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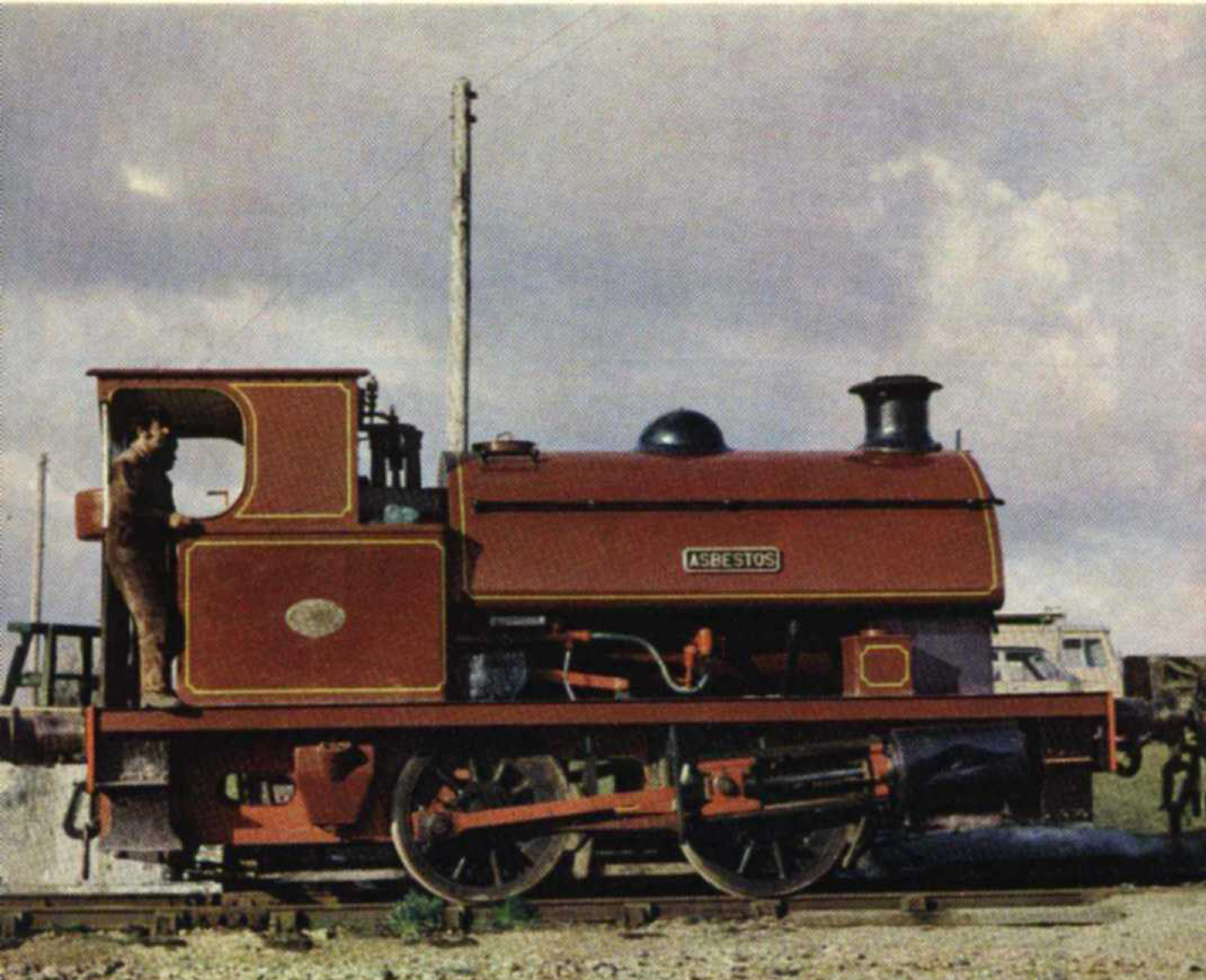

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Volume 143 Number 3552

7 January 1977

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COVER PICTURE

R & W Hawthorn Leslie saddle tank locomotive shunting at Chasewater. Colour photograph by Mike Wood.

NEXT ISSUE

A 16.5 mm. butane-fired steam locomotive built by a Japanese reader.

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SMOKE RINGS

A Commentary by the Editor

Metrication

I would like, in this my first editorial of 1977, to refer to metrication, a subject which is obviously worrying many of our readers.

Mr. Stuart Blackley ("Postbag" this issue) says that we should not mix Imperial and metric dimensions in the same design, but I fear that this is unavoidable at present and may be so for some years yet. Mr. Blackley must remember that *at the moment* the great majority of model engineers who are likely to build the locomotives and other models described in *M.E.* will be using Imperial tools and materials and even those just starting in the hobby would not be able to purchase *everything* to metric standards.

The "change-over" period is bound to be a difficult time for both amateurs and professional engineers, added to which the change to metric standards is already increasing prices all round.

As to the *Model Engineer* series of fine threads, it is probable that one at least of the tap and die manufacturers will continue to make these. After all, the existing range of 40 thread taps and dies from $\frac{1}{8}$ in. to $\frac{1}{2}$ in., and the 60 thread series from $\frac{1}{8}$ in. to $\frac{3}{8}$ in., were specially manufactured for the model engineer and have been available for at least 40 years, so there seems no reason why these should be discontinued. No doubt the time will come when all new designs in *M.E.* will be 100 per cent metric, but this may not be for three or four years yet. Existing drawings will of course have to stay in Imperial dimensions, as it would be an enormous task to convert all the M.A.P. designs, which now number some 780 individual sheets of drawings.

Revolutionary Engine

A revolutionary engine that runs on heat generated by mixing a concentrated salt solution and pure water was successfully demonstrated recently at the Tokyo Institute of Technology. A small model of this engine was shown operating a model car and lighting a series of 5 watt bulbs by Professor Isshiki and his team at the Institute. A larger model is now being developed to produce at least one kilowatt. I am indebted to Roger Calvert, Secretary of the National Council on Inland Transport, for this information.

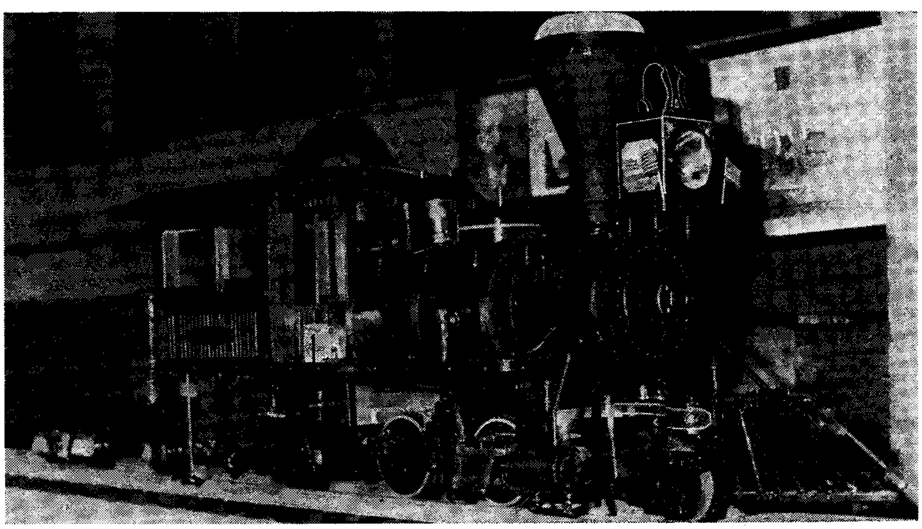
Marshall Portable

Builders of Bill Hughes' model Marshall portable engine will be interested to know that Mr. R. Kibbey of Mackworth, Derby, is showing an unfinished Marshall at the Model Engineer Exhibition. It was expected that Mr. Kibbey would have the cylinder, crankshaft and motion mounted on the boiler by the time the Exhibition opens.

The late A. E. Bowyer-Lowe

I was very sorry to hear of the death recently of Mr. Albert Bowyer-Lowe, A.M.I.Mech.E., M.J.Inst.E., F.B.H.I., at the age of 92.

Mr. Bowyer-Lowe had been a reader of *Model Engineer* from no. 1, and an occasional contributor on clocks and workshop matters. He won four Silver Medals and two Bronze Medals at M.E. Exhibitions between 1949 and 1958. Mr. Bowyer-Lowe was a designer with J.A.P. Motors from 1904-6 and with Phoenix Motors from 1906-22. From 1939 to 1949 he was an Inspector at the Ministry of Supply.



A fine 4¾ in. gauge 2-4-2 narrow-gauge locomotive based on the 1870 Denver and Rio Grande Railroad locomotives, built by Ray Woodward of Fayetteville, U S A. It has cylinders 1¼ in. x 1¾ in. and a working pressure of 100 p.s.i.

A MARSHALL PORTABLE

Part VI

by W. J. Hughes

From page 1203
3 Dec. 1976

To CONTINUE with the cylinder and valve chest, there are plenty of holes to drill and some to be tapped. I mentioned last time the two which take steam from the recess in the saddle up to the annulus, but before the liner is inserted it will be desirable also to drill the one from the top of the block (where the safety valve seat is to be fitted) to the annulus, and the other pair from the bottom corner of the dome cavity, or regulator recess, also through to the annulus. These last two, 3/16 in. (4.5) dia., will need to be drilled on a sideways as well as a downwards angle so as both to hit the annulus.

But first the bulk of the waste must be machined away, and this is best done whilst the chest is separate from the block. At this stage too the regulator port can be milled. Drill the governor port right through to the valve chest, ¼ in. (6) dia., but be careful when breaking through. Next drill the 3/32 in. hole for the governor spindle to a depth of 23/32 in. (18.5)—I cannot specify a metric equivalent for this spindle as it is to be fitted with a standard 3/32 in. "O" ring. A metric ring (2.5 mm.) probably is available, but as yet I have no information either as to a suitable source, or as to the size of recess it will need.

The governor chest can be milled or bored out 7/16 in. (11) dia. by 15/32 in. (12) deep, with the valve chest held in the 4-jaw chuck. Then drill a ¼ in. (6) hole through from the inner face of the valve chest to the governor chest, and file or mill out the corners to make it a rectangular shape. (If milling, use a 3/32 in. end-mill at high speed—it will leave the corners rounded, but no matter.)

