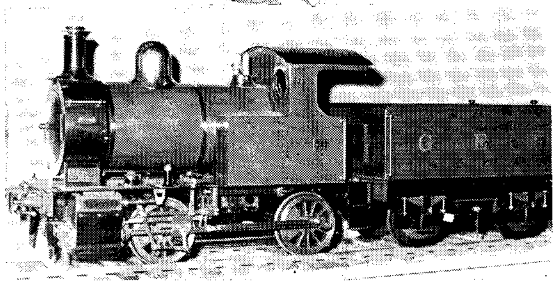


L.N.E.R. "A.4 Pacific" by B. H. Dunster of Dover: Silver Medal.



A 3½ in. gauge L.N.E.R. "L.I." by Mr. J. C. Bye.

Below: A 5 in. gauge "Rail-motor" by Mr. A. T. Vince.



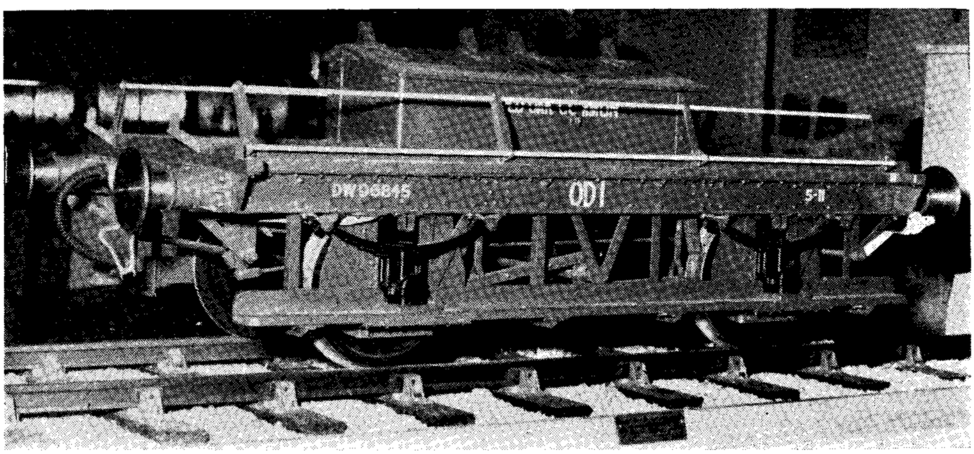
paintwork and general finish were good, the appearance of the model left one in no doubt it was a L.1.

The New Zealand Cup, which is awarded for the best locomotive based on a LBSC design was well deserved by Mr. P. J. Morgan of Ruislip together with a Commended certificate. This was for a 5 in. gauge 4-4-0. *Maid of Kent* modified to represent a Midland Compound, the construction of which had occupied 1820 hours. The model was well made and finished, being complete with tea bottle in the cab. The dome should have had a larger radius at the base, and the buffers and cab fittings could have been improved, but in spite of being a *Maid of Kent* it gave one the impression of a Midland Compound.

A 5 in. gauge Don Young Railmotor was entered by Mr. A. T. Vince of High Wycombe disguised as a G.E.R. 0-4-0 tender loco. It looked a useful type of model but I doubt whether Stratford would have recognized it!

Other models exhibited were a 3½ in. gauge *Maisie* by Mr. J. Martin of Thetford, Norfolk, some nice work in this loco. but rather spoilt by the excessive use of chrome plating and I am sure the crew would have complained of the green painted backhead. A 3½ in. gauge *Jubilee* 2-6-4 tank by Mr. C. J. Goulding of Newport, Mon. potentially a good looking model with a considerable amount of detail work, but some defects in motion work and finish. A 3½ in. gauge L.M.S. Class 5 by Mr. W. F. Graces of St. Albans suffered the same defects. A 3½ in. gauge *Juliet* by Mr. A. Gardner of Melton Keynes & a *Tich* by Mr. J. S. Dedman of Cheltenham completed the Locomotive Section.

In conversation with visitors at the Exhibition I had progress reports of a number of fully detailed locomotives in course of construction, and



A 7¼ in. gauge G.W.R. shunter's truck loaned by G. A. Eveniss.

no doubt we will see these in future years. This type of model takes many years to build and almost as much time in research into the prototype. I have no doubt we will see in future Exhibitions the high standards that give us so much pleasure, but this must not deter the average model maker as their work also gives a great deal of pleasure to the visitor.

Previously I have mentioned that it is always interesting to see part finished work in the loco. section, unfortunately no such models were forthcoming this year.

HOT AIR ENGINES

by W. D. Urwick

Part II *From page 144*

QUITE APART from the performance of the moving regenerator, the experiments gave convincing evidence of the desirability of keeping the power unit entirely separate from the heat exchanger with as little metallic contact as possible. In a model, plastic hose seems to be perfectly satisfactory as an air pipe between the two at these low pressures and a heat insulating baseplate is probably well worth while. The result of this treatment is that the power cylinder does not warm up at all and is probably benefiting from the fact that it is doing work and getting some cooling for this reason. There is then no piston expansion or lubrication problem.

One indication of the effectiveness of the regenerator is the fact that, after removing the supply of heat, the engine continues to run for about 60 seconds, compared with 10 seconds with a normal displacer.

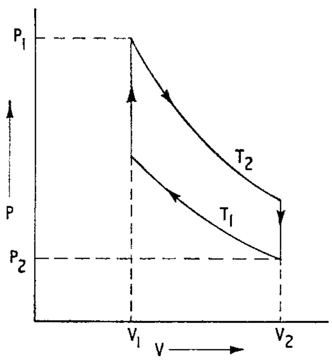
The long run after heat has been removed, together with the low water temperature and cool power cylinder would seem to indicate a very promising thermal efficiency. The regenerator is evidently holding in storage about six times the heat retained by the hot cylinder end when a normal displacer is used. From the fact that the regenerator is useless without the gauze wrapper, one can conclude that each of the gauze discs acts as a reservoir for its 13 deg. C. fraction of the temperature gradient and effectively removes the heat from the small box of air separating it from its neighbours and returns it again on the reverse stroke.

Compression Ratio

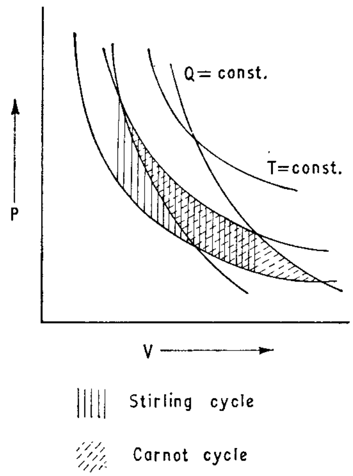
The ratio of about 0.133 seems to be a good working figure with the regenerator in use and is surprisingly low. A larger version of the engine was built using stainless steel tube of 1.5 in. O.D. for both heat exchanger and power cylinder, so that the ratio was brought up to about 0.2. It was found necessary, however, to increase the size of the flywheel so much in order to get the power piston over compression, that the engine reached only a fairly low speed with little power. As soon as the ratio of 0.133 was restored by fitting a smaller piston and cylinder, the excellent performance of the smaller engine reappeared.

This larger engine with a power piston 1 3/16 in. dia. x $\frac{3}{4}$ in. stroke and with a 10 oz. flywheel $2\frac{3}{4}$ in. dia. runs at a no load speed of about 1000 r.p.m.

From cold, the engine starts within 15 to 20 seconds from the application of heat and then steadily builds up speed and power over a period of just over 2 minutes by which time it can be presumed that the regenerator has acquired its working temperature gradient. Conversely, on



STIRLING CYCLE



turning off the heat, the engine continues to run for about $2\frac{1}{2}$ minutes on the heat stored in the regenerator. At atmospheric pressure the power output cannot be very great but if the engine were run at, say, 60 p.s.i. pressure and developed anything like four times its present output, it would be quite an impressive little machine.

These experiments, although on such a small scale, have provided convincing evidence that a rearrangement of the engine components in this way gives a promising new slant on the possibilities of the elusive and fascinating Stirling cycle.

POSTBAG

Continued from page 203

North Western engines, are in the safe keeping of Mr. Reg Hanks of Oxford.

I hope perhaps other owners of LBSC locos will follow Mr. Owen's lead and notify any change of ownership or a modification so that the identity is not lost for ever.

London, N.W.11. G. M. Cashmore.

Compounding

Sir,—I noticed Conrad Milster's remarks in Postbag December 6th when he referred to the peculiar method adopted for compounding I had mentioned in my article on Steam Evolution page 596. June 21st, but I think he rather misread the specification, or I did not make it clear enough, as he mentions "utilising tandem compound cylinders, but with each taking steam on only one side of the piston, or in other words, two single acting cylinders". I rather think he had in mind the patent system of Willans for single acting compound, and triple expansion quick revolution engines, later built by Willans and Robinson; these engines had piston valves working within a large diameter piston rod, the eccentrics being between divided connecting rods.

The patent of 1881 I mentioned, was nothing like so sound a proposition: the engine I alluded to had tandem cylinders of two diameters, the larger of which was open ended, and the piston of which acted as a crosshead, the connecting rod oscillating on a gudgeon pin within it. The cylinders were bolted together end on with a common cover between them, this being fitted with a metallic gland similar to that used later in Thos Green's tandem compound tractors. The larger single acting cylinder was nearest the crankpin, and the piston rod was common to both pistons. It must here be mentioned that the smaller diameter cylinder was double acting, inasmuch that the live steam power stroke was developed in it at the end next to the larger cylinder, and at an arranged point exhausted into a receiver connecting the lower pressure cylinder, and the other end of the smaller diameter cylinder together, to form the return power stroke. The two cylinders combined to form an expansive ratio of two to one roughly.

The valve itself would have provided a maintenance nightmare: it had two working faces at right angles to each other, and had separate exhaust ports to exhaust the steam from the live steam cylinder end to the receiver and from the receiver to the atmosphere during the live steam power stroke.

From the foregoing it will be seen that the one power stroke was obtained from live steam, (in one end of the small diameter cylinder), and the return stroke power was provided by the expansive effort of the steam in both the other end of small diameter cylinder, and the larger diameter cylinder acting as low pressure together.

This description is I am afraid rather involved, and I was rather disappointed that space was not available to allow the patent drawing which I submitted with the article to be printed. The drawings also included another version of the engine having a very complicated rotary cylindrical valve, driven by a "half time side shaft" exactly as a horizontal gas or oil engine. I ascertained that the side shaft actually had to run at half engine speed.

Finally I would say that there was a rather pathetic (to my mind) addition to the specification which stated that if the expansive effect of the steam was insufficient, arrangement for admission of live steam at the low pressure ends could be made. I imagine the condensation would be considerable.

Newcastle upon Tyne. E. H. Jeynes.

Dividing Device

Sir,—I read with interest the article by F. W. L. Heathcote (M.E. Vol. 140 No. 3500 P.1059) on a compact dividing device. By inference the detailed design shown on P.1061 would be suitable for a M.L.7 lathe. I would like to point out, however, that the M.L.7 headstock is drilled $\frac{5}{8}$ in. (although Myford literature indicates a 19/32 in. hole), and the O.D. of the mandrel insert to fit the headstock would therefore need to be a shade under $\frac{5}{8}$ in. rather than the 19/32 in. shown in the figure. Unfortunately I found this out the hard way!

Claygate, Surrey. John Catchpole

Beam Engine

Sir,—I am writing to tell you about my *'VULCAN'* non-condensing beam engine which I built when I was 11.

I purchased a superb set of all gunmetal castings from Messrs. A. J. Reeves & Co. Birmingham. My Dad let me use his Myford lathe which he has at his workshop. I started work on New Year's day 1974.

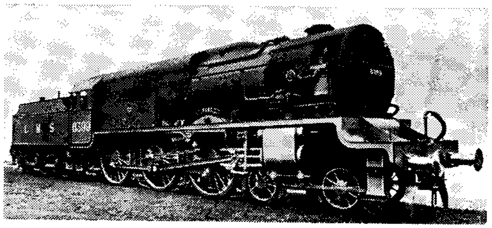
The flywheel was the most awkward thing to machine as it wouldn't fit in either of the chucks on account of the boss on the wheel. I finally got over the problem by putting it on the faceplate and securing it with three dogs.

The diameter of the shaft hole is 7/16 in. so I drilled the hole while the flywheel was still on the faceplate. To true the wheel up perfectly I put the 7/16 in. shaft through the hole and having now machined off one of the bosses. I could hold the flywheel in a 7/16 in. collet.

I managed the other part alright and I finally finished it in July. I was working each Saturday morning 9-12. I calculated that I spent about 100 hours on it in all.

I now need to construct a boiler. Could any of your readers tell me of a suitable size for an engine of 7/8 in. bore x 2 in. stroke. I would be very glad of any help.

Solihull. Simon Fisher (age 12).



"FURY"

A High Pressure Compound Locomotive for 5″ gauge

by Martin Evans

Part VII

The outside cylinders

From page 133

THE OUTSIDE CYLINDERS for *Fury* are very similar to the inside cylinder, except that there is no receiver or simpling valve of course. There are minor but important differences in the valves and the valve liners.

In order to provide a reasonably easy method for attaching the exhaust pipes, the exhaust passages from the steam chest are milled right through from the back, and as they will be covered by a "gasket" of Walkerite or similar steam packing sheet and then by the engine frame, there should be no need to plug their openings. A central hole, 5/8 in. dia. and 1 in. deep is drilled as shown, and the exhaust pipes are attached by a flanged "elbow" fitting, which I will detail later on.

Before bolting the cylinder to the frame therefore, it will be necessary to drill two holes in the frame, 3/16 in. dia., each side of the 5/8 in. dia. hole marked "B" on the drawing, at a spacing of 1 in. As far as the cylinder is concerned, connection between the milled exhaust passages and this 5/8 in. central hole is made by two holes drilled at each end, as close together as possible, which are then tapped and plugged 3/8 in. x 40t.

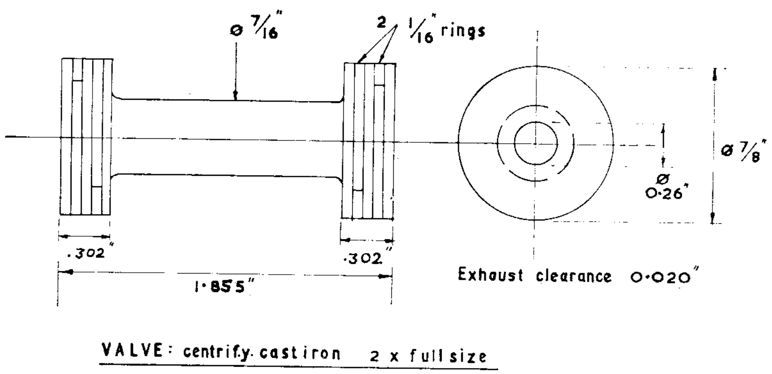
It will be noticed that the rear section of the valve chest liners has the same large diameter boss as the front, whereas on the inside cylinder, the rear liner boss is considerably smaller in diameter than the front boss. This is because a recess is provided in the outside rear boss to receive a plate to support the valve spindle guides. Details of this later.

The piston of the outside cylinders is longer than that of the inside, to reduce the clearance volume, and the exhaust clearance provided for the valve is less- at 0.010 in. rather than 0.020 in.

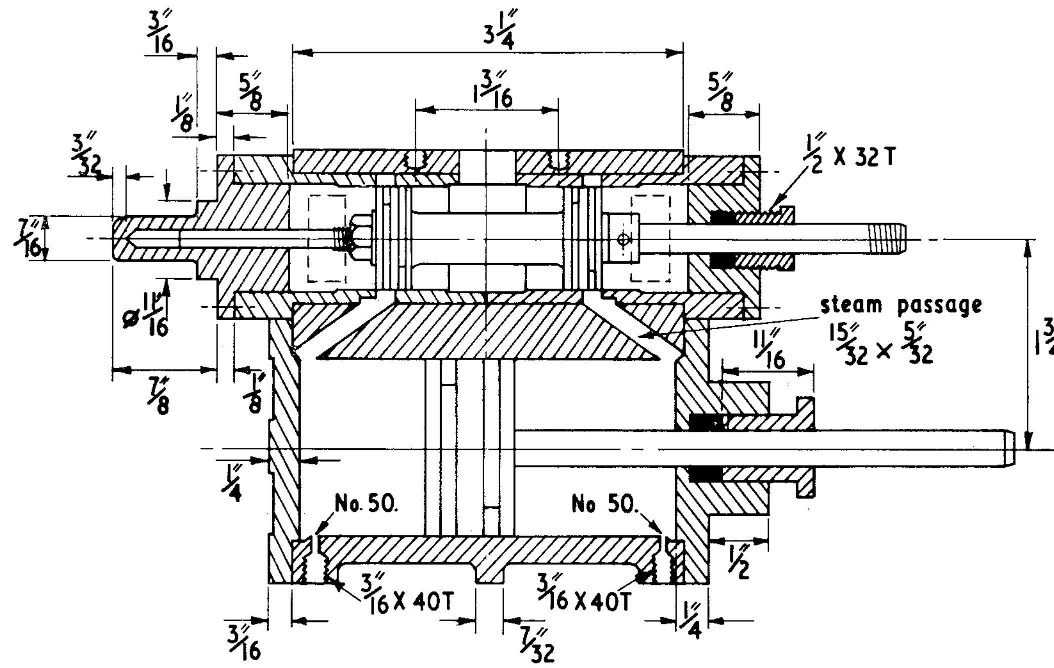
As gland adjustment is much easier on the outside cylinders, a proper studded gland has been specified, with the studs at 45 deg. which should make access particularly good. Another point is the use of countersunk screws above and below the slide bar attachment points (one above and two below) which should make the fitting of the slide bars much easier.

The usual two drain cocks can be fitted this time; these will be positively operated by a system of rods and levers. I have not shown plugs for valve setting purposes, but these may be provided for builders who prefer to set their valves visually. They could be at least 3/8 in. x 40t. or even larger and they should be drilled on the longitudinal centre-line of the valves, with their centres coinciding with the inner edges of the steam ports.

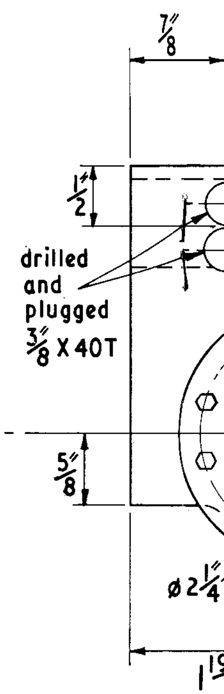
The valves spindles are similar to that provided for the inside cylinder, though a little longer. A shallow "flat" is filed on the front end, to prevent water being trapped in the front steam chest extension.



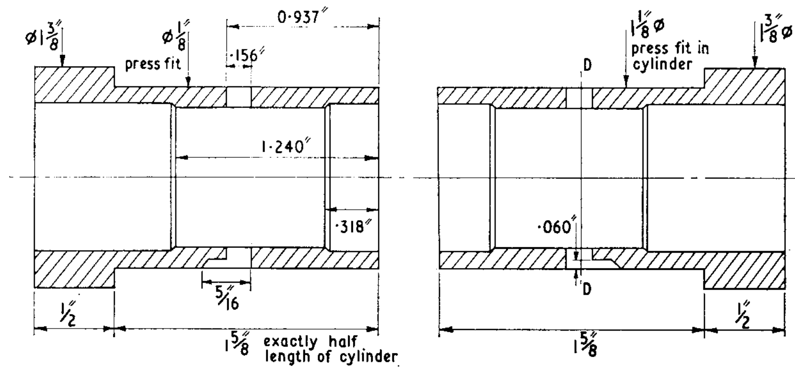
The valve for the inside cylinder. See 7 February issue for details.

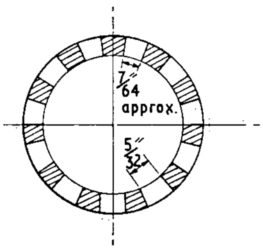


SECTION OF OUTSIDE CYLINDER



FRONT OF

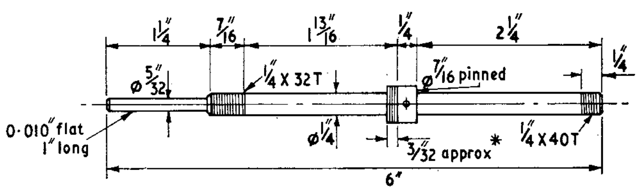




Section DD

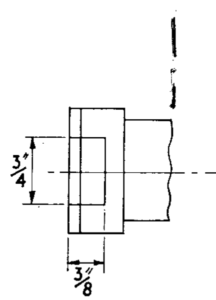
VALVE CHEST LINERS FOR OUTSIDE CYLINDERS two pairs c/cast iron (2 X F/S)

(see scrap detail for rear liner and cover)



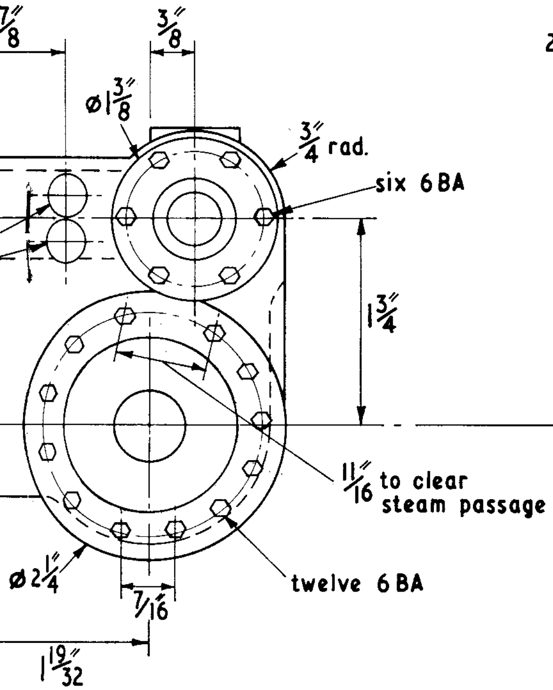
OUTSIDE VALVE SPINDLES stainless steel

*Group of washers 7/16 ø 2 to 25 thou thick for valve setting

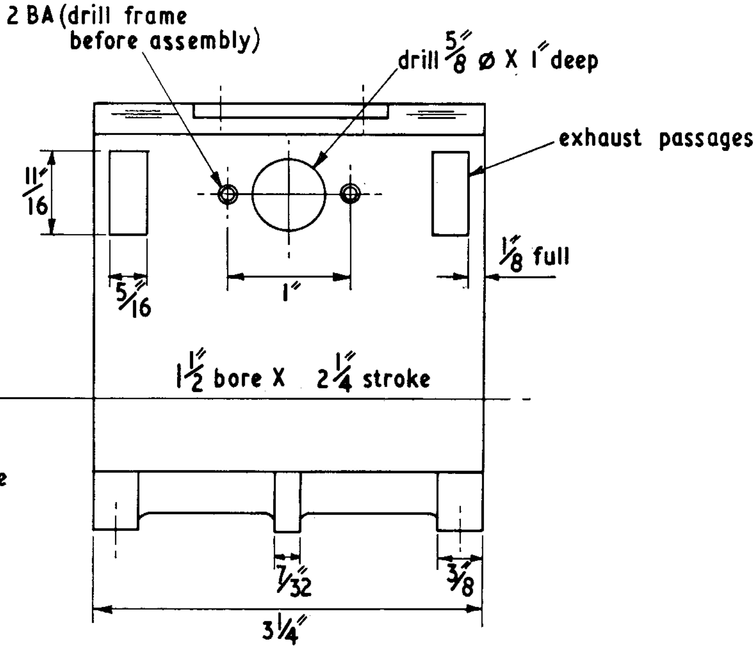


REAR VALVE CHEST

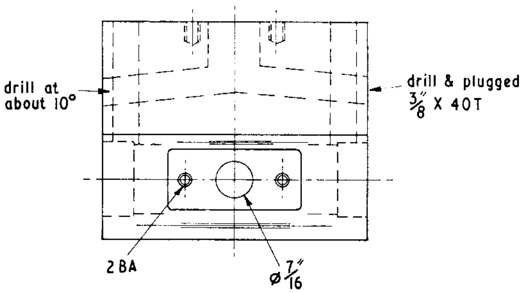
(to show recess for



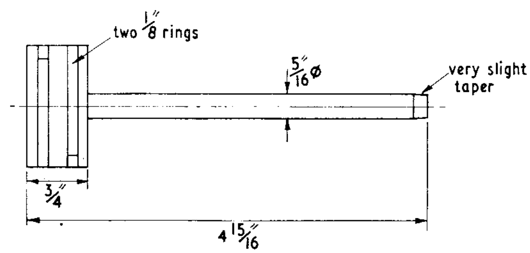
NT OF L.H. OUTSIDE CYLINDER



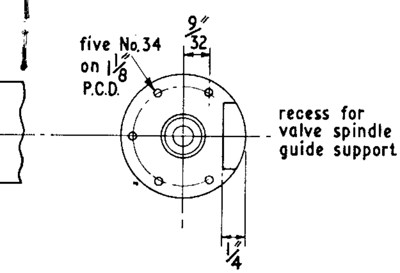
BACK OF OUTSIDE CYLINDER



PLAN OF OUTSIDE CYLINDER

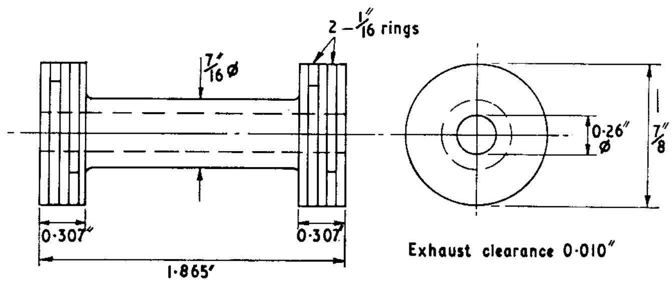


PISTON C.I. ROD stainless steel



E CHEST LINER AND COVER

ess for valve spindle guide support)



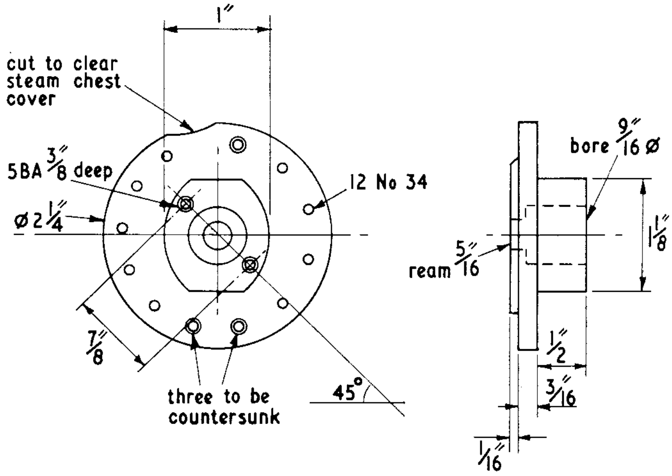
VALVES FOR OUTSIDE CYLINDERS centrif/cast iron (2X FS)

Those building the normal "Royal Scot" class locomotive *Royal Engineer* can use these cylinders without any alteration except for one small point —there is no need for any exhaust clearance, so the overall length of the valve will be 1.875 in. and the length of each valve bobbin or "head" will be 0.312 in.

Digressing for a moment, I have been very interested in the comments about the "Royal Scots" and the G.W.R. "Castles" in "Postbag" recently. I think that it was a great achievement on the part of the North British Locomotive Company to build the "Scots" more or less straight off the drawing board, though to achieve this, the Company obviously had to use some standard details from existing Derby practice, such as the 4-bar slide bars, which I mentioned in my last article, and the none too efficient Midland main axlebox.

When first put into traffic, the "Scots" proved very efficient. Fowler put out a claim that on a drawbar-horsepower-hour basis, the first "Scots" were lower on coal than the G.W.R. "Castles", but this was afterwards found to be an error, due to some incorrect figures produced by the dynamometer car used in the tests. But the biggest drawback to the "Scots" as built was surely the valves, with their single wide rings. These were steam tight when first fitted, but after a very small mileage, began to leak badly.

The "Rebuilt Scots", thanks to many important modifications introduced by Stanier, were a great improvement, and undoubtedly were among the very best 4-6-0's seen in this country, but I certainly could not agree that the G.W.R. "Castles" would not have stood up to the hard work of the L.N.W. section of the L.M.S. The "Castles" had a better all-round record than the original "Scots"; while the performance put up by the very last series of "Castles", when fitted with double chimneys, with draughting by S.O.E11, and high superheat with mechanical lubrication was second to none.



REAR COVER: outside cyl — L.H.

To be continued

Building a Horizontal Engine

Part IV

by "Tubal Cain"

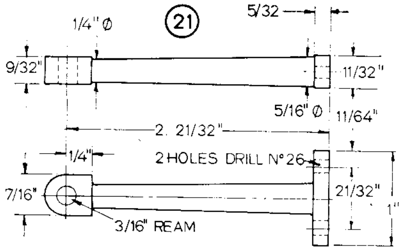
From page 128

CONTINUING WITH THE assembly of the crosshead and its slide, tighten up the bolts and clamps a bit more each time until towards the end, all is hard up. This may seem a tedious job, but I think you will get a great deal of satisfaction out of it; after all, when you have finished, and it is right, YOU have done it all — it's your skill, not some machine copying the accuracy the makers have put into the bed, that has achieved success.