This passage will conduct the steam into the governor chest from that milled in the port-face, which in turn leads from the governor port. Whilst set up for milling, the clearance can be milled 5/16 in. (8) deep into the valve chest from the foot of the governor port (see drawing "inner face of chest" in the last instalment, or Sheet 5) to prevent wire-drawing of the supply of steam to the valve-chest from the governor chest.

The recess for the 3/32 in. "O" ring for the governor spindle will need a D-bit making from silver steel. It is 0.277 in. dia. and 3/32 in. deep (7.035 by 2.38). At first glance it doesn't appear easy to measure such a recess, but if a small "button" is made as sketched (Fig. 1A) the hole can be drilled out until the smaller diameter spigot just buttons in it. Keep the button for future use with 3/32 in. "O" rings, of course. If by unfortunate chance you drill the hole out a bit too deep, there's no need to worry. Simply add a little spigot (Fig. 1B) of 0.277 in. dia. to the inside of the oval dummy gland, making the measurement "X" equal to the surplus depth on the hole.

Gland for Valve Rod

On the prototype the gland for the valve rod is carried in a separate casting with a rectangular flange, fastened with four studs to the valve chest itself. The model uses the same system, except that the gland itself is a dummy and an "O" ring is used to seal the rod. (See the cylinder general arrangement cross-section on Sheet 5, or on page 1014 of the issue dated 15 October 1976.) This time the ring is for a ⅛ in. rod, and the recess is 0.259 in. dia. by 7/32 in. deep (6.58 by 5.56). Again the diameter will be made by a D-bit, and the depth can be gauged by a button.

The gunmetal casting for the dummy gland has a spigot at either end, and should be gripped first by the inner one. Clean up the outer one and use a thin parting tool to face up the rectangular flange and to turn the two grooves of the dummy flange, 9/32 in. (7) and 13/32 in. (10) dia. respectively.

Reverse the piece in the chuck, face up the other side of the flange, turn the spigot a little over-size, and part it off a little over length. Centre the end, drill 7/64 in. (2.5), and ream ⅛ in. Remove from the chuck, and file up the oval flanges of the "gland", and also the rectangle of the bolting flange.

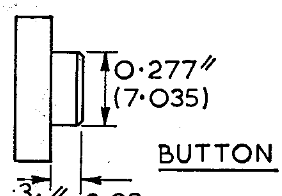


Fig.1A

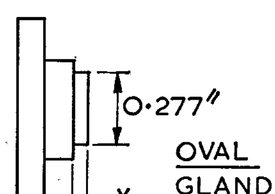


Fig.1B

Drill the four stud-holes No. 42 (2.1) in this, and drill and tap the two 8 BA (M2.0 x 0.4) holes in the oval flanges for the dummy studs—those in the external flange are clearance, of course (No. 42 or 2.1). Turn away the surplus of the inner spigot to leave it ⅛ in. long, not forgetting that if you have accidentally made the recess for the "O" ring a fraction too deep (or even too shallow) the length of the spigot will need to be adjusted appropriately.

We don't want to risk damaging this spigot now, so it will be worthwhile sawing off the outer spigot, and then holding the workpiece in the 4-jaw chuck to clean up the outer face of the oval flange. Lastly clamp the fitting to the valve chest, spot through the four No. 42 stud-holes, and then drill and tap them 8 BA.

Incidentally, please note here that since the centre-line of the valve rod and gland is only 9/32 in. (7) from the inner face of the chest, and the flange is ⅝ in. (16) wide, the edge of the flange does overlap that of the chest by 1/32 in.

Cylinder Liner

As in the Allchin, a cored-out gunmetal casting is available for the cylinder liner, and it has a flange at one end (though the flange is smaller than for the traction engine, and the cylinder block is not itself counterbored outside the flange).

With the flange outwards in the 3-jaw chuck, face it off, and then bore out the interior to 1/16 in. (27) dia. It can be reamed if that size is available, or indeed there would be plenty of power in the engine if the bore were finished to a 1 in. or 25 mm. reamer. On the other hand a nicely rounded and very keen boring-tool, newly honed with an oil-slip, and used with the finest feed available, will give a bore which takes a lot of beating. As always, of course, it must *not* be advanced on the final cuts, so as to ensure a parallel bore.

It is necessary to ensure that the outer surface of the liner is concentric with the bore, and a mandrel will do this. It can be run between centres, but it will save material if we use the jig we made previously to fit the bores of the cylinder block, on which we mounted it on the vertical-slide for machining the port face and so on. But first, assuming that this jig's two diameters were a good fit in the bores of the block, mike them up and note down the figures. If a micrometer of 1¼ in. capacity isn't part of your equipment, use outside calipers, but set them to the diameters plus a 2 thou. (0.05) feeler-gauge in each case. You will need two pairs of calipers, and once set see that they aren't moved. Alternatively turn up a plug gauge to fit the diameters of the bore.

Grip the base of the jig in the 3-jaw chuck, with the outer end supported on the tailstock centre, and turn it down to a good fit in the bore of the liner. The ideal is a fit which will "drive" by friction the liner as it is machined, though not a "drive fit" which could damage the bore. In any case there must be no shake. If the fit is not tight enough to drive, however, use a couple of blobs of soft solder to secure the liner to the mandrel—it can be cleaned off easily later.

Some latitude is allowable on the interference fits of the liner in the block: since both are of gunmetal they will expand in steam at the same rate, but the minimum should be a half thou. and the maximum two thou. (0.013 and 0.005), in this diameter. Use light cuts and a keen tool so as not to overheat and possibly distort the work.

The liner when machined will slide into the bore for about two-thirds of its length, until the interference begins to bite. Now put a ⅜ in. or ½ in. bolt right through, centrally, with a stout washer or bush at each end and a thin card washer between them and the machined surfaces. As the nut is tightened up on the bolt it will pull the liner home, and it should then be immovable.

For cleaning up the outer surfaces of the block it can be mounted on the vertical-slide using the existing jig. However, make this a sliding (but close) fit in the bore now, and check to see that its base still is true with its spigot, before bolting it to the slide. The block can be held on it with faceplate dogs, and placed at any required angle to machine the various surfaces.

On this operation, the valve chest should have been secured in place. In general the bolting faces —e.g. on the ends for cylinder covers and dummy glands, and on the top for dome and safety-valve fittings—should stand proud 1/32 in. (0.75) from the block itself. They can be "outlined" by careful manipulation of the handles of the cross-slide and vertical-slide, with a 3/16 in. or ¼ in. (5 or 6) end-mill gripped in the chuck, the cut-back surfaces eventually being finished off by filing and/or filling. At this stage too the edges of the cylinder saddle may be milled straight and true.

Drilling the Steam Ways

Three steam ways ⅛ in. or 3.2 mm. will be sufficient for the portable at each end of the cylinder. On the Allchin they had to be staggered because of the position of the cylinder cover studs, but on the Marshall the latter are not in the way, so the passages can be drilled side by side. The angle of inclination to the ends of the block is 18 deg.

The method was described and illustrated fully in the Allchin article 6 December 1974, so I will deal with it only briefly here. If an adjustable angle-plate is available, set it to 72 deg., if not, plane or machine a block of wood to that angle. File a small bevel on the edge of the liner where the holes are to be drilled, and mark out and centre-pop the centres on the bevel. Remove the valve chest from the cylinder, for ease of mounting, and clamp the latter to the angle plate or wood block, with its port face on the 72 deg. slope. In other words, the cylinder bore will be at 72 deg., thus bringing the as yet undrilled passages vertical.

It is over forty years—though sometimes it seems as yesterday!—since I first read (and used) the late LBSC's tip to grind a drill slightly off-centre for drilling steam passages or other deep holes, thus making an oversize hole to avoid the drill jamming and breaking. In those days the tough high-speed drills were unknown in hobby workshops, and indeed I think in most commercial engineering shops, and you had to "nurse" the cast steel ones, especially in the smaller diameters. So I consider it worth keeping a few assorted specially off-centre drills in a separate little tin: it saves having to grind a standard one up for the purpose and then later having to regrind it to an accurate point.

Even with an offset drill, withdraw it frequently to clear the chips and don't force it. The depth to reach the steam port will be about ¾ in. or 13/16 in. (19 to 21). If you don't emerge into the steam port at 13/16 in. deep at the most, then a check should be made. It could be that the port itself is not quite deep enough, but care is needed in any case, since there is not much metal to spare between the bottom of the ports and the annulus.

How Many Left?

To change the subject from construction, I have been asked how many Marshall portables are still in existence, and a quick count through that invaluable handbook *The Traction Engine Register* gives more than forty. The earliest listed is No. 8839, an 8 n.h.p. engine, built 95 years ago, and the latest is No. 90128, of which the horse-power and date are not given, but the latter would be about 1944 to judge by the works number.

The firm was building steam portable engines certainly until 1946 and possibly into the 'fifties. I believe that from 1940 onwards they were all fitted with piston valves, but there could have been exceptions. Those built during the Hitler war were for the Ministry of Supply, and a number of these were used in forestry, especially in Scotland where a few still survive.

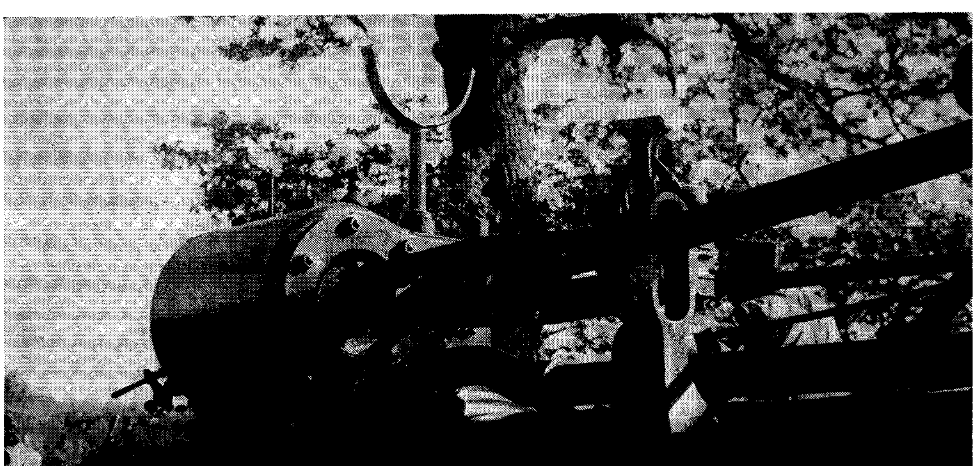
Talking of piston valve engines reminds me, by the way, that I have a Marshall catalogue dated 1926 showing their Class "S" portables which used this type of valve as early as that date. But the great majority were slide valve engines, in all makes.