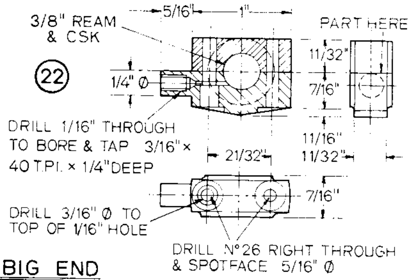
Now, if on the first assembly you find the rod butts against the LOWER edge of the hole in the gland, you need a putting-on tool; and even KRW at New Mills hasn't offered one of these yet! The solution, however, is to add a refinement to the design. Most "real" engines of this sort had provision for adjusting for wear on the crosshead, and you must do the same for this one. Machine about 1/16 in. off the face of the crosshead slipper, as truly as you can manage, and attach a piece of brass or gunmetal with a couple of well countersunk 8BA brass screws. In addition, drill for and fit a brass dowel, 1/16 in. dia. — two if there is room, but I think you will find there isn't. Make sure the csk screws don't stand proud. Bed this as I have outlined above. Now, when the crosshead wears, as it may if you use the engine to drive the lathe, all you have to do is to remove the false face, fit a shim, and replace.

Crosshead pin Part 18

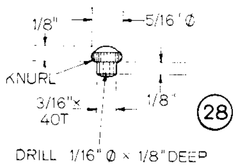
This is a straight turning job, but make the 3/16 in. dia. a very good push fit in the crosshead,



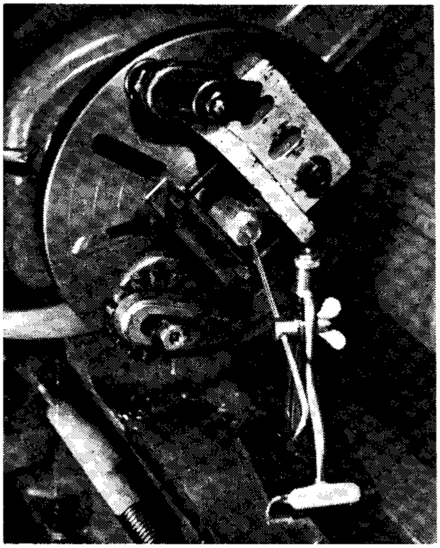
CONNECTING ROD



BIG END



OIL HOLE CAP FOR BIG END

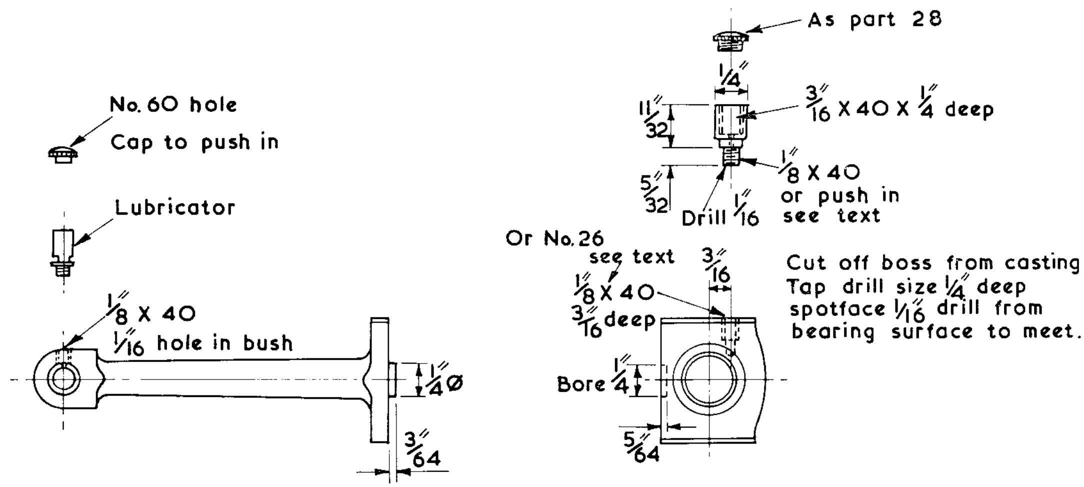


Left: Fig. 13 Setting up the cross-head for boring.

even if this means it will be oversize; not shown on my alteration sheet is the fact that I fitted a bush to the little end of the connecting rod (it appears later) and this can be bored to suit. Note that the length of the pin must be such that when tightened the nut does *not* nip the cross head, clearing by a couple of thou. The peg will stop it turning. I casehardened the shank only (not the thread) with Kasenit, and this only needed polishing afterwards. Sometimes you may get a pitted surface after this operation, but I was lucky. Don't be tempted to make it of silver steel and harden it; even if tempered to blue, the thread will probably snap off.

Connecting rod Part 21

Two modifications are shown here. The small end is, as already mentioned, fitted with a little bush, and a lubricator. The foot of the big end is provided with a spigot which fits into a recess to be provided in the brasses. This makes it easier to hold whilst machining and also aligns the brasses to the rod without depending on the bolts.



MODIFICATIONS TO CONNECTING ROD Fig. 14

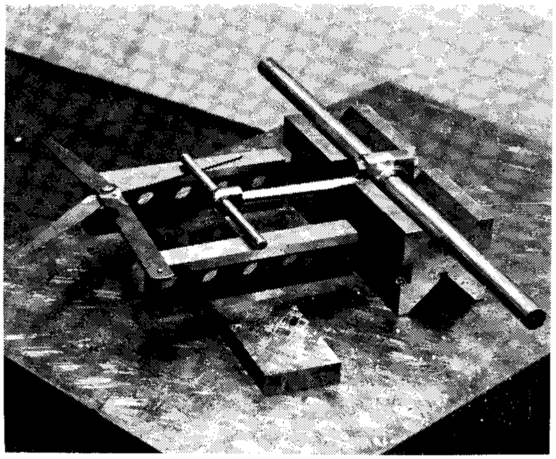


Fig. 15: Checking connecting rod alignment.

Trim up the forging, and inspect it to drawing— it may need straightening. The material is a free-cutting mild steel, and handles easily. Grip by the small end in the 4-jaw, with the adjacent shank as true as may be, and set the foot end running true. Bring up the tailstock chuck with a centre-drill into contact with the foot before starting the lathe, and drill a reasonably deep centre. Support this in the tailstock and machine the foot to diameter, and almost to thickness, but leave a pip 11/32 in. dia. (This acts as a guide to machining the width of the foot, as well as providing material for the spigot). Rough turn the taper — this is about 3/4 degree set-over on the top-slide; leave about 10 thou or so on for finishing later.

Fit the 3-jaw, and grip the 11/32 pip; support the end of the machined taper in the steady and when true, centre the small end. Support in the tailstock, and machine the boss to **7/16** in. dia. (The drawing shows this flat, but many prototypes I have seen had turned small ends). This time leave a 9/32 in. pip on the end, as a guide for the flats at the sides. Remove from the lathe and either file or mill the foot and the small end flats, taking care that these are in line. Return to the lathe and finish the thickness of the foot and the taper, making nice fillets at the junctions with the feet and small end boss. Reset the top-slide. Turn down the pip to form the ¼ in. spigot at the large end, but leave it a bit longer than shown. Reverse, finish form the small end and turn off the pip at this end — there should still be a trace of centre left in — if not, deepen it first. Reverse again, but between centres this time, and turn the spigot to size. Whilst in the lathe, set the flats vertical with a square and mark out the horizontal CL for the small end hole. Remove all burrs.

Big end brasses Part 22

The casting for the cap comes with the lubricator boss cast on. I sawed this off — it makes a very tricky machining operation — and substituted a lubricator cup. Dress off the castings, file or mill the joint faces and clamp together. Mark out, using the joint face as datum. Set up the rod half either in the 4-jaw or in a vice on the faceplate, the joint face true to the chuck jaws or the faceplate, and with the centrepop on the centrelines running true. Machine the face and the recess a good fit on the spigot of the rod. Mark out for the two bolt-holes whilst in the chuck. Remove and drill the bolt-holes in this half No. 28 (smaller than the drawing). Solder the two halves together and drill the other half. Clamp up to the rod, and drill this also. Follow with No. 27 and then No. 26 drill; mark adjacent parts. (This mark will need repeating after machining). Fit temporary bolts and pull up tight.

Grip the assembly very lightly in the 4-jaw by the small end and set the whole true — use a steady if need be. Very carefully centre the big end cap from the tailstock. Fit a carrier and between centres machine the O.D. of the big end, and partially form the profile, leaving a 7/16 in. pip to act as a guide when machining the side faces. Now set up the faceplate and mount the assembly with the big end centred, packing behind, and drill and bore (or ream) the bore. You can machine one face of the bearing too, if you like, but better to transfer all to a ⅜ in. mandrel for this job. Machine the faces till the tool just brushes the guide pip, and then reduce the width of the body till the tool just brushes the foot of the rod. Reverse the mandrel and repeat for the other side. The width should be a few thou over rather than under-size on width. Whilst still on the mandrel in the lathe you can use a surface gauge to mark out for the centre of the little-end hole. The centre-to-centre distance between bearings is 3 in., so if you set your vernier height gauge or scribing block to ½ in. above lathe bed (on a 3½ in. machine) and square up the rod to the bed this job is easy and accurate.

You can either set up all on the faceplate again to drill the small end and bore or ream to choice, or trust your drilling machine. I did the latter, and found the hole a little out on checking! Make a little bush of gunmetal or cast bronze (not drawn P.B.) the bore a smooth fit on the pin (part 18) and the O.D. a tight fit in the reamed hole in the rod. This will tighten the bore on the pin, when you press it in later, but don't worry; it will bed in. File up the bottom brass where the remains of the pip lie — or machine it off if you like. Unsolder the two halves and clean up the joint face. Counterbore the nut faces if not already done, and with a scraper put a light bevel on the ends of the bore. (Don't make this too large till you have made the crank). Make the little lubricator as shown in Fig. 14. Drill a No. 26 hole 3/16 in. deep for it and follow 1/16 in. right into the bore. Take off the burr. Find the bolt and mark it for this side of the big end. Push it through its hole and mark through the 1/16 in. hole to scratch the bolt. Set it up in the 3-jaw and machine a groove 3/32 in. wide and to the depth of thread for 4BA (15 thou deep) to let the oil get past the bolt. You can use another similar but smaller oil cup for the small end if you like, or just drill a countersunk 1/16 in. hole.

To inspect the rod, set up as shown in Fig. 15. A piece of ground stock or silver steel through each bearing, ¼ in. in the small end and ⅜ in. the other. If the rod shows a twist — as that does in the photo, about 3 thou — you can adjust a small amount in the clearance in the bolt holes, but if larger you must twist the rod. DON'T do this with the brasses in place; grip the foot of the rod and twist with a bar in the small end. This corrected (an error of less than ½ thou per inch length of test rod is allowable) set the assembly up vertically and measure the distance between the ends of the test rods along the axis of the rod. This is most easily done by using a dial gauge on both top and bottom rods — it is the DIFFERENCE in length we are looking for. If the two are not the same, then the bores are not true laterally. The rod is bent to correct this. Go gently, for we are not expecting a great error, and it doesn't need much force to shift it. The allowable error here is about the same as that in the other plane, but naturally the closer the better. (½ thou per inch means that when assembled, the engine crankshaft will shift in its bearings by about ¾ thou; OR, the small end of the rod will flap sideways in the crosshead by 1½ thou every stroke. So, though ½ thou/inch doesn't sound much, it is, in fact, rather a lot!).

You can now press in the small end bush, fit the lubricators, clean up the heads of the big end bolts, and assemble all together. If you haven't already marked the mating parts, do this now. Don't try to fit the small end to the crosshead yet, as this is best done when the crank is available and set in its bearings.

To be continued

ERRATUM

In the drawing of the bedplate, part 27, on page 93, the two dimensions of 5/16 in. from the centre-line should be 15/16 in.

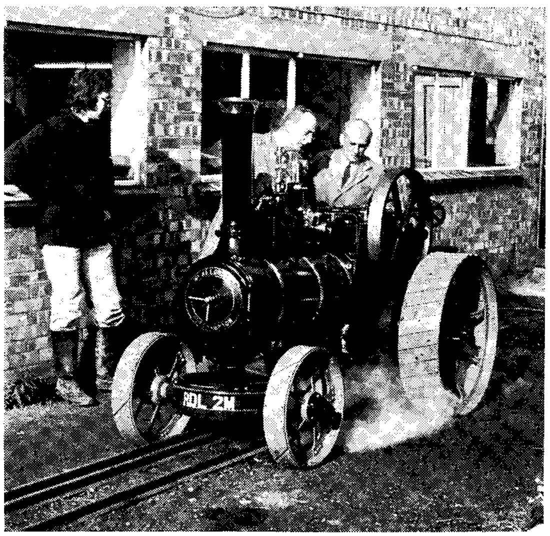
TWO LARGE ALLCHINS

described by W. J. Hughes

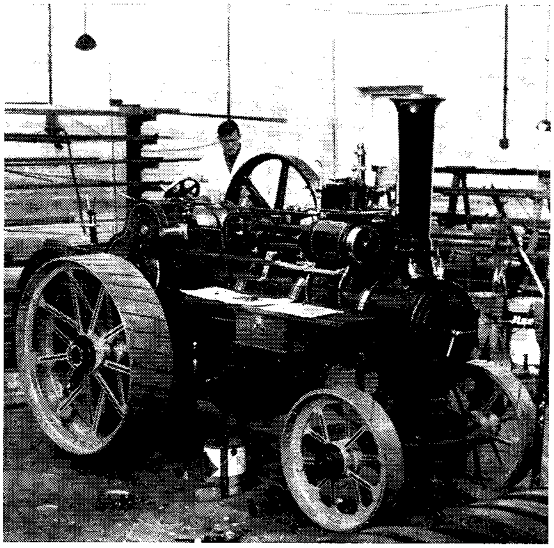
RECENTLY I HAD the pleasure of visiting Severn-Lamb Ltd. at Stratford-on-Avon in order to inspect two 6 in. scale Allchin traction engines which the firm has built for private individuals. They were not quite complete when I was there, but by the time this appears their new owners should be in possession.

Certainly an Allchin is very impressive in this size, with the polished copper chimney cap at about eye level and the rest in proportion. Many folk, of course, would say these were not models at all, but full-scale engineering jobs—however, each to his own taste. For my part, I think 3 in. scale is too big for a model, but who am I to say? It must be admitted that to have one of these 6 in. scale jobs in my garage would give me a considerable kick!

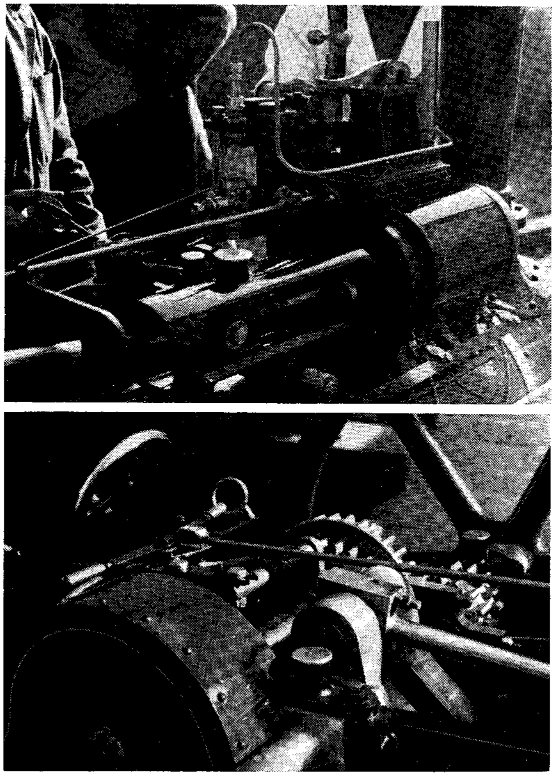
The two engines are virtually identical, both



having been built by scaling up my own 1½ in. scale drawings by four to one. One difference from my arrangement is that a balanced crank is fitted instead of the correct bent-from-the-round-bar' appearance. I did not like this personally as not true to prototype, but it was to the customers'



One of the engines nearing completion at Severn-Lamb's works.



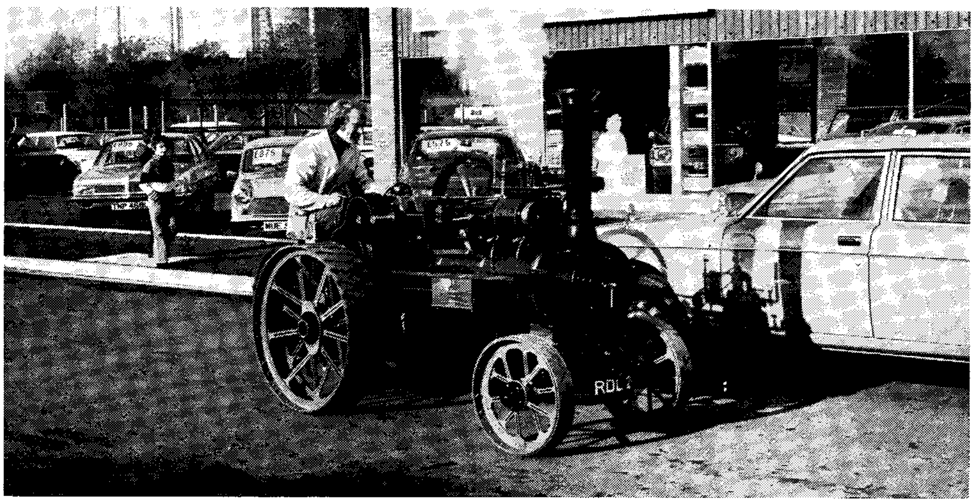
Two close-ups of some of the motion parts.

orders, to try to eradicate some at least of the oscillation which occurs when the motion is running free.

The big ends too are of the marine type instead of the correct strap and cotter type, and I thought them ugly—but again he who pays the piper . . . The gear ratio has been increased, but this only shows in the dimensions of the gear guard which few onlookers would notice. However, I think that in practice there will be found to be more speed in fast gear than the steersman can cope with adequately.

A considerable amount of pattern making was involved and for example the steam ports are cast into the cylinder. This is of 4 in. bore by 6 in. stroke. The boiler is of welded construction in steel, with the valves set to blow at 100 p.s.i. and the hornplates are bolted through the stays.

The wheel hubs are built up in a similar manner to the $1\frac{1}{2}$ in. scale ones, and the tee rings are fabricated by having steel plate rings (on edges) welded inside rolled up plate rims. The strakes are riveted on, but also are tack welded



Out on the road, the big Allchin showed a fine turn of speed.

for extra security. They are to be clad with rubber tyre segments cemented to rolled steel plates bolted on outside the strakes.

Different liveries have been chosen by the two customers. One is in the standard colours for *Royal Chester*, crimson with vermilion wheels, whilst the other is is green—about Great Western colour—with orange-vermilion wheels. Both are lined out in black and yellow, and both look very attractive.

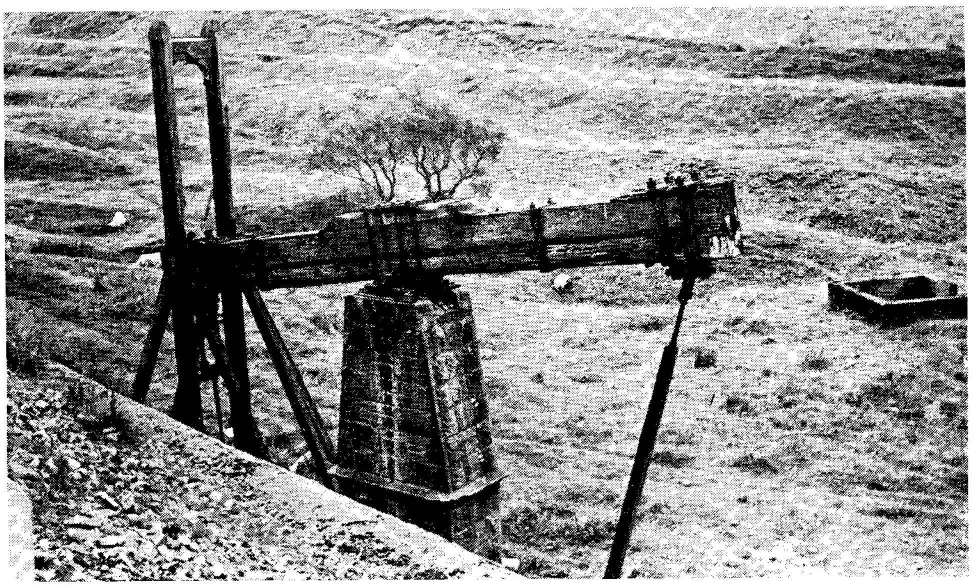
I first saw and heard one of the engines tried out under compressed air, and she had a very nice even beat which, with the wheels jacked up and the brake partly on, sounded really beautiful.

Later on, with the engine outside the workshop on a lovely autumn morning, the first was lit and steam raised. No attempt was made to hurry, as this was the first time of steaming and an eye had to be kept on everything. Natural draught was used, but in about forty minutes it was possible to use the engine's own blower and it seemed only a very short time before the needle was up to eighty.

Now came the crucial moment. The flywheel was turned to bring the crank to the top, the regulator was opened gently, and away she went, running free and easy with a nice musical "tum-tum-tum" in the chimney. Careful checks were made, with a gland adjusted here and a nut tightened there, and much stopping and starting, both in forward and reverse. But all was satisfactory—a tribute to the wav the engine had been built and assembled.

Then came the second crux. The driver climbed aboard, the slow gear was engaged and the brake released, and she was off slowly down the driveway. Two or three turns up and down, and then it was into the road outside the works, where she was put thoroughly through her paces. And the performance in slow speed—at least six m.p.h. at a moderate regulator opening—did seem to indicate that she will be very fast indeed. But time will tell whether all the speed will be usable!

Certainly a very good time was had by all, and I look forward to being there when the next steam road vehicle is tried out at Severn-Lambs in perhaps six months' time. It is to be a 6 in. scale Burrell showman's engine!



THE WANLOCKHEAD BEAM ENGINE

by Frank Jackson

IN A LETTER published in the issue of *Model Engineer* for 9th June 1938 a reader who had recently seen a derelict pumping engine at Wanlockhead lead mines, Dumfriesshire, expressed curiosity as to how it had once worked.

The engine still exists and recent historical research, combined with information obtained from a study of its remains, has provided enough data for me to make a one-eighth scale model of the engine which works quite well.

Description of the Engine

The Wanlockhead Beam Engine is the only water-bucket pumping engine still to be seen on a mine in Britain. It has a wooden beam 26 ft.

4 in. long, 2 ft. deep and 11 in. wide made up of two baulks of pitch pine which are bound at the ends and centre with wrought iron straps. The beam is mounted on a pillar of dressed freestone 14 ft. in height and measuring 7 ft. by 3 ft. at the base. It has a carved cornice and is similar in style to some 19th century railway bridge columns.

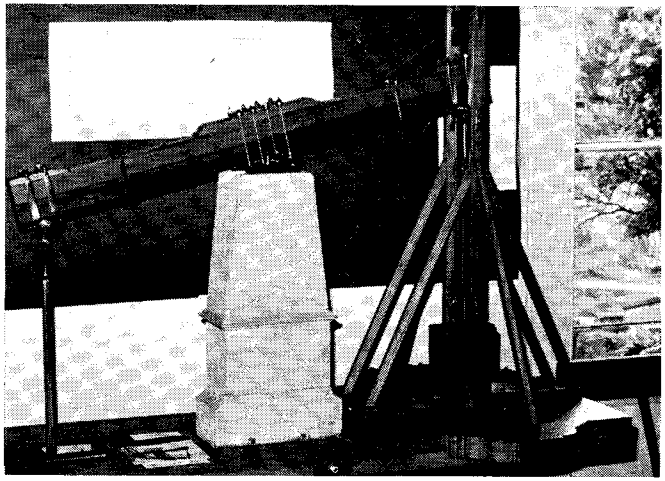
The beam has a sawn-off wooden pump rod spear at one end, and a crosshead that once carried a wooden bucket at the other end. Power to work the engine was obtained by alternately filling and emptying the bucket.

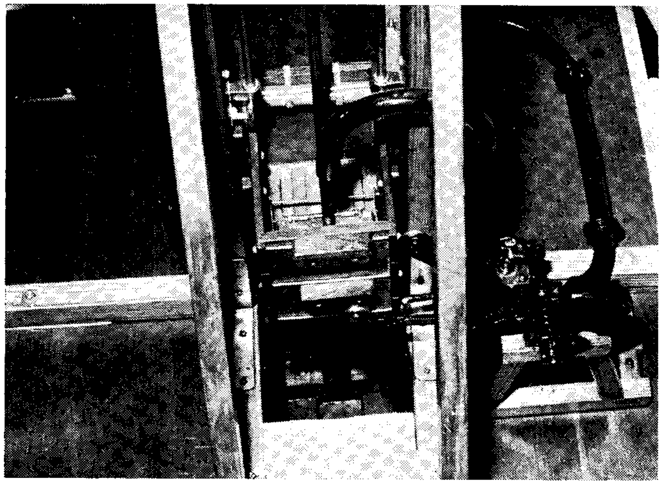
When at work, the beam pivoted on a trunnion of ingenious design in which a cast iron support plate is jointed into a massive wrought iron axle. The latter turned in stepped plummer-blocks on split brass bearings. These blocks sit on bearing pads which are anchored to the pillar by long tie rods which pass through the pillar and are secured at the base by cotters.

At the power end, the crosshead that guided the rod to which the bucket was attached moved inside a high wooden 'steeple' and is itself an iron forging with brass bushes in each end. These bushes moved on guide rods attached to the steeple uprights. The two connecting rods which fasten the crosshead to a universal joint at the end of the beam have strapped bearings of the type once used on steam locomotives.

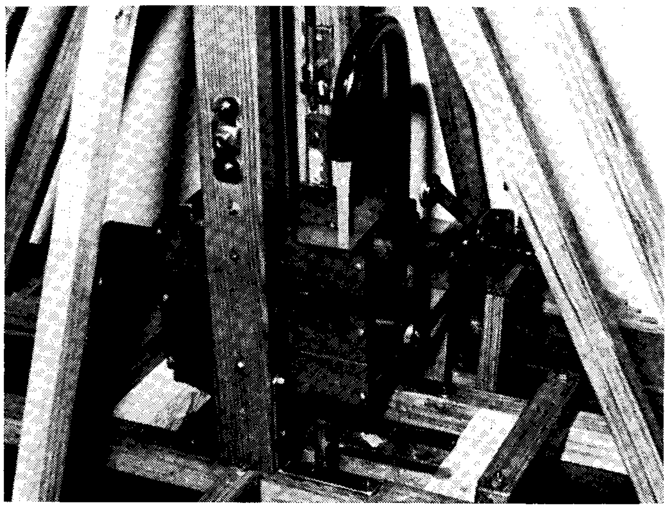
The bucket rod is 12 ft. long and has a round plate 9 in. diameter at the bottom which supported the bucket. The stone-lined pit into which the bucket descended is 6 ft. deep and has a natural rock floor. The pit has a drainage hole through which water from the bucket flowed to a nearby stream. Two iron-faced guides fixed to the inside of the steeple uprights reach into the pit to hold the bucket steady as it travelled up and down. Nothing remains of the wooden bucket, the valve which opened in the bottom of the bucket to release the water, or any mechanism which may have been used to control the flow of water supplied to power the bucket.

The wooden bucket was filled from a cistern on the hillside above the engine. The weight of the full bucket being greater than that of the weight of the column of water above the mine pump piston, the bucket fell, raising the pump spear and lifting the column of water through the pump pipes to be ejected into a drainage level. When the bucket reached the bottom of the pit a valve opened and the water was dumped out. The balance of the engine was adjusted, by using lead weights, in such a way that the pump spear and piston were heavier than the empty bucket which was raised again when the pump piston fell to complete the cycle.





A view of the model from above the bucket. Below: Side view of model showing a 3/4 full bucket almost ready to descend.



Water-bucket pumping engines had their origin in attempts to make 'perpetual motion' pumping machines long ago, and by the end of the 18th century they were successfully used throughout Britain on coal and metal mines, especially in Cornwall where their use on shallow shafts was commonplace. Little has been recorded about them in the past but interested readers may consult a history of these machines and their development which was published in *Industrial Archaeology,* Vol. 10, May 1973. It was at the suggestion of the authors of that article, G. Downs-Rose and W. S. Harvey, that I decided to attempt to make a working model of the Wanlockhead engine.

To date no reliable description of the Wanlockhead engine at work has been found. But the history of the workings on the lead vein which it drained is fairly well documented. The Straitsteps Vein on which the shaft is sunk was first worked about 1680, and lead ore was won intermittently till the end of the 19th century. Throughout its life the mine was subject to flooding and in its busiest period, during the 18th century, two water-wheel pumping engines were in constant use. In the mid-19th century the old workings were sealed off to keep the working part of the mine dry, but water seeped past the dams through the country rock and the water-bucket engine appears to have been built at that time to cope with the seepage which, although not great, as in a leaking ship had to be dealt with. Such an engine, working steadily for 24 hours a day without the need for constant attention would be a cheap, effective answer.

No precise date as to when the engine ceased to work has been found. The *Model Engineer* reader in 1938 was told 'over 50 years ago'. A photograph taken in 1906 shows it in a deteriorating state while an earlier one taken in the 1880's, which gives a distant view of the engine, shows a blurred image of the beam, as if the latter were in motion at the time. Neither photograph gives a clear view of the steeple mechanism.

The Model

From the depth and area of the bucket pit and the estimated 9 ft. movement of the crosshead and bucket rod it has been possible to calculate that the original bucket measured about 38 in. in length, 24 in. in width and was 30 in. deep. The centre line of the pit is several inches to one side of the centre line of the crosshead and bucket guides, leaving a gap of 10 in. between the bucket and that pit wall which is most distant from the beam pillar.

This gap prompted the idea that some mechanism associated either with the operation of filling the bucket or with emptying it, or both, moved in the space. As no remains of the bucket or its valve were found during the excavation of the pit and any control mechanism for filling the bucket has long since been scrapped, the choice of possibilities made reconstruction in the model a little daunting.