As I write this, it is only three days since my wife and I drove north into the Yorkshire dales to see the last steaming before winter of the Marshall 8 n.h.p. portable No. 38318, new in 1902. She belongs to my old friend Douglas Stables, who also possesses a genuine Marshall saw-bench and a couple of Field-Marshall tractors as well as three or four threshing drums, a baler, and other assorted agricultural machinery.

In much of its detail, No. 38318 resembles the subject of my drawings—e.g. in the cylinder and motion — so we took numerous close-up photographs which should be useful to constructors. Meantime here is a picture of an earlier engine, No. 30169 of 1899, which I photographed in 1960. It will be seen that although the cylinder is a different shape from ours, such parts as the guide-bars and their support, and the chimney crutch are similar.

To be continued

Full-size drawings of the Marshall portable are available from "Historic Steam", Beighton, Sheffield, Yorks. S19 6EP.



The cylinder cross-head and slide bars of a Marshall portable engine.

AN EIGHT-DAY WALL CLOCK

Part II

by J. Lowndes

From page 1268

The pivot holes are enlarged with a cutting broach until the pivots will just enter and then burnished with an oiled polishing broach. The finished holes should be made to a fairly loose fit for the pivots, say 0.0015 in. clearance. The smaller holes are countersunk on the outsides of the plates to form oil sinks. The rear anchor position is drilled clearance for the arbor.

Bridges and Cocks

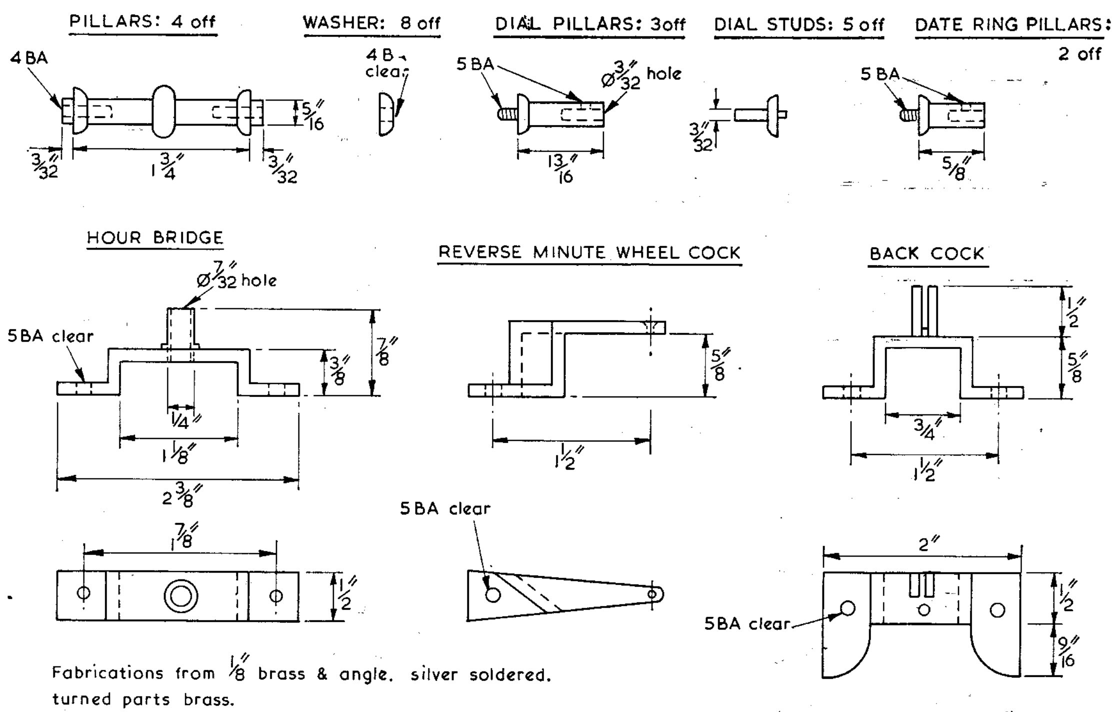
The bridges and cocks are fabricated from brass sections silver soldered together. They can be cleaned and trued by rubbing on a flat file held in the vice and finished with emery sticks. After fitting the suspension post and making the arbor pivot hole, the back cock is located using the escape arbor as a guide. The back plate is then marked ready for drilling and pinning. The hour bridge, after being fitted with the hour wheel tube, is similarly located from the centre arbor and the drilling points marked. The plates can now be drilled and tapped 5 BA at these points. Once the back cock is located, the arbor hole in the rear plate should be enlarged and slotted to the top of the plate to facilitate fitting the escapement. The front plate is drilled $\frac{1}{8}$ in. to the left of pivot centre 5/16 in. dia. for the adjustable front pivot bush.

Adjustable Bush and Crutch

The adjustable bush is turned to the dimensions given and secured to the front plate with two 10 BA screws. The eccentric pivot hole enables adjustments to be made to the escapement depth. The crutch, which is a straightforward fabrication from 16 s.w.g. brass, is colleted in the same way as the wheels. The collet is split and fitted with a collar and set screw to enable the crutch to be adjusted to set the clock in beat. The crutch fork should be an easy sliding fit on the top pendulum block.

Pendulum

Two $3\frac{1}{2}$ in. dia. discs are cut from 22 s.w.g. brass sheet and annealed. These are spun to the required shape over a hardwood former. Soap is a good lubricant for this operation and prevents scoring. It is generally necessary to re-anneal once or twice to complete the forming. After spinning, the two shells are smoothed and polished in the lathe using files and emery paper. Whilst still on the former, the discs are turned to $3\frac{1}{4}$ in. O.D. and the rear one



bored 5/16 in. in its centre for filling. The two shells are smoothed and polished in the lathe using mating surfaces by rubbing on emery cloth laid on a flat surface. The pendulum blocks are made next and slots are filed in the bob shell for the lower block and rating thread. The lower block with a piece of $\frac{1}{8}$ in. dia. mild steel screwed in the rating thread hole is smoke blackened over a candle and fitted in the shells. Wooden clamps are made to hold the shells together during filling and a short header tube fitted to the rear hole. The bob is then filled with molten lead. When cool, the lower block is driven out and filed slightly smaller to produce an easy sliding fit. The bob is then held by the sprue, polished in the lathe and lacquered before the sprue is removed. The pendulum can now be assembled. A mild steel rod is used, and 5 BA studding for the rating thread. A knurled rating nut is made to fit the thread. The suspension spring is pinned in the slit in the top block. The spring is 0.004 in. thick; either buy one, or use a feeler gauge.

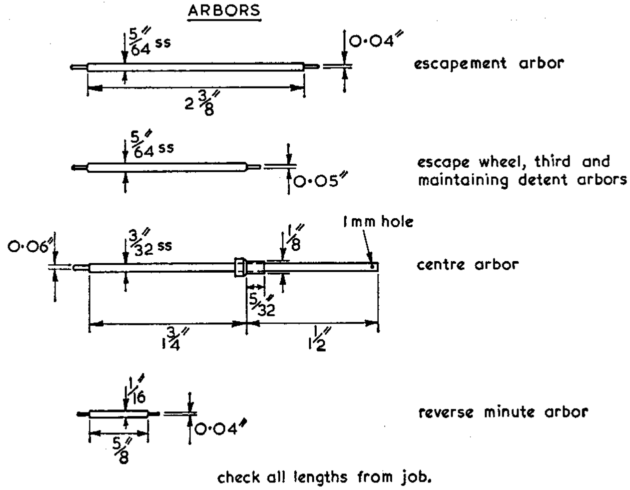
Preliminary Running

The pinions and wheels may now be cemented to the arbors with Loctite. I use bearing fit Loctite, it is not too strong to allow some adjustment later. The movement may now be assembled, pivots oiled and checked for free running. After mounting on a test board and hanging the pendulum, hang a $3\frac{1}{2}$ lb. weight in single fall from the barrel line. The clock should run when set in beat and the escapement depthed correctly. Failure to run may be due to tight pivots; open them slightly with the broaches and try again.

Motion Work and Hands

The wheel tubes are turned from brass rod to the dimensions given. The hour and minute wheels are then crossed and depthed in the same way as the time train wheels and fixed to the tubes. The six-tooth pinion has its pins pitched on a 0.141 in. circle. The two pinion ends are separate since a centre section would foul the hour wheel teeth. An arbor made from 1/16 in. dia. silver steel, pivoted in the normal way, fits between the cock and the front plate to carry the pinion and reverse minute wheel. The hands are cut from 1/32 in. steel. Carbon steel blues best and old saw blades are suitable material after annealing. After polishing with fine emery paper the hands are blued in the oven at 465°F. The hand collets are turned from brass rod, and the hour hand riveted to its collet. A hard brass spring is made to drive the minute wheel and the motion work assembled on the movement. The minute hand is fitted to the square on the minute wheel tube followed by its collet. Sufficient pressure is applied to the collet to give enough friction to drive the hands and the centre arbor is marked for drilling for the retaining pin. A blued needle makes a good pin for this job. Once the hands are in place it will be possible to regulate the clock to some extent.