However, the common method of dumping water in such machines was to fit one or more flap valves in the bottom of the bucket. These were opened when the bucket reached the bottom of its travel either by chains, fastened at one end of the flaps and to the engine superstructure, or by the flaps striking pins or blocks in the pit bottom. The latter arrangement has been adopted in the model and it works quite satisfactorily.

The feed water from the cistern on the hillside may have been allowed to flow unchecked into the bucket, and trials using this method of supply to the model engine proved successful. But surface water at the Wanlockhead mines was scarce and great efforts were made to conserve it for driving pumping and smelting machinery during the 19th century, and it is more probable that some simple control was used for economy of water and labour.

The mechanism devised for the model, although conjectural, meets these requirements and utilises the space between the bucket and the pit wall. It consists of a forked lever which takes its motion from the bucket by the arms of the fork engaging alternately with two cams attached to the end of the bucket. The movement of the forked lever turns a second lever through a shaft and opens and closes a piston valve in the water supply pipe. In the model the piston valve also works to bypass the water supplied from a storage tank below the model by an electric pump once the power bucket is filled and begins to descend. Likewise, after the bucket has emptied and begins to ascend, the forked lever opens the piston valve and the supply water flows once more.

In the original engine, the wooden spear rod at the work end of the beam was connected to the piston of the mine pump and lifted water to a drainage level 90 ft. below the shaft collar. Given a bucket of the size estimated above, which would hold about 750 lbs. of water, and assuming mine pumps of 7 in. dia., which was a common size at these mines, the engine was capable of lifting water more than 20 ft. to the drainage level. To meet the requirements of space, the spear rod in the model is foreshortened considerably and, to compensate for the lost weight of the spears the rod was made of steel and veneered with pine wood. The model spear connects to the piston of a pump which is 1 in. diameter and 1 ft. long. At the foot of the pump pipe is a bottom clack-piece pipe in which a flap valve holds the head of water in the pump pipe during the descent of the piston when the empty bucket is rising.

In work, the model engine makes two strokes per minute and with each stroke the mine pump lifts one-sixth of the weight of the water taken to power the bucket.

The model is now on permanent loan to the Museum of the Scottish Lead Mining Industry at Wanlockhead and was on display to the public for six weeks last summer during which time it worked without trouble and required no maintenance apart from occasional lubrication.

The original engine has been taken into guardianship by the Secretary of State for Scotland recently and once restored by the Department of the Environment which is responsible for its future preservation it will provide a unique relic of mine-pumping history for visitors to see, and I wonder if the letter-writer of 36 years ago will be among their number?

HUDDERSFIELD EXHIBITION

Reported by "Northener"

AT THE EXHIBITION of the Huddersfield Small Locomotive Society, one of the first models to catch my eye was the 3 in. scale Foden 6 ton end-tipping wagon being built, and very nicely too, by Jack Sykes of Golcar. One advantage of its not being complete was that one could see the typical Foden steam porting, where the inlet ports were close to the ends of the valve face, to reduce clearance and so waste of steam. The model was fitted with hydraulic tipping gear.

Close by was P. Robinson's 3 in. scale Burrell, demonstrating its power by driving an 8 in. circular saw. It became obvious that with this handsome and reliable prime mover the club will have no difficulty in sawing up sleepers for the new track which the members hope shortly to commence building. In passing, it may be mentioned that the track will have a length of 1120 ft. with a maximum gradient of 1 in. 100, and a minimum radius of 50 ft.

Also near at hand was David Waite, cleaning Jack Sykes' 0-6-2 built to the $3\frac{1}{2}$ in. gauge LBSC *Mona* design. On the previous day this engine was steamed on the portable track for six hours non-stop, and was being prepared for another similar spell. One notices that quite recently several examples of this engine have cropped up, no doubt encouraged by re-publication of the "words and music" in booklet form.

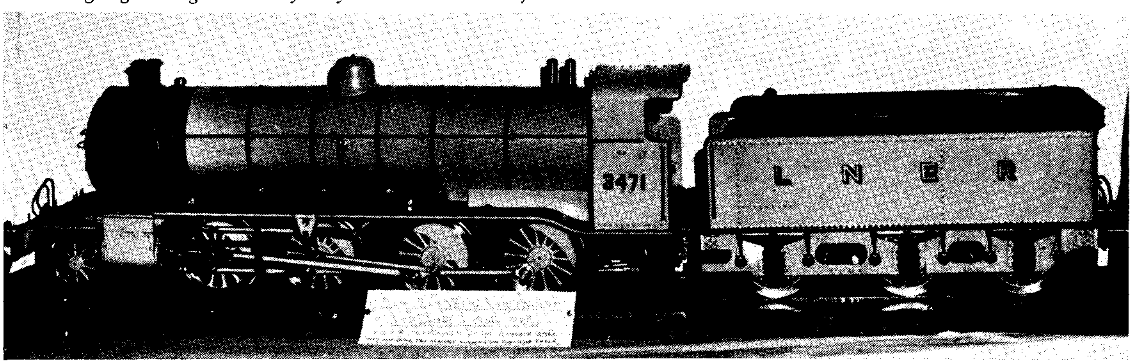
David's own $3\frac{1}{2}$ in. gauge 4-6-2 side tank locomotive *Bessborough* stood by, and an unusual feature of this was that its boiler barrel once formed part of a main steam pipe on a very famous cruiser. This is a nice model of a handsome and well proportioned prototype.

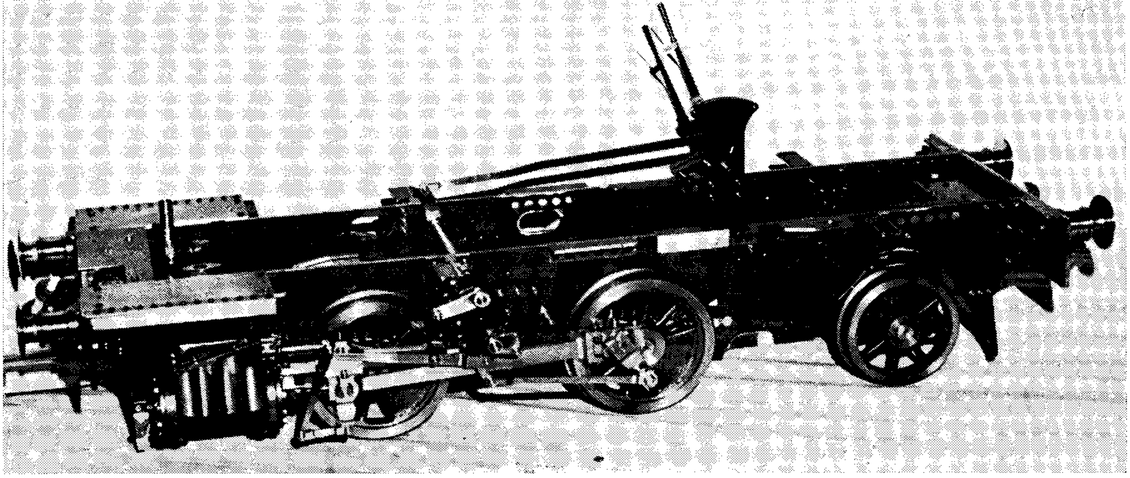
The same can be said of P. Jackson's 5 in. gauge Midland Railway single-wheeler, though I thought the colour was not quite right. The inside cylinders had the valves beneath, at a slope, and they were driven by Stephenson valve gear. This was a very creditable and unusual first attempt.

From F. P. Jackson of Rochdale came a good example of Martin Evans' 5 in. gauge design for the ex-G.N.R. 2-8-0 goods engine, which also is being seen in increasing numbers. Mr. Jackson's engine has done two seasons' running on his club track, and I was told it performs with distinction.

Also in the Rochdale contingent was a first class 2 in. scale model of a Wallis and Steevens 8 ton steam roller, built by S. Jackson. This "Advance" design was fitted with two high pressure cylinders and small internal flywheels to

A 5 in. gauge "Nigel Gresley" by F. B. Jackson of Rochdale.





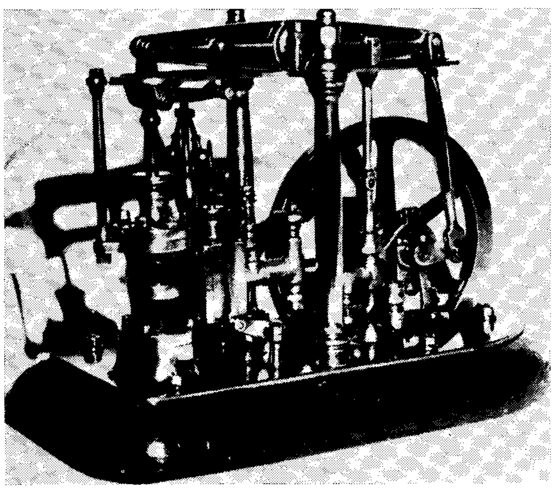
A fine 7¼ in gauge "Bridget" chassis by D. Brook.

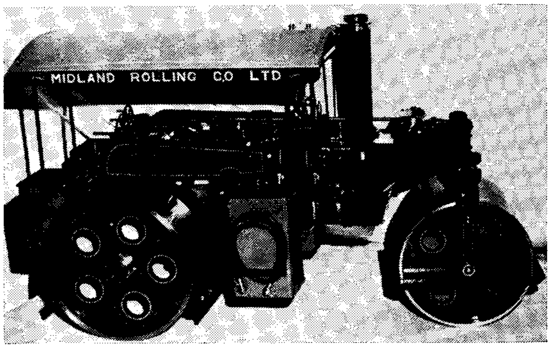
allow quick reversing on "modern" road surfaces.

As many as three examples, in chassis form as yet, of the 7¼ in. gauge 0-4-2 "Bridget" design were on show, one by H. Green of the home club, one from D. Sidebotham of Buxton, and the third by D. Brook of Wakefield. It seems we shall be seeing increasing numbers of this locomotive on the various tracks before too long!

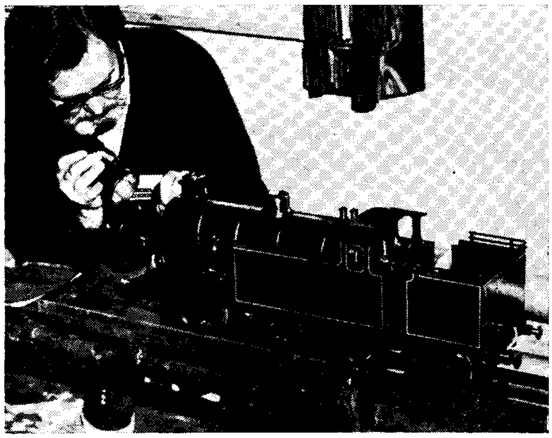
And finally, a relic of the past, in more ways than one, was a small beam engine model built in 1875 by Allen Chapple Armitage, and now owned by Harry Armitage. Based on a local prototype, it was built in brass. The model is fitted in a glass showcase, with friction drive to the rim of the 5 in. diameter flywheel, and can be set in motion by pressing a button. Incidentally, I was told that Mr. Harry Armitage, though now 86 years of age, is a very active man and engaged in building five beam engines himself.

Below right: A 3 in. scale Burrell by P. Robinson of Huddersfield. Below: An 1875 model beam engine built by A. C. Armitage and now owned by H. Armitage.

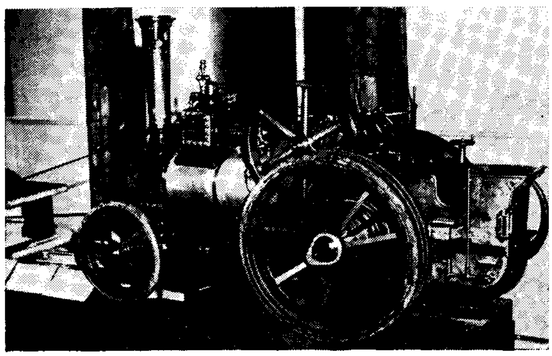




An 8 ton "Advance" roller to 2 in. scale by S. Jackson.



David Waite preparing Jack Sykes' "Mona".



Modifications to the Jones "Hipp" Clock

by John Stevens

NEARLY A QUARTER of a century ago, the writer constructed the Hipp Wall Clock, described by Mr. C. R. Jones in "M.E." at that time, and which subsequently gave very good results over many years. However, the vane and notched block of the switching arrangement became troublesome after a time—the vane having a dead action rather than a bouncy one when trailing over the block, into which it frequently failed to engage cleanly resulting in distracting clicks and bangs. This is a perennial weakness with this system and various remedies have been tried to overcome it. The design, however, seems such a good one that these troubles may have their origin in faulty workmanship—whatever the cause, the alterations decided upon have greatly improved the action if not entirely cured the fault.

The Vane:

Originally this was pivoted on a stub arbor of 3/32 in. silver steel, which seemed unnecessarily large for its admittedly constant but light duty. A drilled bush was fitted tightly in the hole and a steel staff, .026 in. dia., firmly driven into the hole in the bush. This measurement is simply that of a dressmakers' pin, of hardened and tempered steel, which was readily available and proved ideal for the purpose. See Fig. 1.

The Vane Fork:

As designed, the pivot carrying the vane was secured to a brass clamp adjustably fitted to the pendulum rod. This pivot was cut off and a carefully made split fork riveted to the flange, Fig. 2. This split fork is quite a pretty component to file up nicely, having two steel end "plates" to ensure that the vane does not rub on the inner surfaces of the jaws and so cause friction: in a word, similar to the general arrangement of a watch balance. The pivot holes should be broached a close but free fit with a needle, both to smooth and to harden the internal surfaces.

The Notched Block:

The block as described was of considerable width (about 5/16 in.) so that unless block and vane were in almost perfect alignment there would be faulty engagement, one with the other. The hardened block was softened and the operative part with the notch reduced to a bare 1/16 in. in width, as shown in Fig. 3. The block was next re-hardened and polished, paying particular regard to the edges of the notch, both of which should be finished with a sharp edge and of equal height.

There is an example of a Hipp table clock in the Science Museum which appears to function perfectly in this respect, having a very thin notched plate with a short light vane to engage. This clock has a shorter pendulum than a three-quarter second and consequently more rapid oscillation which may be part of the reason for the satisfactory action.

Suspension Spring:

While the clock was in pieces, opportunity was taken to modify the suspension spring, which seemed unnecessarily stiff and stronger than required to carry the admittedly heavy pendulum, by cutting away the centre of the spring. This was done by a simple improvised punching jig, consisting of a scrap of mild steel strip folded over with a 1/16 in. hole drilled through to take a hardened and tempered punch. The spring was slipped between the folds and holes punched in the hardened spring until the unwanted metal was freed; after which the edges were smoothed with an old needle file with the spring held closely in a cramp.

This, of course, weakened it considerably and

THE VANE (or TRIGGER)

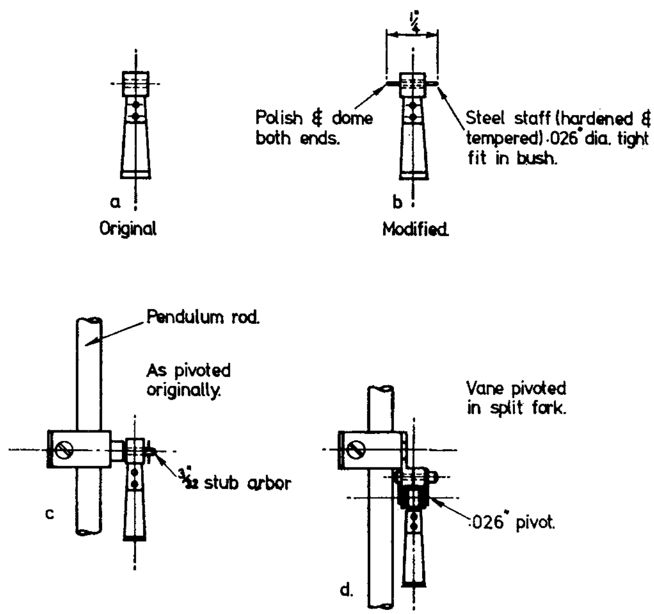


Diagram only

FIG. 1.

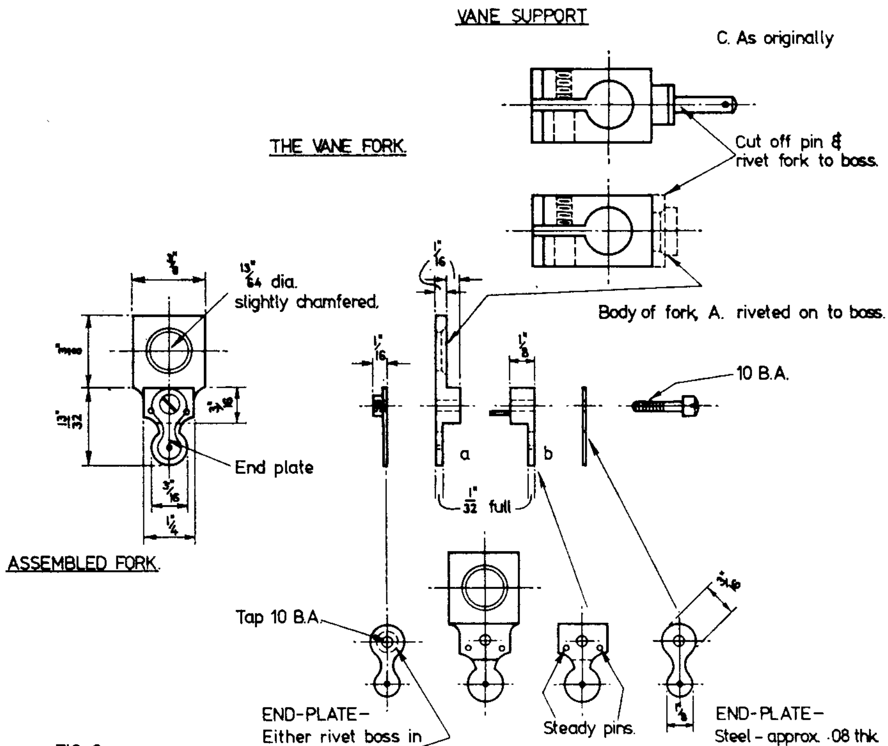


FIG. 2

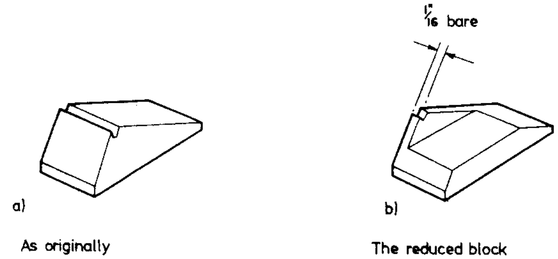


FIG. 3

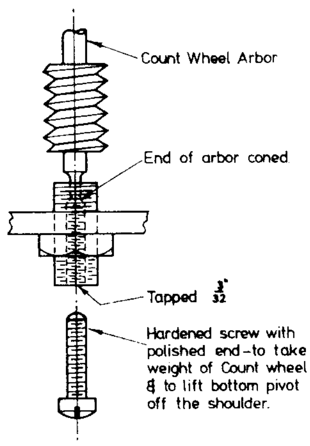


FIG. 5

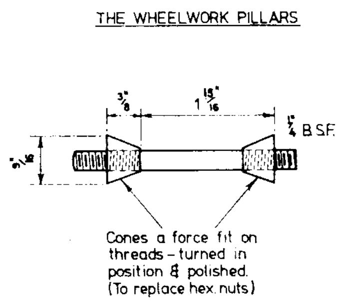
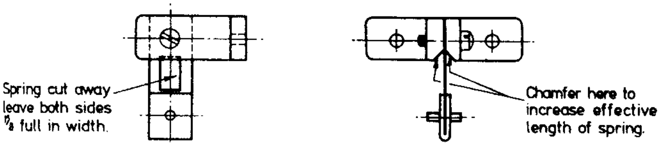


FIG. 6



THE SUSPENSION SPRING

FIG. 4

so resulted in a longer run between contacts—however, this must not be overdone or "rolling" of the pendulum may result as the vane and notch are not on the same axis as the pendulum rod. The effective length of the spring was also slightly increased by chamfering the clamping edges of the support brackets, thus reducing the strength a trifle more, Fig. 4.

The Count Wheel:

To reduce friction the lower pivot was coned and polished, removing the extreme point with a touch of fine emery paper. The adjustable screw, which forms the lower bearing, was tapped at its lower end with a fine thread and furnished with a hardened mushroom-ended steel screw—thus the weight of the count-wheel carrying the worm was now taken on a point instead of on the shoulders, resulting in easier running. Fig. 5.

The Pillars:

Although these play no part in the functioning of the clock, the original use of hexagon nuts to secure the wheel-work to the frame—and also to position the exact distance one from another—seemed a little unworthy of the design as a whole. This position is neither critical nor variable: moreover, any unnecessary adjustments are a nuisance when the clock is dismantled for cleaning and subsequently put together.

Two tapped steel collars were forced tightly onto the screwed spindles, turned cone-shaped and polished. This starkly simple pattern seemed suitable for this type and period of timepiece. Fig. 6.

The clock was finally cleaned and assembled, leaving the vane pivots absolutely dry, the contacts adjusted and the timepiece set going.

The improved action was ample reward for the work involved, the vane now bounced merrily over the block in its excursions to and fro and the vane engaging satisfactorily in the notch. Only *very* occasionally is there an unwelcome sound from this point, and only when the battery has almost run out. The work was carried out over two years ago and seems to be perfectly satisfactory.

Thread grinding on the "Quorn" cutter grinder

by W. M. Thomas

In the July 19th issue of *Model Engineer*, Professor Chaddock claims that the Quorn Cutter Grinder can be used as a thread grinder. Surely he is letting his enthusiasm run away with him? The object of thread grinding is to produce accurate threads, either single or multi start, in a wide range of pitches—commonly 2-60 T.P.I. in hardened and unhardened steel.

On a thread grinding machine it is possible to grind threads from the solid in hardened material, so that the plain diameter and the threaded diameters are perfectly concentric about a common axis, and distortion errors of pitch, form, drunkeness or straightness do not arise. To do this, all thread grinding machines have certain features in common. They are:—

a) A means of reforming the wheel without removing the workpiece, or having to realign the wheel with the thread.
b) A lead screw and accurately cut gears to ensure that the pitch of the thread is accurate to fine limits.
c) An efficient coolant system to ensure that the heat formed by the grinding operation is dissipated rapidly throughout the operation. Unless this is done, burning of the workpiece with subsequent distortion of the form and the introduction of pitch errors is unavoidable.
d) A range of grinding wheels with grain sizes ranging from 100 grain size down to 400-500 to accommodate the differing pitches of screw threads to be ground.

With the exception of the last, the Quorn does not have any of these features, nor can they be fitted to the machine in its present form, and to purchase 4 in. diameter wheels of the required grain size, grade of bond, structure etc. would be prohibitive to all but the wealthiest model engineers.

To explain the above I will deal with each point in turn.

Wheel Truing and Dressing

To satisfactorily true a wheel to the correct form requires a very sharp formed diamond. The slightest bluntness of the diamond will cause it to tear out the grains in clumps and prevent the formation of the very fine radii or edges on the periphery of the wheel needed to form the root radii of the thread being ground.

The cube diamond of .120 in. protrusion which I use when forming the wheel on the Newall model NL thread grinder on which I train grinding apprentices, costs between £50 and £60 when I last priced it, and they don't last all that long in any case.

To retrue the wheel on this machine, the pantograph dressing attachment fitted behind the wheel allows the form to be reformed accurately, quickly, and the form is still in perfect alignment with the thread being ground.

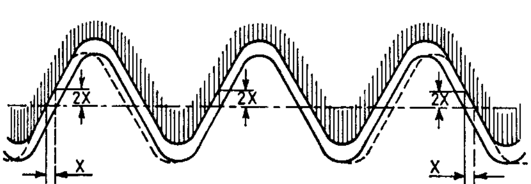
On the Quorn, to retrue the wheel means that the job has to be removed from the workhead, the diamond substituted, the wheelhead swung off its set position. The angles trued on the wheel; then the whole lot set up again. Not a very easy operation, and please don't tell me it is possible to grind a thread on the Quorn satisfactorily in one pass without coolant and with the thread not even supported by a tailstock. As the professor says, .005 in. is a pretty hefty cut, I'm afraid it can't be done. To realign the formed wheel with a pre-cut thread on the Newall requires the use of a microscope complete with thread occulars, a dial indicator mounted permanently on the machine and a means of bodily altering the position of the table carrying the workhead relative to the leadscrew. The wheel is brought into light contact with each flank of the thread, by using this control. Position of the table is noted at both these positions on the D.T.I. The table is then set to the mean of these two readings, so that the formed wheel is smack in the middle of the thread. How one realigns the wheel and work on the Quorn, unless one has a microscope for the eyes I don't know.

Lead Screw and Gear Train

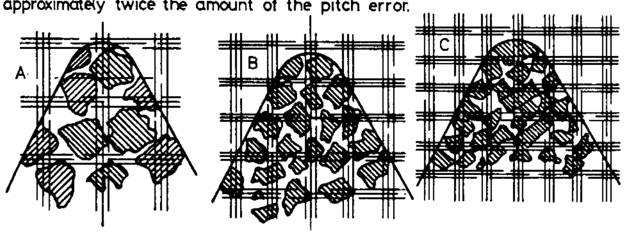
On the Quorn a hob formed to the required pitch is used to advance the work one pitch per revolution. This means that unless precision thread ground hobs are used, any pitch errors in the hob are reproduced on the workpiece. The hobs should also be hardened because the stylus would quickly wear soft hobs, again with bad results on pitch accuracy. Also it must be remembered that the effective diameter of the screw is increased by approximately twice the pitch error. (See Sketch).

This pitch error also causes effective diameter errors and this will mean that the thread will have to be ground undersize to enter a standard threaded hole. The cost of a set of hardened thread ground hobs to cover the range of threads used by model engineers would also set one back a pretty penny, indeed if one can get them.

THE EFFECT OF PITCH ERROR ON EFFECTIVE DIAMETER



Showing that the effective diameter of a screw is increased by approximately twice the amount of the pitch error.



WHEEL STRUCTURE

Showing how grain size controls thread forms that can be produced on wheels and how free cutting properties are controlled by structure.

(A) Structure of 120 graded wheel showing comparative size of grains and mesh with radius for 26 t.p.i. Grains are too big. Very free cutting, but form will be bad.

(B) Wheel formed of grains of 180 mesh compared with radius for 26 t.p.i. Free cutting better than form (A)

(C) Structure of wheel formed of grains from 220 mesh and profiled to 26 t.p.i. Grains allow correct radius to be obtained and the wheel will cut properly free cutting. Good form maintained.

Coolant

The cutting of threads with a grinding wheel requires very deep cuts (A 20 T.P.I. Whit. thread has a depth of .6403P or 0.032 + 0.033 in.).

With this large area of contact plus the fact that the strength of the bond or grade of the wheel must be strong to retain the form, a great amount of heat is created, the workpiece becomes burned, localised heating causes the workpiece to expand unevenly and the work is ground oval. As the work expands so the depth of cut is increased and when the work cools down it will be undersize. Pitch errors can also be caused by the work expanding lengthways, again causing pitch errors when it cools.

On the Newall it is virtually impossible to take cuts .005 in. deep at a rotational speed of approx. 2 RPM's, without a jet of thread grinding oil directed with considerable force between wheel and work. There will be more heat created by the small wheels of the Quorn as opposed to the 14 in. diameter wheels of the Newell and how one dissipates this is beyond me.

Fine Grain Wheels

In the thread grinding illustration Fig. 76, a 20 T.P.I. thread is being ground. The wheel is apparently a 46 grain size aluminium oxide wheel with resinoid bond. This wheel is unsuitable for a number of reasons, the main being the grain size.

In thread grinding the abrasive wheel has to be trued to a sharp edge or very small radius to form the root radius or flat of the thread, to do this requires very small grain sizes.

For example it would not be practicable to true a wheel containing 46 grain abrasive, average grit diameter .018 in. down to an edge measuring .005 in. which would be required to correctly grind a thread of 20 T.P.I. In practical thread grinding it is seldom that a wheel coarser than 100 grain size can be used. I think I had better explain this.

Grinding wheels are made from abrasive grains which are graded according to their size. They are grouped into very coarse, coarse, medium, fine and very fine. Each group is subdivided into standard numbers corresponding to the number of holes to the linear inch in the screen or sieve, through which they are passed. i.e. a 46 grain size just passes through a sieve with 46 holes to the linear inch, but is retained by the next smallest, 54. Thus the thickest part of the grain is 1/46 of an inch or .018 in. approx. A 100 grain size = 1/100th of an inch or .010 in.

If one tries to true a wheel of 46 grain size the smallest diameter one would expect to obtain on the periphery of the wheel would be .018 in. but a 20 T.P.I. thread requires a flat of .006 in. or equivalent radius, so it is obvious that a finer grain size than 46 is required to grind a 20 T.P.I. thread.

The Universal Grinding Wheel Co. recommend the following grit sizes for various pitches of thread:—

GRIT	T.P.I.
100-120	10
150	20
180-220	30
1 flour size	
240-280	40
2F-3F-400-500	60-80

From the above it will be seen that the 46 grain size wheel is much too coarse to cut a 20 T.P.I. thread, 150 grain size should be used, more than three times smaller than the one used.

The effect of this large radius on the thread means that when the thread is ground to be correct effective diameter, there will be insufficient clearance at the root. To overcome this the thread has to be ground deeper. The effective diameter is undersize. The thread is thin and consequently weaker than it should be.