ARBORS



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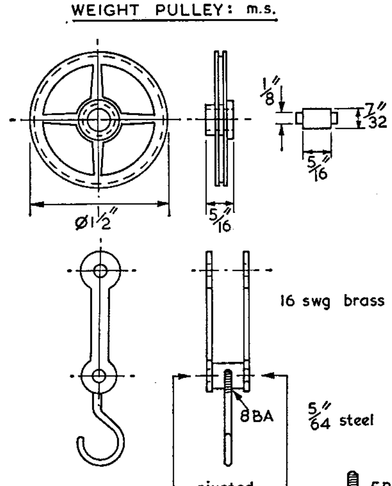
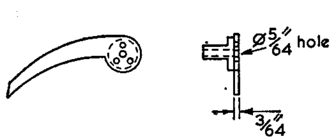
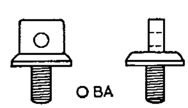
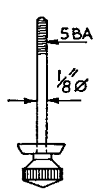




MAINTAINING PAWL steel



WEIGHT EYE



SEAT BOLT & WASHER

Chapter Ring

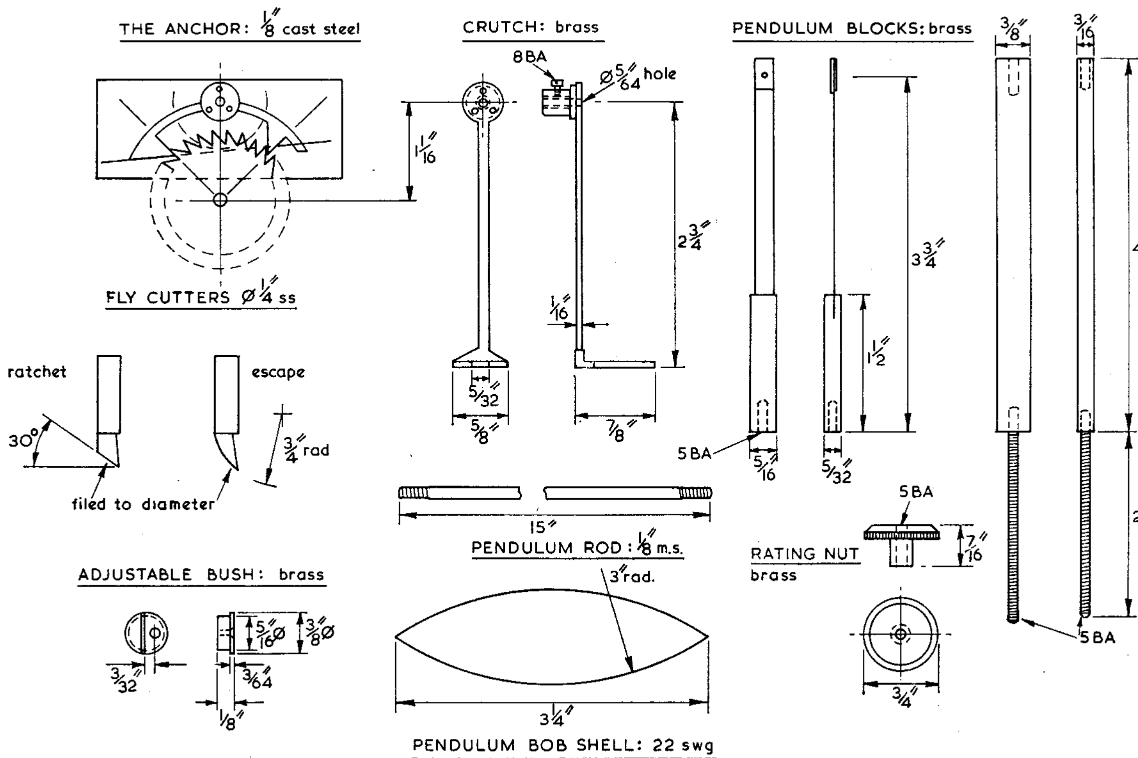
An 8 in. dia. 16 s.w.g. blank is screwed to a circular piece of block board mounted on the lathe faceplate. After truing the edges of the blank, the minute and quarter hour circles are turned using a 30 deg. vee tool. These are divided into 60 and 48 parts respectively using the same tool turned on its side and indexing with the division plate. The extreme widths of the Roman numerals are marked in pencil on the ring and the serif turned in with the vee tool. This is done with the lathe in back gear turned by hand. The wide strokes of the numerals excepting fives and tens can be planed in using a tool like a parting tool but with much more front clearance. The tool is held in a holder on the vertical-slide and the operation indexed from the division plate. The strokes are parallel, not radial so the graduated feed on the vertical-slide is employed to raise or lower the tool to give the correct spacings. A little careful planning saves time here. I, and the centre strokes of III and VIII can be done at the same setting. The same tool is used to mark the hour positions on the minute and quarter hour circles.

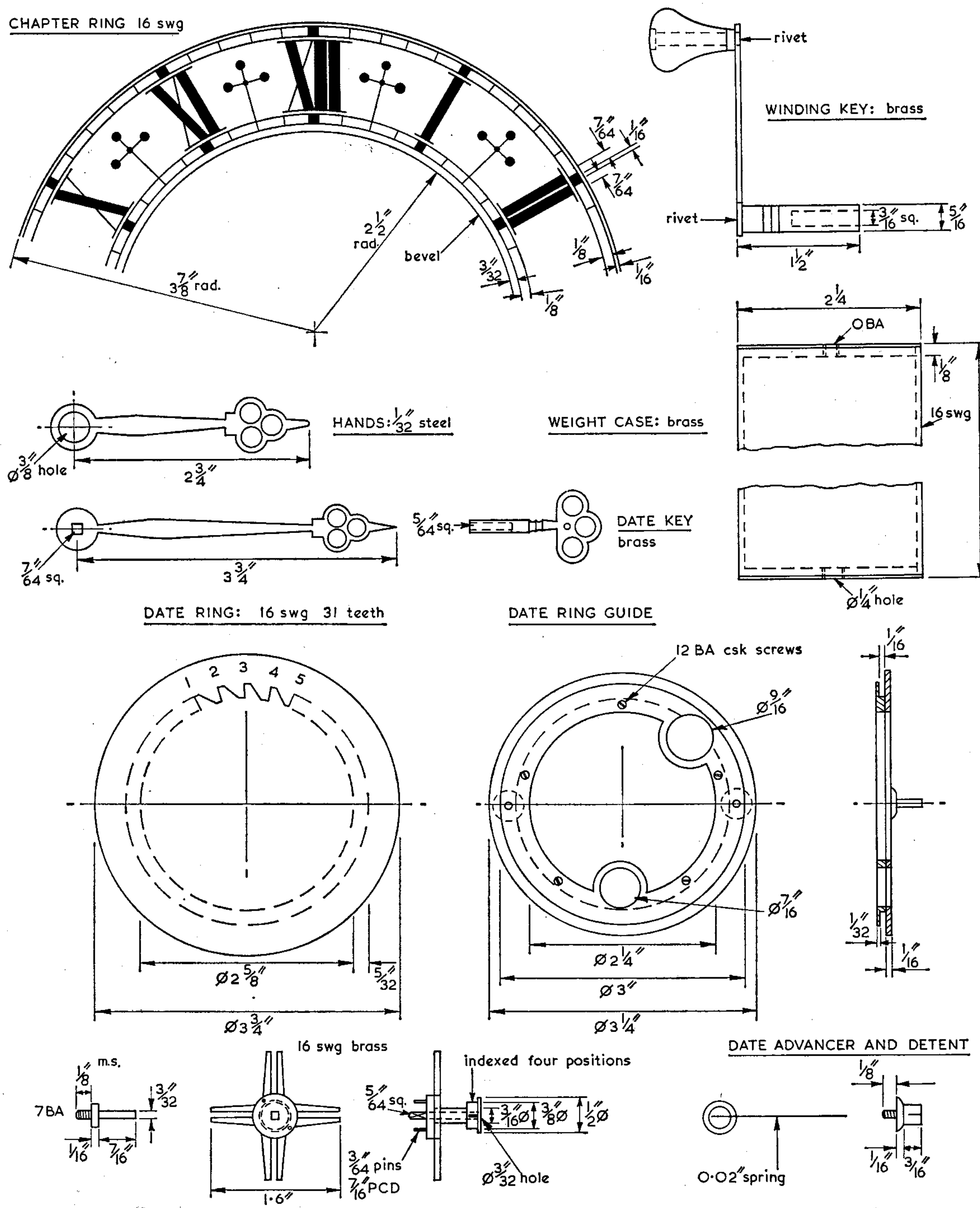
The fine strokes of V and X are cut next with the vee tool; the correct angles being obtained by rotating the ring and lifting or lowering the tool. The wide strokes can be cut with the same tool by taking a number of cuts, advancing 0.01 each time. This is a good method for the V's since the tool can run out into the narrow strokes. The decorative patterns between the numerals are also planed in and the spots formed by drilling from the drilling spindle. Four of these spots are used to contain and hide 12 BA fixing screws. All the engraving described can be done perfectly in the lathe, no hand work is necessary. I usually make several cuts, finishing about 0.015 in. deep.

When all the cutting is finished, run the lathe and clean the ring with '0' emery paper on a cork block. Remove the work from the faceplate and fill the engraving with a mixture of Araldite and black oxide (obtained from builders' merchants). When partially set, scrub the surplus filling away under water using a pumice stone. When completely set return to the lathe and give the ring a circular grain with '0' emery paper. The ring can now be trepanned from its centre leaving a bevel on its inner edge. The ring should be scrubbed in soapy water to remove any brass dust from the numerals and dried. Silvering powder (silver chloride) is applied with a damp cloth and rubbed in until the desired result is obtained. This is followed by cream of tartar to whiten the ring and then by clear lacquer to prevent tarnishing. I find that Radio Spares insulating lacquer aerosols are good for this job.

Dial Plate

This is 16 s.w.g. hard compo brass 9¼ in. square. After soldering dial studs to the back, to correspond





to dial pillars screwed in the front plate of the clock movement, the plate is given a straight vertical grain with '0' emery paper. The centre portion showing through the chapter ring is matted using a 1/16 in. wide graver made from silver steel. The process requires cuts in four directions overlapping each other. Each cut is made by wriggling the graver whilst applying forward pressure. Practice on a piece of scrap first, it's tedious work, but the finished result is very good. When the matting is completed, the dial centre must be scrubbed with a soft brush and metal polish, followed by soapy water and then methylated spirit. After drying, it is sprayed with clear lacquer. Cast spandrells bought from clock material suppliers, screwed to the corners of the dial plate, complete the job apart from cutting holes for the key and hands.

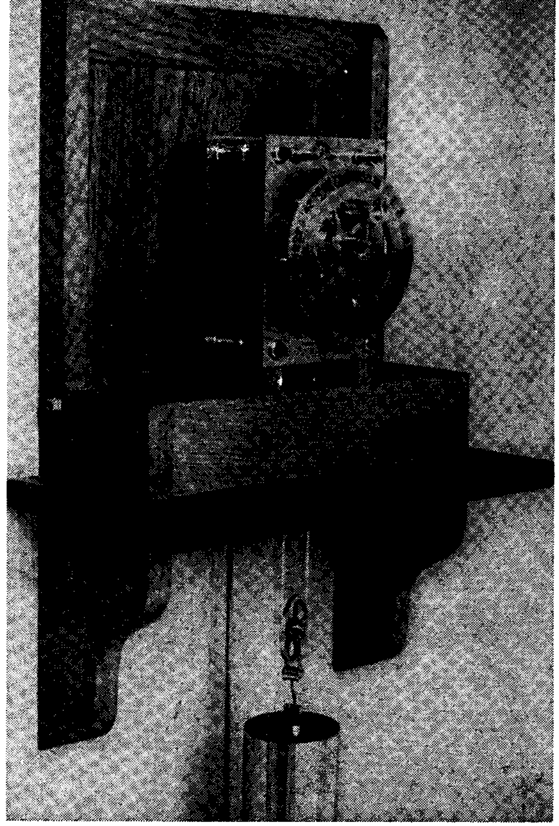
Weight, Pulley and Fixing Screws

The weight (7 lb) is made from a 5 in. length of 2¼ in. O.D. 16 s.w.g. brass tube with ends made in the same way as the barrel ends. The ends of the tube are squared in the lathe using a four jaw chuck to give good support and the flanged ends turned to a loose fit. One end is tapped 0 BA for eye bolt and the other drilled ¼ in. for filling. The components are soldered together with pressure applied finally to expel surplus solder and make a close joint. To prevent the parts separating when filling, 12 BA studs are fitted in the same way as those in the barrel. Now, turn and fit the eye bolt and fill with molten lead, and return to the lathe for finishing. The weight eye is gripped in the chuck and the tail centre is run in the filling hole. A light cut all over followed by '0' emery paper gives the best finish, if a high lathe speed is used to eliminate chatter. The pulley, key and fixing screws are simple turning and filing operations as indicated in the drawings. The square hole in the key can be cut in a single pass with a home-made silver steel drift following a pilot hole. This completes the clockwork, apart from the datework. Some constructors may wish to omit this extra complication and proceed with making a case.

Datework

The date ring is constructed from a 3¾ in. dia. 16 s.w.g. brass disc. This is gripped in the outside jaws of the 3 jaw chuck and after trepanning out the centre, thirty-one teeth are end milled on the inside. I used a modified centre drill for this job. The numerals can be cut with punches held in a jig or if you can get access to one, a gravograph does a good job. The ring is filled, silvered and finished in the same way as the chapter ring. Two guide rings are required for the ring. The front one is made from a 3 in. O.D. x 3/32 in. blank. A spigot is turned to a running fit for the inside of a ring leaving a flange 0.02 in. thick. The rear ring has no spigot, but is cut to the same dimensions. Both rings are screwed together with five 12 BA screws and the date ring should run freely when in place. As much metal as possible is then removed from the centres of the guide rings and a section cut away so that the pins advancing the date can engage with the ring. On my clock, I had to fit the guide rings round the winding square. It pays to check with the job as work proceeds. When finished the assembly is mounted on the front plate with two pillars and studs in the same way as the dial. The pillars should be 5/32 in. shorter than the dial pillars.

To advance the date, a four slot geneva wheel is made, this is driven from a pin in the hour wheel



and advances 90 deg. in 12 hours. Two pins must therefore be fitted to advance the date ring. The pins are fitted in a flange on the geneva wheel collet. The geneva wheel runs on a stud screwed in the front plate. I found it necessary to fit a spring detent to locate the four stations of the geneva wheel. The detent engages with notches in the collet. A square is fitted to the front of the collet to enable the datework to be advanced at the ends of short months by using a small key. Apertures for the key and the date must be made in the dial plate. It is advisable to locate the positions of these from the job.

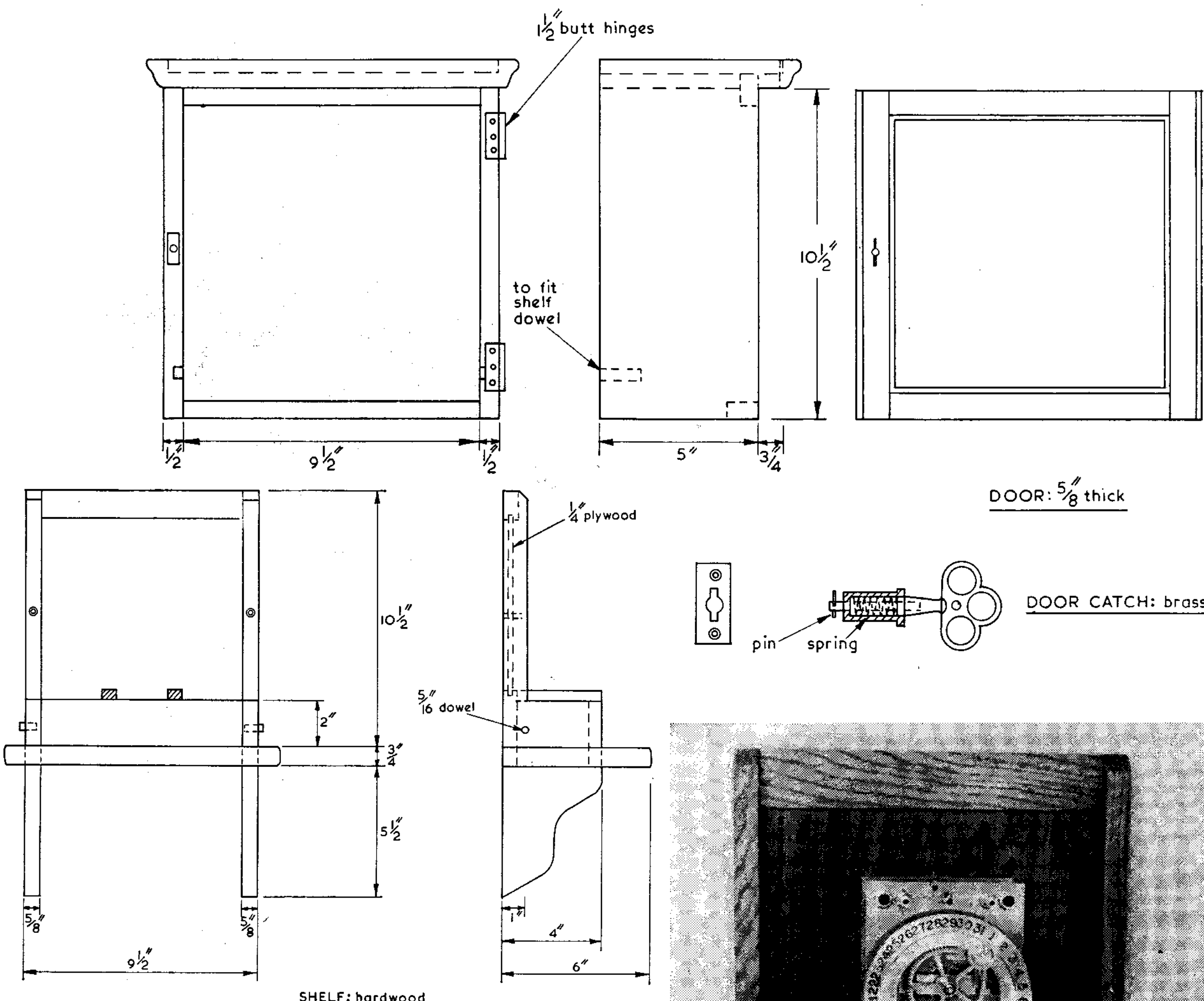
The Case

I am not giving a detailed description of how I made the case because I have a cabinet maker's tool kit and will have used tools which most model engineers will not possess. My clock case is constructed from oak and has contrasting mouldings of teak. The case is finished by applying teak oil and rubbing down with fine glass paper between coats.

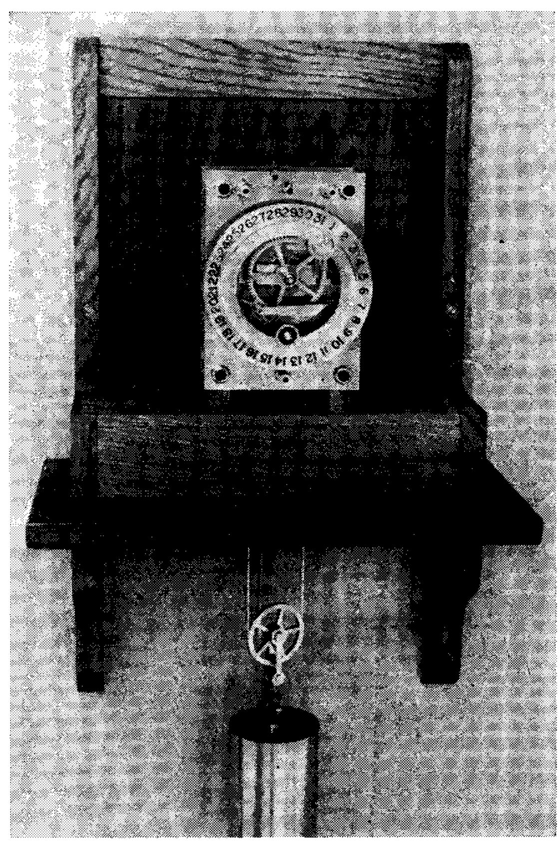
The woodwork on my case is solid, I used dovetailed and dowelled joints where applicable and worked my own moulds. Other possibilities would be plywood followed by veneer or contiboard etc. The glass front door may be omitted to simplify the job; in which case, the case should be made smaller so that the dial plate rests on its front.