The resinoid bond is a very strong bond and will stand a lot of abuse, but it is not as rigid as the vitrified bond and excessive heat and pressure will cause it to deform and give errors of form and pitch. The vitrified bond gives much more precise results. Anyway to get the proper results from the resinoid bond it should be run at a much higher speed than the vitrified, i.e. 9500 surface feet/min as apposed to 6500 SFPM for the vitrified. If the wheel head speed is not increased to the correct speed for resinoid bond, the wheel will work soft. Remember the slower the wheel speed the softer it works i.e. the quicker it breaks down, without any change in work speed or traverse rates.

Another thing about organic bonds i.e. resinoid, shellac and rubber—these have a store life of two years. They absorb water which affects the bond and can cause trouble. So be careful and don't use any old organic wheels which may be given you. They really should be date stamped like bread and cakes.

Conclusion

While the writer does not deny that a thread could be ground on a Quorn cutter grinder, he is extremely doubtful as to whether the results obtained, as regards form of thread and pitch accuracy, would entitle anyone to seriously claim that the machine is capable of thread grinding in the accepted sense.

Jeynes' Corner

continued from opposite page

ally, I have noticed that cylinder head studs are often long enough to come through flange to receive a nut on the underside which was machined, thus taking much of the load off the stud threads in flange. This certainly stops 'The wrong nut unscrewing", which "Tubal Cain" mentions; I imagine he has had some joy in this direction before now.

How right he is regarding cheesehead screws, often I have had to deal with screws which had been fitted with hexagon heads which had been twisted off by brute force and ignorance: it is really remarkable how few people are endowed with that sense of touch which seems able to gauge just how much spanner can be applied to a set screw head, without seeking the aid of penetrating oil, or heat.

"Tubal Cain" also mentions the socket screw getting filled up with grit etc. this is worse when it is full of damp metal dust which sets solid. This can be avoided if an oiled soft wood plug is driven into the socket when installed, it can easily be got out, and should be replaced with another when finished; yet how seldom have I had the joy of finding one.

Now on to Lock Nuts; the very name implies that it should be put on the top of the full nut, I have often come across them referred in old time engineering notes as 'JAM NUTS' which was exactly their purpose. How anybody can imagine the thin nut goes on first I cannot imagine: the old engine builders knew what they were about when they originated them. Imagine a nut constantly working loose from some cause or another, and as several threads protruded through the full nut, some bright chap cut a full nut in half, fitted it on top of the full nut, and tightened it up; and the lock nut was born. D. K. Clark's 'The Steam Engine' has many illustrations showing lock nuts in their proper place, and he should know.

Finally the most effective and cheapest lock nut I have ever seen was produced by an old traction engine driver, he took a full nut, and put a saw cut nearly halfway through, then bashed the saw cut shut: I have done likewise many times since.

Windmills

SIR,—I am interested in the feasibility of using a windmill for the generation of electricity. Can anyone suggest a source of information of modern design data regarding sails and control mechanism. Number of blades, area of blades, amount of twist in blades, revolution per minute at a given wind speed? Could an aircraft wing section be the most efficient for the blades?

Stratford-upon-Avon. R. G. Selman

Old engine

SIR,—I am just starting restoration of a model horizontal steam engine and I am wondering if any of our readers can throw any light on its origin and when it was manufactured.

The engine has all the castings in gunmetal including the backplate and flywheel and has what I call early type slidebars in gunmetal.

Principal dimensions are:— length of bedplate 12 in., bore 1 in., stroke 1½ in., flywheel diameter 6 in.

There is a large "V" cast into the steam chest cover and under the bedplate is cast "Vesada PTAH".

Christchurch, Dorset. A. G. Parkes

JEYNES' CORNER

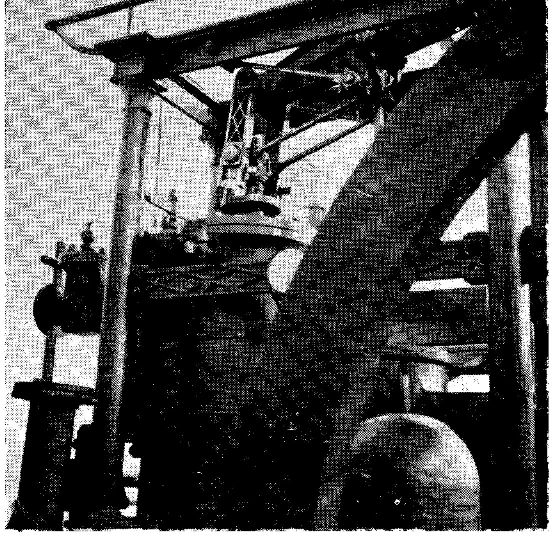
E. H. Jeynes on bolts, nuts and screws

As usual, I was greatly interested in "Tubal Cain's" article under the above title, especially the researches he has made into the history of these, also the conclusions he arrives at regarding the use of square and hexagon nuts and bolt heads. Personally, I have made no special research on this subject, but the conclusions I have come to entirely agree with his statement that he believes the hexagon nut was well and truly established early in the 19th century.

Now as he says, square nuts and bolt heads are still in use today, the most common instances being for rail fishplates and roof guttering; the latter, known as spouting bolts, are produced in galvanised and in alloy, the bolt having a mushroom head with a screwdriver slot. However, I do not agree with his statement that all chequer plates are fitted and secured by countersunk-head bolts with screwdriver slots, as I have come across many instances of the bolts being innocent of slots, which often presented a minor problem. Large numbers of lathe chucks have square-head jaw screws, or female squares to receive a square ended chuck key. All the American lathes I have worked on had square-head screws for the toolboxes, and the majority of fixed and travelling steadies had screws with square heads which the toolbox spanner fitted, also the tailstock set-over screws required the same spanner. But the fact remains, that more force can be applied on a bolted joint having square-head bolts and nuts using two spanners, than can be applied when hexagon-head nuts and bolts are used, without the spanners slipping off, unless of course ring spanners are used.

It has been my privilege (of which I always took full advantage) over the last 70 years or so, to see and in many cases to examine quite a number of old engines, many of which were old when I was young, and I have always noticed the intermingling of square and hexagon nuts; and I cannot recall a single instance where the nuts were all square. I have never seen square nuts on glands. One engine I photographed which was built about 1830 had square nuts on the framework but hexagon everywhere else, although most of the bolts were square headed. Another interesting instance of square and hexagon nuts on the same engine was the old 'Dudley' beam engine, purchased in 1930 by Henry Ford, and removed to his museum at Dearborn U.S.A. This was probably the oldest rotative reversing engine in the world, and is believed to have worked for nearly 130 years, which would put the manufacture around 1800. This engine had a mixture of hexagon and square nuts, while all the visible bolts were square-headed. This engine had some peculiar points which I hope to comment upon at some future date.

An overcrank engine built around 1845, though possibly earlier, has all hexagon nuts, but most of the bolts are square-headed. The valve chest has outward turned flanges on each side, by means of which it is bolted to the cylinder, which has a receiving flange, and to secure the cover. The surface of the hexagon nuts suggests that they have been replaced, or were filed finish to start with. The jet condenser is below the bedplate, and secured to it by square-head bolts and hexagon nuts. I imagine the cylinder top cover is also bolted to the cylinder, but the wooden lagging prevents this being ascertained; I imagine all this bolting together was to avoid using studs.

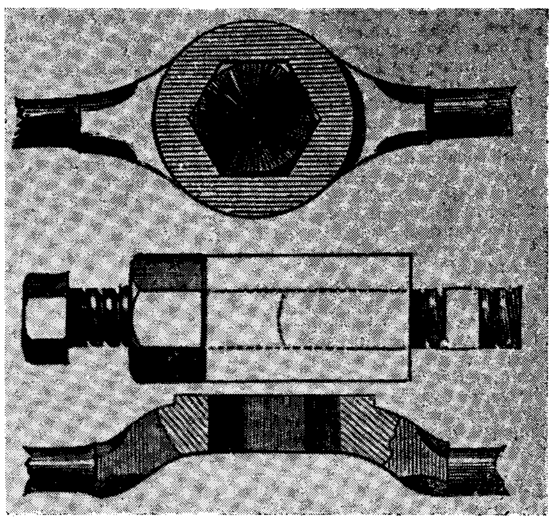


Note square nuts on framework, hexagon nuts everywhere else.

Having arrived at studs, I have often wondered how many people when riding in a steam hauled express train, have thought about the stresses imposed upon the cylinder head studs. There seems to be great ignorance on the part of some engineering examination question setters; a year or two ago, a student put a query to *Model Engineer,* regarding the question: "What is a Stud Box": he was given the correct answer, which the examiner would not accept, saying it was for the production of studs, in fact a sort of collet adaptor. How wrong he was; for at least 200 years, stud boxes have been used to insert and remove studs, my illustration comes from the English Mechanic of 1865. I have had many jobs requiring studs, and carried special sets of taps consisting of five to the set, known as 'Blind Hole Taps' the small amount of lead on these taps, allowed the full thread to be carried almost to the bottom of the blind hole. In hydraulic work especi-

continued on preceding page

An illustration of a Stud Box from "English Mechanics", 1865.



News from the S.M.E.E.

At an informal meeting on October 26th last, the subject raised was locomotive topics, and the afternoon was started off by the presentation of some colour slides by Mr. J. Heap of preserved locomotives, views of the Stapleford Park Railway and the Dart Valley Railway.

Mr. G. H. Thomas referred to his very neat eight-wheel L.N.E.R. tender to ¾ in. scale, and showed a spring assembly detached from one side. The tender was estimated to weigh 40 lb., with 5 lb. loading on each wheel, producing a deflection of ⅛ in.

Mr. W. H. Clarke, who is building a 5 in. gauge 2-4-0 tank locomotive of the 1854-5 period, displayed a transparent plastic and wood model for valve gear setting, full size for 5 in. gauge, equipped with graduated sectors which give angle readings for the lead of the valves.

Mr. G. Hatherill described a

CLUB NEWS

5 in. gauge model of a 0-4-0 outside-framed freelance battery locomotive which is mainly for use on a small ground level track. A motor car starter battery is employed.

Crawley A.G.M.

At the A.G.M. of the Crawley Model Engineers, Mr. R. P. Mayes was elected Chairman, Mr. R. Calder Secretary, and Mr. W. F. Tingley Treasurer. The last section of the rebuilding of the track will be completed during the next three months, and the running season will start at the Easter weekend and continue every Sunday until the end of September. The Secretary's address is 17, Oakhill Road, Reigate, Surrey.

And at Crewe

At the recent A.G.M. of the South Cheshire Model Engineering Society, the following officers were elected:— Chairman—Mr. B. Jenks, Treasurer—Mr. R. O. Mayer, Secretary—Mr. H. Livesay, 21 Park Drive, Wistaston, Crewe. Gerry Buck has accepted an invitation to become an honorary member of the Society.

New Ship Society

A new society is the Trafford Model Ship Society, which will be meeting on the first and third Monday night of each month. The Secretary is Mr. H. R. Foster, of 29 Cumberland Road, Urmston, Near Manchester, from whom full particulars can be obtained.

Tiverton Model Engineering Society

Due to the success of the Exeter Exhibition there seems to be sufficient interest in the Tiverton area to form a Model Engineering Society, based at Blundells school. Should anyone be interested, or would like further details please contact Mr. R. Tedbury, 4 The Avenue, Tiverton.

CLUB DIARY

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

February 21 Romford M.E.C. Film Show. Ardleigh House Community Centre, 42 Ardleigh Green Road, Hornchurch, Essex. 8 p.m.

February 21 Stockport & District SME. Hot Pot Supper.

February 21 Malden & District S.M.E. Slides of Thames Ditton etc. by a Member of the Public. Slides to be given away after show.

February 21 East Sussex Model Engineers. Problems in a Nuclear Reactor talk by Ron Draper. Mercatoria Hall, St. Leonards. 7.45 p.m.

February 22 Hull S.M.E. Hobbies Exhibition at the City Hall, Hull.

February 23 Chingford & District M.E.C. "Steam Up at Track". Ridgeway Park, Chingford. 10 a.m.

February 24 Clyde Shiplovers & Model Makers Society "Ships Here and There" Mr. J. McKee. Partridge Halls, Burgh Hall Street. 7.30 p.m.

February 24 Stafford & District M.E.S. Talk and films on "Loctite" by Mr. Kilcannon. New Inn, Stafford. 7.30 p.m.

February 24 Willesden & West London S.M.E. Questions on model engineering **practice**. Kings Hall Community Centre, Kings Road, Willesden NW10. 8 p.m.

February 25 Sutton Coldfield & North Birmingham M.E.S. Railway Film Show, presented by T. Rowley (including film of the Baddesley "Garratt") Co-operative Meeting Room, 286 Brookvale Road, Erdington, Birmingham. 7.30 p.m. for 8 p.m.

February 26 Southampton & District S.M.E. Colour Slide Competition. Conference Room, Hospital Broadcasting Association, Winchester Road, Southampton. 8 p.m.

February 26 Chingford & District M.E.C. Talk on Photography by D. Capener. Friday Hill House, Simmons Lane, Chingford. 8 p.m.

February 26 Birmingham S.M.E. Pid's Quiz. Clubhouse, Illshaw Heath.

February 26 Sutton Coldfield Railway Society Festiniog Society (Midland Group). Wylde Green Library, Emscote Drive, Little Green Lanes, off Birmingham Road, Sutton Coldfield. 7.30 for 8.15 p.m.

February 26 Cannock Chase M.E.S. Open Evening. Lea Hall Colliery Social Club, Sandy Lane, Rugby. 7.30 p.m.

February 27 Harlington Locomotive Society. Guest Speaker still to be confirmed. Members please stand by with slides.

February 27 Hull S.M.E. Engine Driving Experience by Bob Sedman (Retired Locoman). Trades & Labour Club, Beverley Road, Hull (Room 3). 7.45 p.m.

February 27 Leyland, Preston & District S.M.E. Meeting. Roebuck Hotel, Leyland Cross, Leyland, Lancs. 8 p.m.

February 27 Sutton M.E.C. "Introduction to Astronomy" — A. Rains. Clubhouse off Chatham Close, Sutton, Surrey. 7.30 p.m.

February 28 Colchester S.M.E.E. Members' Film Show. An 8mm projector will be available. Clubhouse, Old Allotments Lexden, Colchester. 7.30 p.m.

February 28 Dublin S.M.E.E. "Electric Muffle" by Mr. P. MacCabe. City Quay School. 8 p.m.

February 28 Malden & District S.M.E. Member's Night.

March 1 S.M.E.E. Slide—Talk—"Sugar and Steam in Peru" Mr. Heathcote. Marshall House, 28 Wanless Road, SE24. 2.45 p.m.

March 3 Leicester S.M.E. A.G.M. Royce Institute, Crane Street, Leicester. 7.30 p.m.

March 3 City of Leeds S.M.E.E. "Telegraph and Telecommunications", a talk and if possible, demonstrations by Mr. R. I. Atkinson. Salem Congregational Church, Hunslet Road, Leeds 10. 7.30 p.m.

March 5 Guildford M.E.S. British Transport Films by Mr. Potter. H.Q. Stoke Park. 7.45 p.m.

March 5 Harrogate M.E.S. A.G.M. Eccleshill Community Centre, Harrogate Road, Bradford 2. 7.30 p.m.