Finishing

When the case is ready to receive the clock, the movement should be stripped down and cleaned. The plates should be given a grain finish after removing any marks. The pillars and washers can be given a



polish in the lathe. Smaller parts can be cleaned with a brush and metal polish and washed afterwards in methylated spirit. Care must be taken not to overdo polishing because it rounds corners which should be square and destroys grain finishes. In general as little polish as possible is a good rule. I did not lacquer any of the movement and assembled my clock very carefully using gloves or pieces of paper to avoid finger marking the brass parts. Before assembly it is worth pegging out the pivot holes with a sharpened match stick to remove any abrasive or polish. Damaged screws should be replaced and steel screws blued in the oven. Cheesehead screws look better than round-headed ones in the pillars and cocks. Remember, that clocks are judged by their finish and the clock with best finish is the most attractive. After the final assembly, oil the pivots and pallets. The completed clock should now be regulated. My clock will keep time to within half a minute per week and is reliable in all respects.



A simple low-pressure boiler

by "Tubal Cain"

THERE ARE many occasions when model engineers need a supply of steam in small quantities and at lower pressure than usual and on such occasions, all too often, the shop is filled with steam blowing off from the test boiler. Not only a nuisance, but the stuff can condense on tools and machines too. This little boiler was knocked up in an evening to provide steam for the "Williamson" Columnar Engine, recently described, and the external proportions were modelled on the usual "7-foot" vertical centre-flue type which might have been supplied with the engine in the 1860's. Spirit fired, it supplies quite enough steam to run the Williamson for about half an hour at a filling, and has driven a 1 in. bore x 2 in. stroke beam engine at 60 r.p.m. (This engine was only moderately run in at the time.) Steam is raised from all cold in 5-6 minutes and it takes about two minutes to get enough steam through the engine to warm it up before running under its own power. Working pressure is 30 ps.i., though the safety valve on mine has been set at 20—quite enough for the purposes mentioned.

Construction has been made as simple as possible. Top and bottom end-plates are identical apart from the bushes in the top for such fittings as are decided upon. The flue is a piece of ordinary commercial copper water pipe, and the shell may be either copper tube 20 swg, or a rolled and jointed sheet of 18 swg, the increase in thickness to allow for the "efficiency" of the joint. The firebox is a rolled sheet of copper or brass, and the base on which it sits is made of tern-plate (lead-coated steel) but could be tinplate if desired. Two bushes are shown for water level test; the builder can fit a water gauge of the usual type, but I used test cocks, as normal on small boilers in those days. However, if you DO fit test cocks they should be off centre to each other, not one above the other as I made them; this prevents the lower cock from being flooded with hot steam/water when the upper one is opened. A "spiral retarder" is fitted in the flue; the boiler works well enough without it, but the draught is a bit fierce for a spirit lamp, and flue gases are rather hot. The retarder slighter improves the heat transfer. The lamp is a simple "pot" with three wicks and can be refilled at least once without refilling the boiler. Naturally, constructors can add feed-clacks, pressure gauge, and so on if desired, to add to the realism if not strictly necessary! Fig. 1 shows the sectional arrangement.

Formers for beating out the boiler ends are shown in Fig. 2. The sheet should be cut to a circle and annealed, after which a $\frac{5}{8}$ in. dia. hole is cut in the centre. The edges of this may be beaten down over a jig as shown in the sketch, but I just used the rounded edge of a small bench anvil. The hole should be bell mouthed till the flue tube *just* enters. The plate can then be set on the flanging jig, the first step being to beat down the conical body profile. After re-annealing, beat down the circumference to form the flange. Do this a little at a time, don't be in a hurry or it will cockle. I found it necessary to re-anneal four times in this operation. When finished it should only just go into the shell tube—better if it won't quite go in. Now take the flanged plate and on a soft surface—a bag of dry sand, for example—and with a wooden or leather ball-ended mallet, slightly dome the cone so that it adopts a curved rather than a conical shape. Finally, re-flange if need be to fit the shell-tube. Take care that there are no gaps in the fitting. The holes for the bushes for the top fittings can now be made. I have a punch for such jobs, but a drill will do provided you have a metal backing under the sheet. It pays to use a drill one size down and enlarge with a taper reamer or the tang of a file. The holes should be a good fit for the bushes.

If you use tube for the shell, no problem; all you have to do is to drill the holes for the two bushes and square the ends up with a file. If you roll-and-joint a piece of plate, then you must remember to joggle the joint at the ends so that the flanged end-plates fit properly. In either case you may care to set up a vertical row of dummy rivets to "make it look proper"! 1/16 in. rivets at 3/16 in. or $\frac{1}{4}$ in. pitch would be about right. Incidentally, you can avoid the joggle at the joint if you use an external butt-strap at the joint, but if you do, don't forget that you should have a DOUBLE row of said dummy rivets!

The lower end of the flue $\frac{3}{4}$ in. dia. x 6 in. long is bell-mouthed; simply anneal the end, and beat round with a small ball-pein hammer till it fits snugly to the lower plate. You can make a jig similar to that shown in Fig. 2 if you like (wood will do at this thickness) but it is hardly necessary. Make the bushes next. These are shown in Fig. 4. Don't use brass; though it should be satisfactory at the pressure there is always a risk of burning such thin section if you are too enthusiastic with the blow-lamp. You may well have fittings available (my own safety-valve is the spare from a very ancient "toy" steam engine!) in which case make the bushes to suit. Note that threads are not the usual 40 t.p.i.;

I dislike these for boiler fittings, and have specified 32, except for the filler plug, which is 26 t.p.i., as this one has to be undone frequently. Incidentally there is no reason why you should not enlarge the safety-valve body and use this as a filler—it has the advantage that you inspect the valve spring every time you use the boiler! The bushes are a very simple turning job which I don't think I need detail, but simply remind you to take care that the thread is square to the bedding face, and to put a countersink one thread deep at this end of the hole after threading.

Brazing up—I should have warned you that if you are using a rolled shell it pays to braze this up before making the end-plates, so that any errors can be allowed for in the flanging. It isn't easy to get both ends the same diameter. Braze up the seam using C4 alloy if you have it, otherwise Easyflo No. 2. Heat the job from the inside of the tube, of course. If you have done the usual and fitted a few rivets to hold all together whilst heating, these should "take" satisfactorily whilst brazing the strap or overlap, but if you have put in a row or rows of dummy rivets you may care to touch each of these with Easyflo No. 2 after the main brazing but before the job cools. Pickle, or just quench from black in cold water and wire-brush off any flux residue, and then make your end-plates to suit. (After restoring the shape to cylindrical!) The next step is to braze the flue into the bottom plate, again

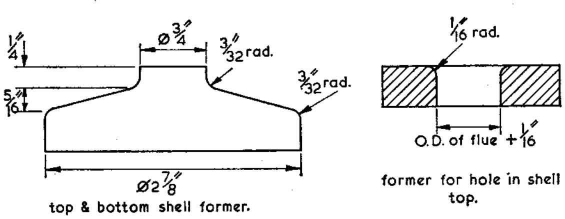


Fig. 2

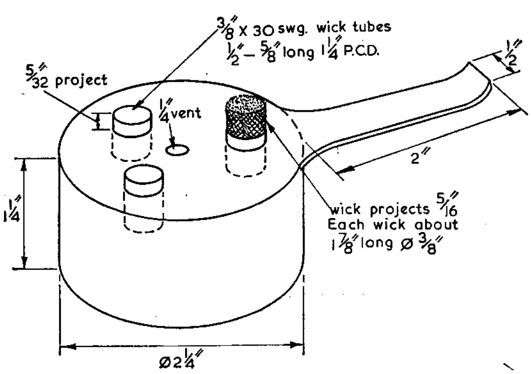


Fig. 6 LAMP 26 or 28G. brass silver soldered

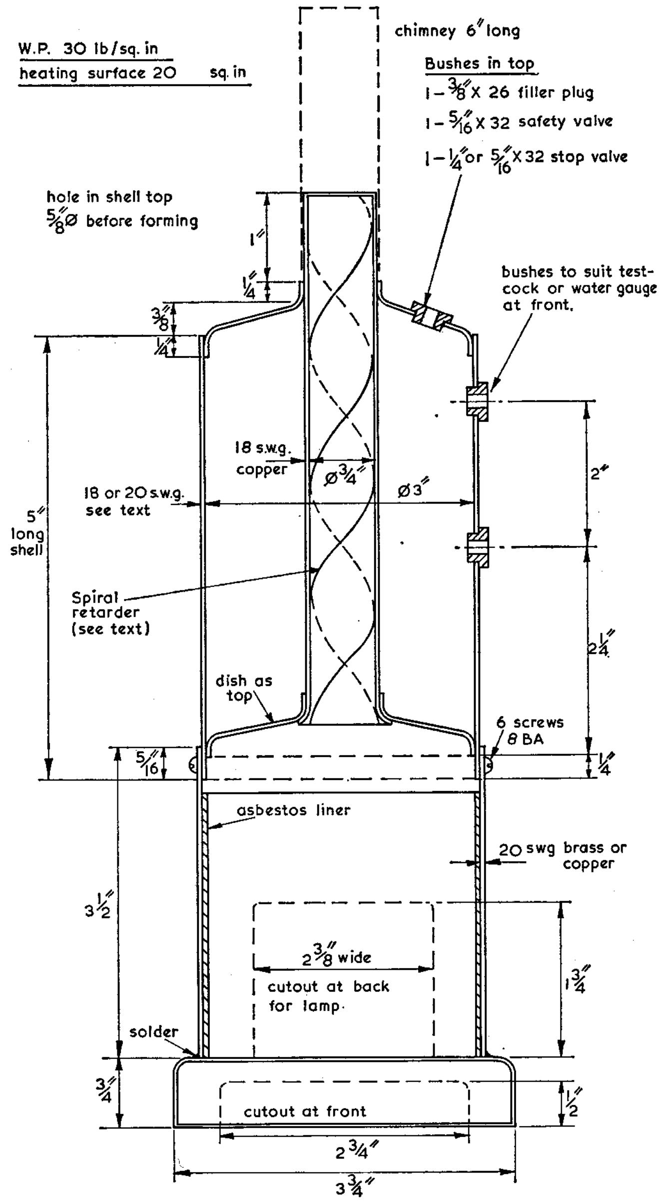
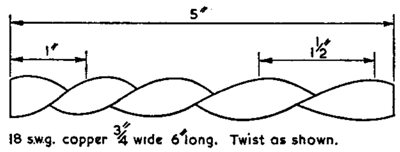


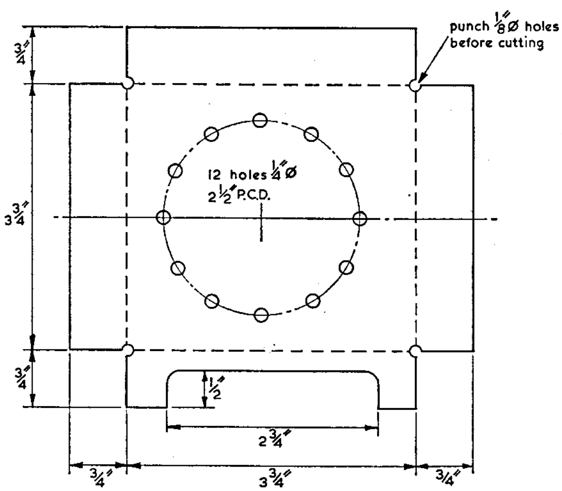
Fig. 1.

using the higher-melting-point alloy if available. Care is needed here to see that the flue stays square with the plate whilst heating, and you will have to rig up fire-brick packing to do this. Pickle this bit, too.

You can now assemble the parts, well fluxing each joint, including those already brazed, and fitting the bushes. The lower flange should be at least ¼ in. inside the tube. Stand the boiler upright, but NOT on a piece of asbestos. If you do, then liquid flux may cause some of this to adhere to the metal, and



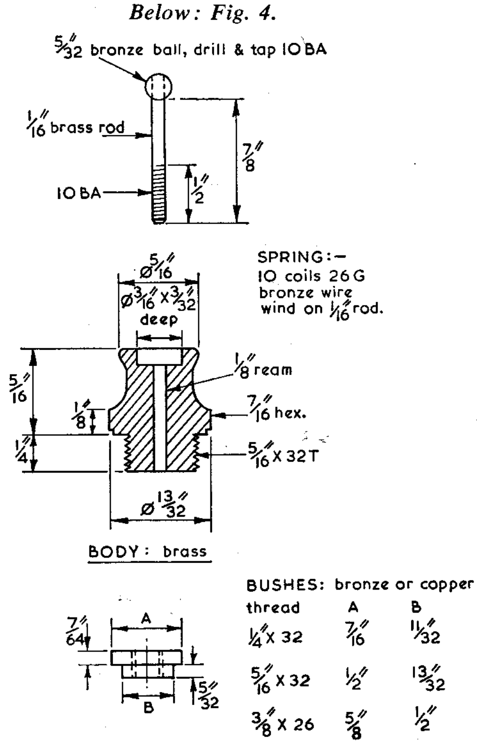
SPIRAL RETARDER Fig. 5

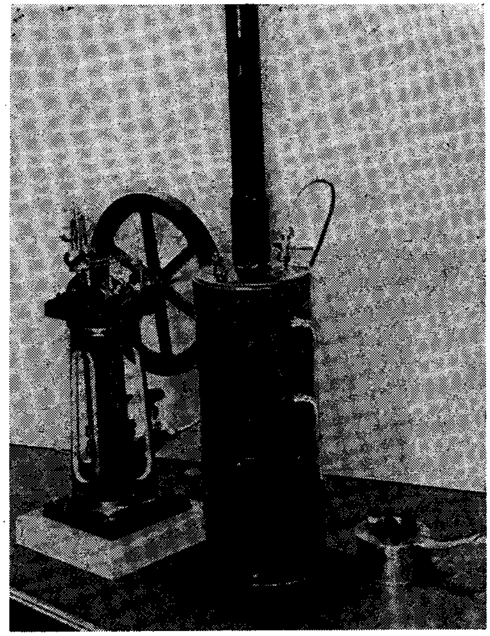


Fold on dotted lines and solder corners inside.

BASE BEFORE FOLDING 22 gauge tinplate Fig. 3

Below: Fig. 4.





The simple vertical boiler with the writer's Williamson engine.

result in a dud joint. I use "fosalsil" brick ("folsain" is another similar) which is an insulating brick used in furnace construction for this sort of job. Start with the joint of the flue to the top plate, use Easiflo No. 2 and feed well to make sure the material fills the joint. Then do each of the top bushes, and finally the shell-to-top flange. Heat quickly, to avoid prolonged heating of the flux, which will decompose it, but don't heat to a higher temperature than needed to melt the solder.

Now transfer the flame to the boiler side, turn the boiler sideways so that these bushes are uppermost, and braze these. Finally, turn all upside down and braze up the lower flange joint. Now, it may well be that when you come to this part you find the flux all black, and it won't clarify; the brazing alloy won't take either. This is due to prolonged heating and the remedy is simple. Pickle the job, wash well inside and out with water, reflux, and deal with the bottom flange separately. You may decide to do this anyway, but nevertheless you must still flux the bottom joint for the first heat, to keep the metal clean.

The final pickle should be followed by a good swill in warm water, after which the joints should be inspected, first visually, and then by fitting plugs and water testing. 50 or 60 p.s.i. is quite adequate for this little chap.

To be continued

LATHEWORK FOR BEGINNERS

Part III

by the Editor

From page 1140 19 Nov. 1976

So far, I have not said anything about accessories for the lathe, and although the lathe is a most versatile machine, a fair number of accessories will be required if the best use is to be made of it.

Most lathes, if purchased new, are supplied with a faceplate, two centres (one of which is generally hardened and the other soft) and if the machine is of the screw-cutting type, a set of change-wheels. Very often a driver plate is also supplied. This is similar to the faceplate but smaller in diameter and usually has one slot with a peg for driving work between centres.

As a large proportion of lathe work done by the model engineer is chuck work, the first purchase, and an almost essential one, is some kind of chuck.

My drawings show the two principal types of lathe chuck, the 4-jaw independent (in which the jaws are reversible) and the 3-jaw self-centring (for which two sets of jaws, inside and outside, are generally supplied). Both these chucks are extremely useful, and if resources allow, both should be purchased. If only one can be afforded at first, my advice is always to go for the 4-jaw. The reason for this is that the 3-jaw is only suitable for holding round or hexagon work, and even then it is not ideal for holding round castings.

The 4-jaw chuck, on the other hand, can hold almost anything, yet it can also be used to hold round work, although of course it takes a little time to get the job running true. Another point in favour of the 4-jaw is that it will hold round work more firmly than the 3-jaw, having the extra jaw; furthermore overhang is generally a little less. As to sizes, the average 3½ in. centre lathe will carry a 6 in. dia. 4-jaw or a 4 in. dia. 3-jaw chuck. For 3 in. centre lathes, a 4 in. dia. 4-jaw and a 3 in. dia. 3-jaw will be found about right.

Some of the smaller self-centring chucks are operated by a knurled ring on the chuck body, but those having a separate key are to be preferred whenever possible.

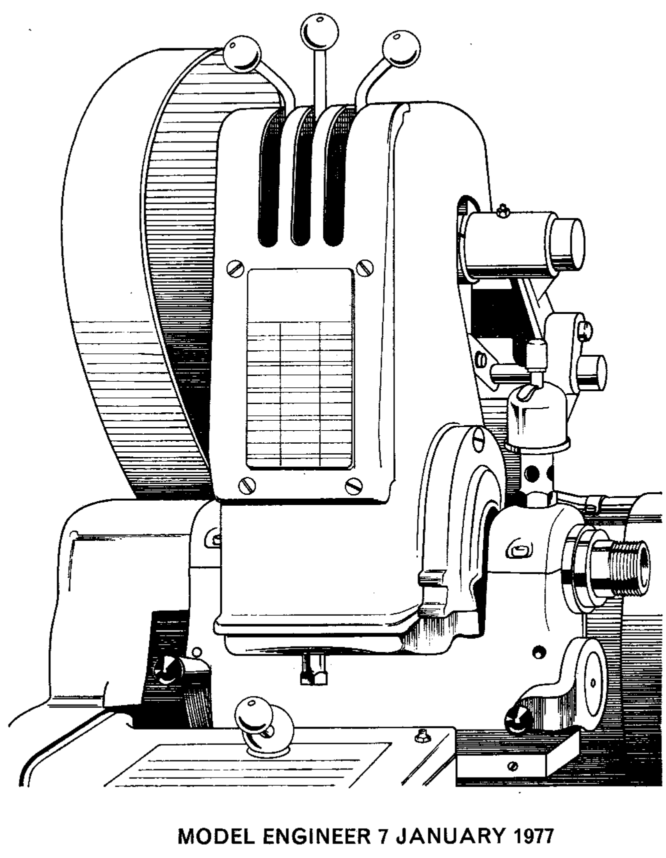
Another almost essential accessory for the model engineer's lathe is a drill chuck, which should be obtained with a tapered shank or arbor to suit the tailstock (this will probably be No. 1 or No. 2 Morse taper in most cases). As with all tools, it pays to obtain the best quality chuck one can afford, and I can recommend the well-known "Jacobs" pattern and the Rohm key-type chucks.

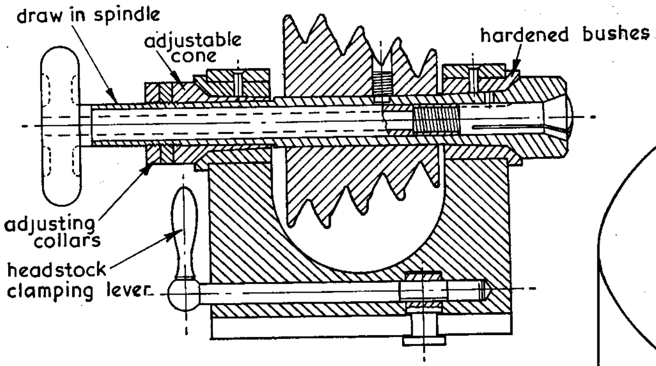
One more essential item of equipment must be mentioned—the tool grinder. Unfortunately, very little lathe work can be done without some kind of grinding equipment and a double-ended 6 in. tool grinder is now quite an expensive machine. However, a cheaper but satisfactory grinder can be made up using two ball-bearing plummer blocks and obtaining the drive from the lathe's own motor. Such a grinding head can still be fitted with 6 in. dia. wheels, which should be about ¾ in. wide and ½ in. bore for preference. It is a good plan to acquire one "green grit" wheel and one "standard" wheel, when the former can be used for sharpening carbide tools and the latter for high-speed or carbon-steel tools.