March 5 Birmingham S.M.E. Lecture and film "Flying Scotsman in America" by George Hinchcliffe, Secretary of "Flying Scotsman Enterprises". Friends and wives will be very welcome for a guaranteed interesting evening to all. Staff Association Club on corner of St. Vincent Street.

March 6 Glasgow S.M.E. Auction Sale of Members' "odds and ends". Museum of Transport, 25 Albert Drive, Glasgow. 7.30 p.m.

March 5 Sutton Coldfield Railway Society. Films of Steam In Action (1958-68) (Bill Garbet). Wylde Green Library, Emscote Drive, Little Green Lanes, off Birmingham Road, Sutton Coldfield. 7.30 for 8.15 p.m.

March 6 Harlington Locomotive Society. Mr. Warwick Ormandy is coming a long way to tell us about his very own preserved ex GWR locomotive. 7.30 p.m.

March 6 Sutton M.E.C. Members' Work. Clubhouse off Chatham Close, Sutton, Surrey. 7.30 p.m.

March 7 Lincoln M.E.S. Bring and Buy Sale. Unitarian Chapel, High Street, Lincoln.

March 7 East Sussex Model Engineers. Workshop Topics, arranged by Stan Garlick. Mercatoria Hall, St. Leonards. 7.45 p.m.

March 7 Stockport & District S.M.E. Bits and Pieces.

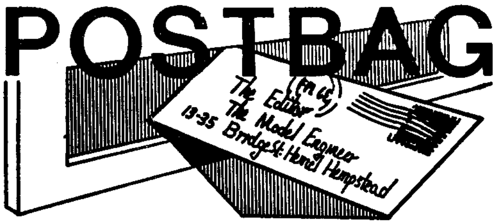
March 7 Malden & District Society of Model Engineers. Single Channel Radio Controlled Glider (Powered) by Den Sullivan (if it has not crashed).

March 7 Romford M.E.C. Competition Night. Ardleigh House Community Centre, 42 Ardleigh Green Road, Hornchurch, Essex. 8 p.m.

March 8 Bracknell Railway Society. Evening Run. Jock's Lane, Bracknell. 7.30 p.m.

March 10 Kings Lynn & District S.M.E. Mr. John Parker will speak about "Glass and its uses."

March 10 Bedford M.E.S. Talk on Signwriting and Lettering. Bunyan Meeting Hall, Goldington, Beds. 7.30 p.m.



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

Tool and cutter grinding

Sir,—I would like the opportunity to reply to the letters of Mr. J. F. Hickle and Mr. A. Mackintosh published December 20th.

The main point of both letters seem to be that I am guilty of unfair criticism because I compared the inexpensive Quorn with expensive commercially produced machines such as the Cincinnati and Jones and Shipman (I have never seen a "Genny" cutter grinder, I didn't think they made one). This is not the case. What I did criticise was the fact that the expensive machine designed for use by skilled operators had extremely simple centre finding equipment, whereas the machine designed for amateurs is extremely complex, as well as being extremely awkward in this respect. It seems to me that the designer's first thought was to get the machine constructed, then work out how to operate it.

As to the machine not being professionally designed, that is another matter entirely.

When the Quorn was launched upon the model engineering world, it was given the extremely hard sell treatment. Here was a machine which would end all cutter grinding problems. No longer would skilled grinders shy at the prospect of having to regrind such awkward cutters as ball end slotting mills etc. Here was the answer. Such phrases as "before the advent of the Quorn" and the "Quorn is a real wizard" commonplace. Also some features of the machine were thought to be revolutionary enough to warrant as application for patent rights. However as the series progressed and the machine began to take shape, I had a feeling that I had seen it before, or something very like it. It looked suspiciously like the small engraving cutter grinder produced by the firm of Gravograph of Troyes in France. Further investigation showed that indeed the Quorn was a modified version of the Gravograph A.F.3 model.

The A.F.3 consists of a fully universal workhead mounted upon a sliding bar, in exactly the same way as the Quorn. The bar is fitted with a micrometer adjustment, exactly the same as the Quorn. It's even on the same end of the shaft. The workhead has been modified somewhat. The A.F.3 had special attachments to facilitate the grinding of single edged engraving tools, but in the main the similarity with the Quorn is remarkable.

The main difference between the two machines is in the wheelhead. In the A.F.3 it is fixed, there being no advantage in having an adjustable head for grinding engraving cutters, while the Quorn has the rise and fall head carried upon a revolving base. The wheel spindle cartridge we know from the designer to be an almost exact copy of a design recommended by the Hoffman Mfg. Co.

So taking into account that the basic machine was designed by a commercial firm of engraving tool cutter grinder manufacturers, and was modified by a Chartered Engineer, who is also a Master of Science, and a Fellow of the Institute of Mechanical Engineers, I consider it professional enough to stand a little criticism from a mere grinding instructor.

As to the idea that one should design a machine before one can criticise anyone else, well I have never subscribed to that particularly sterile dogma. So long as the criticism is factual it can only help to improve the original design. How many of us have designed our own automobiles? Yet nearly everyone is sure he could improve on present désigns, and says so.

Just in case one thinks this answer is an evasion of the issue, I would just add that the Editor has for some time past had some articles of mine which he promised to publish in due course. These articles contain directions for the construction of extra equipment, which will allow builders of the Quorn to correctly regrind such sophisticated milling cutters as staggered toothed ones, and also allow Quorn builders to correctly regrind their blunt taps. There will be more in the future, as and when I can get time to think them up.

I would also like to answer the other points raised by Mr. Mackintosh if the Editor can spare the space.

1. No such grade as a tool and cutter grinder in the U.S.A. Some years ago I was offered just such a job by an agency recruiting labour for jobs in America. Also toolmakers receive a higher rate of pay than tool and cutter grinders. How inefficient of Sperry's to use such skilled labour on lower grade work.

Para. 4

Surely Mr. Mackintosh does not think that I recommend off-hand dressing for all grinding operation. I specifically wrote about cutter grinding. But since he mentions thread grinding, my article in this issue explains why it will not be possible to satisfactorily thread grind on the Quorn.

Para. 7

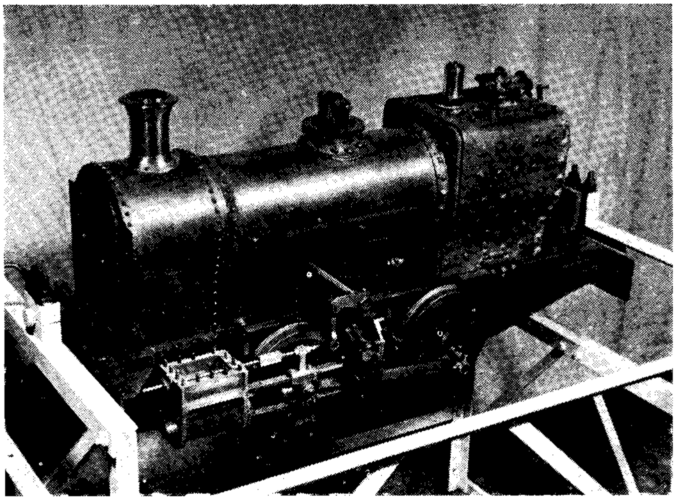
The method I gave is the one used by such well known toolmakers as Messrs. Dormers and Clarksons, and I am sure they would be most surprised at the suggestion that their cutters cut oversize. Also I wrote about two flute slotting cutters, not multi toothed end mills; there is a difference. End mills have a centre hole in the cutting end, so you cannot grind them to the centre anyway.

The method suggested by Mr. Mackintosh where cutting edges are ground to the centre and the edges crossed, does not leave a small portion of the cutting edges cutting at reduced efficiency. It leaves a small area that doesn't cut at all. The cutter so ground will not penetrate, as I explained. The analogy with the drill point chisel edge is incorrect.

Para. 8

The reason behind cutters being used until a predetermined width of wear land has developed is to ensure that the cutter has an economic life between regrinds, but is withdrawn from use while still producing a good job. To regrind more frequently is to waste valuable tool steel and equally valuable time.

Cwmbran. W. M. Thomas



Locomotive stand.

Sir,—Prompted by your remarks in the article on the "Fury" locomotive, December 20th, I venture to send you a photograph of an erection stand I made for my $1\frac{1}{2}$ in. scale *Midge* locomotive, a year or two ago.

It is a simple structure from 1 in. x 1 in. and $1\frac{1}{4}$ in. x $1\frac{1}{4}$ in. angles with mild steel flat bracings. The suspension arrangement consists of two lengths of 2 in. x $\frac{1}{2}$ in. mild steel recessed a tight fit on the buffer beams and secured with a bolt through the draw hook hole. Pins $\frac{7}{8}$ in. diameter a shrink fit in the 2 in. x $\frac{1}{2}$ in., are carried in split bearings from 1 in. square mild steel.

The engine can be swung full circle and fixed in any position by tightening one nut on one bearing. I do not think a worm and wheel for rotating the engine is necessary, it turns very easily by hand although of considerable weight.

I cannot consider building an engine of this weight without the use of such a stand. I trust this will be of some interest to you.

Farnsfield, Newark. Arthur Sherwin.

Track Safety

Sir,—May I take up your invitation of December 6th, to comment further on the problem of passenger safety on miniature loco tracks.

We at Maidstone probably fall into the category of a large passenger hauling society, conveying upwards of 20,000 fare paying customers on our 2,000 ft. track, and have therefore some useful experience in this field.

During 1971 we examined every aspect of track safety and trolley types in use at other clubs. This study forced us to the conclusion that a guard rail similar to Beech Hurst's and a completely new concept in trolley design was essential. The guard rail was finished for the 1972 season at a cost of £400.00, a lot of money I know but can one put a price on injuring other people's children? New trolleys were built and existing ones modified within the framework:— fixed legshields which will make contact with the guard rail, proper brakes, gaps covered with thick rubber, solid link coupling, handrails and buffers.

Add to this the adult supervision of loading and responsible driving and every reasonable care has been taken.

We do not claim any originality for our system, it is just a collection of common-sense ideas.

Suffice it to say we have carried over 65,000 passengers since 1972 with only a damaged shoe to mar our record.

There can be no justification in injuring .56 persons per thousand, the Council would have closed us down years ago.

Finally, further to Laurie's point on communication, all the details of our safety measures were sent to the Southern Federation. May I suggest that this and other Societies' activities in this important field be made available.

Maidstone. R. H. Milliken, Hon. Secretary.

J. E. McConnell

Sir,—In reply to Mr. Wilson's request for information on McConnell, the following may be of interest to him.

James Edward McConnell was born in 1815 at Fermoy, Co. Mayo. Being left fatherless when four years old, he was brought up with his uncle Alexander at Ayr. After a difference between them in later years, he left to seek his fortune with 10/-. He found employment with Girdwood & Co. of Glasgow. He left them to become foreman with Vernon & Co. of Liverpool, subsequently transferring to Bury, Curtis & Co. He was a strong advocate of balancing moving parts of engines, and his principles were adopted on the London & Birmingham.

In 1842, at the age of 27, he was appointed Supt. and Locomotive Engineer to the Birmingham & Gloucester, with works at Bromsgrove. At that time trains were worked up the incline by 4-2-0 Norris engines. English builders had made two attempts to produce suitable locos; Bury had built "The Bury" and personally attempted to surmount the incline, but only reached half way, and Mr. Goddard's engine, the "Surprise", (designed by Dr. Church) was destroyed when its stayless boiler exploded. "Handsome Mac" determined to have a go, the result being the 6 coupled saddle tank with 18 in. x 36 in. cylinders named "Great Britain". This hauled 135 tons up the bank at 8 to 10 m.p.h., against the Norris engines 53 tons, and was reputed to be the most powerful engine in the country at the time (1845).

Whilst sheltering from a rainstorm with other engineers in a hut near the top of the incline in 1846, conversation turned to a subject which was much argued about at the time, viz. the refusal of the Inst. of C.E. to admit George Stephenson to membership. Subsequently a meeting took place at McConnell's house at Bromsgrove at which C. F. Beyer, R. Peacock, C. Geach and representatives of the Birmingham Patent Tube Co. were present. It was decided to form an Inst. of Mechanical Engineers and circulars were issued convening a meeting at the Queen's Hotel, Birmingham on 7th Oct. 1846. McConnell was chairman. Between drinking many toasts, a set of rules was agreed upon, and on 27th Jan. 1847 the Inst. M.E. was formally founded, with Stephenson as first President. This is recorded on a plaque on the portico of Curzon Street Station.

Continued opposite

His feet now firmly on the ladder, the following month the 31-year-old McConnell became Locomotive Engineer of the Southern Division of the newly-formed L. & N.W.R. with works at Wolverton. Between 1851 and 1861 he built his famous 7 ft. "Bloomers". He also established schools, built churches and founded a savings bank. For certain reasons he retired from the L. & N.W.R. on 13th March 1862, and was presented with a handsome silver candelabra and a pair of silver flower stands with his arms, crest and motto.

Handsome Mac bought an estate at Great Missenden and set up as a consultant engineer with an office in Westminster. Already a magistrate, in 1873 he was elected High Sheriff of Buckinghamshire.

He died at his home at Great Missenden on 11th June 1883.

Halesowen. G. Limb.

LBSC's Locomotives

Sir,—I was pleased to read the letter from Mr. John H. Owen in Model Engineer No. 3501, regarding L.B.S.C.'s loco, *Sybil*, the London & North Western "Precursor".

The old engine was originally from Carson and was converted to a coal fired locomotive by Curly. I had the pleasure of driving her on the Purley Oaks track in 1952, and if I recall correctly, the grate measured 15/16 in. wide x 2½ in. long!

Those responsible for the disposal of the 23 engines left by L.B.S.C. tried to ensure that they went to people who would respect their background and not try to profit by their origin. In most cases this has been achieved. I am the proud owner of *Olga*, another Carson rebuild by L.B.S.C. of a L. & N.W.R. Precursor Tank in 3½ in. gauge. *Mabel* and *Jeanie Deans*, both

Continued on page 180

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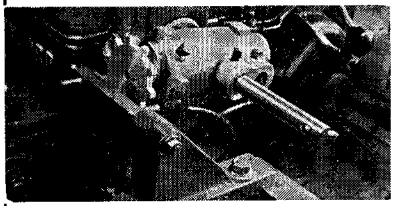

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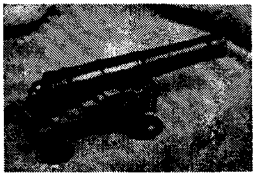

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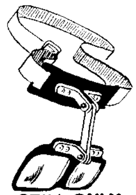

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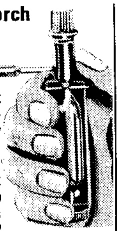

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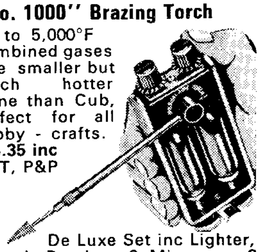

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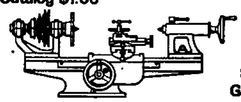
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