Always keep all other machines and tools well covered, when grinding!

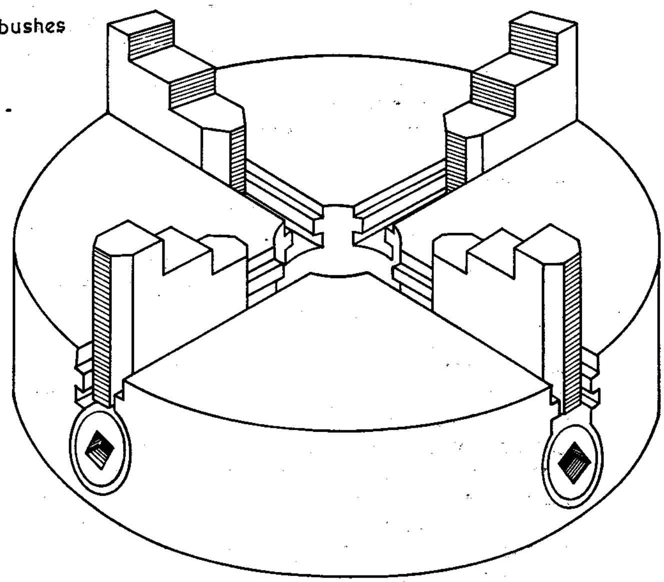
Do not forget that such grinding wheels must be run at a high speed—between 2800 and 3000 r.p.m. for 6 in. wheels—and the wheels must always be clamped with cardboard discs on each side of the wheel and inside the clamping washers. A further

Below: Myford's "Trileva" device makes speed changes very quick and simple.





Typical spindle bearings as used in many precision instrument lathes.



The four-jaw independent lathe chuck.

point is that grinding wheels should always be properly protected; a strong steel casing should be provided covering most of the side of the wheels and the periphery, leaving about 3 in. (for a 6 in. wheel) exposed at the front above the tool rest and around 2 in. below the tool rest. A sudden jamb can cause a grinding wheel to burst, so one cannot take chances! A perspex "eye guard" can also be made up, as a guard against the sparks and fine particles which may be thrown out from the wheel. Further information on tool grinding can be obtained from *The Grinding Machine* by Ian Bradley (Argus Books Ltd.).

Lathe Tools

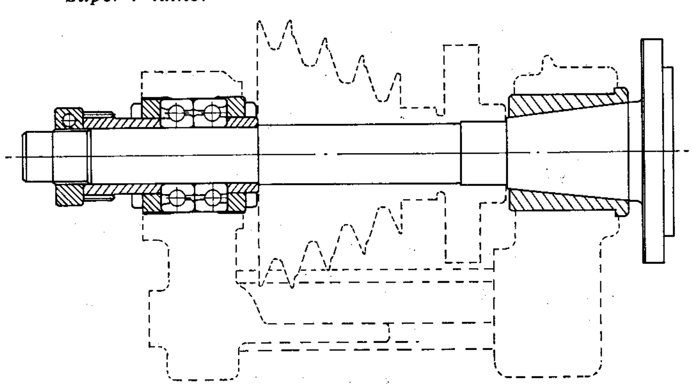
Opinions differ as to the best type of lathe tool for the amateur. I favour the use of high-speed tool bits which can be obtained in round or square section and in sizes from $\frac{1}{8}$ in. square or $\frac{1}{8}$ in. dia. upwards. If these are used directly in the "single-tool" toolpost, probably the $\frac{3}{8}$ in. square x 3 in. long tool bits are the most convenient. If using a 4-tool square turret, the $\frac{1}{4}$ in. or 5/16 in. square bits will generally be convenient; these sizes referring to lathes of 3 in. to 4 in. centre height.

There seems to be an idea prevalent that carbon-steel tools give a better finish than high-speed. I don't think this is true, and in any case poor finish on the work is often due to other causes—wear in the spindle and slides for instance. Apart from that, carbon-steel tools soon lose their cutting edge and are quite unsuitable for most iron castings.

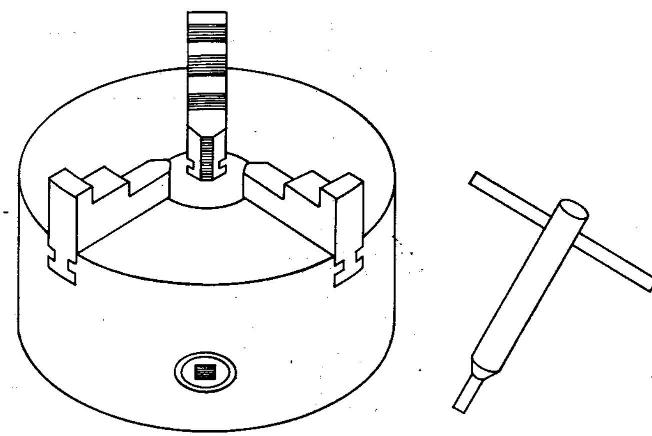
Carbide lathe tools on the other hand are well worth considering, especially for dealing with some of the harder iron castings, though they have to be treated with care if the cut is intermittent. They can only be sharpened on the "green grit" grinding wheel, but as against this, they will give very long service between re-grinds, at least in the average model engineer's workshop.

My drawing shows the shapes of lathe tools most

Below: The spindle bearings used on the Myford Super 7 lathe.



Below: Three-jaw self-centring chuck with key.



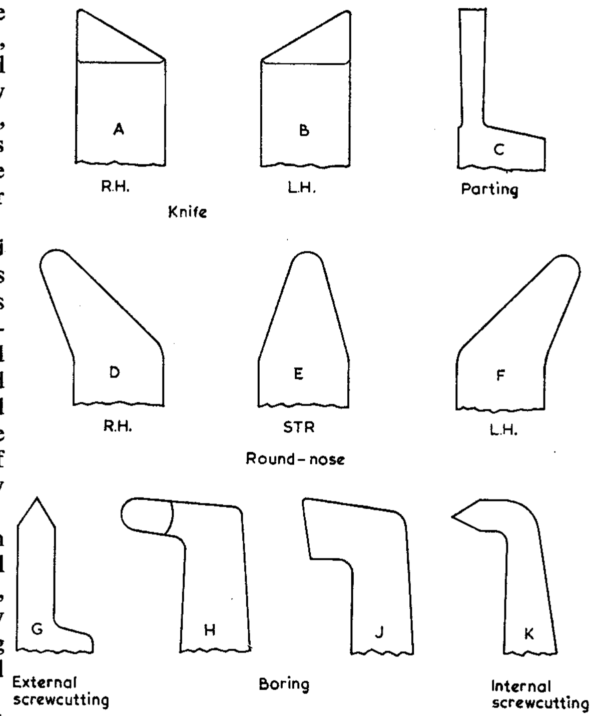
generally useful, and I would suggest that these be ground up from the tool bits mentioned previously, with the exception of the boring tools and internal screw-cutting tool which are best bought ready shaped by the beginner. As regards a carbide tool, probably the most useful shape to start off with is that shown at E in the drawing; there should be *no* top rake, when the tool will be found ideal for such jobs as wheel and flywheel turning.

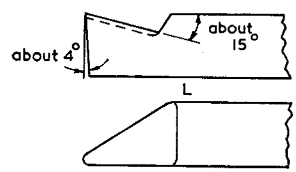
The high-speed tool bits are normally supplied hardened and ground on all surfaces, the end faces being ground off at an angle. To grind the shapes depicted in the drawing obviously involves removing quite a bit of metal and it must be emphasised that this grinding can only be done very slowly and in stages, otherwise the tool will be overheated and spoilt. Have a can of cold water close by the grinding wheel, and using the coarser wheel (if there is more than one), dip the tool frequently immediately it shows signs of overheating.

However carefully this grinding is done, an examination of the cutting edges of the lathe tool will show that they are still comparatively rough, and to get the best results, they should be lightly "stoned". Use a fine-grade oil-stone, and keeping the stone at the correct angle, a few rubs will greatly improve the finish.

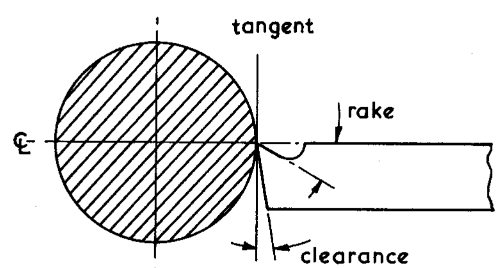
The lathe tool shown at A is probably the most useful all-round shape for the model engineer, while the right-hand and left-hand tools D and F will come in for a good deal of work.

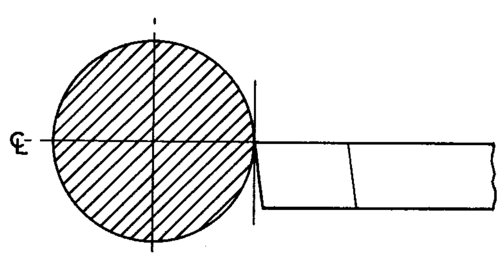
The cutting edge of the lathe tool should always be set exactly at lathe centre height and for this purpose a simple "centre height" gauge which can be stood on the lathe bed is a worthwhile item to make very early in the proceedings. If the lathe tool is set a shade *below* centre height, this is really no disadvantage apart from the fact that a small "pip" may be left on the end of the work when "facing"; but a tool set *above* centre height is not advised as this may cause the tool to dig into the work.





R.H. knife tool for steel





To be continued

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LO. 99, Sheet 3. Full details of the boiler.

Sheet 4. Piston and slide valve cylinders, crossheads, slide bars, connecting rods.

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A Stirling Cycle Engine

Part II

by J. Henshall

From page 1265
17 Dec. 1976

THE MODEL harbour tug used as a test bed to assess the performance of the engine in comparison to a simple steam plant, is 700 mm. (27.5 in.) waterline length, 150 mm. (6 in.) beam, and 76 mm. (3 in.) draught with a total displacement of 4.9 kg. (10.7 lb.). With the Stirling engine installed 1.5 kg. (3.3 lb.) of ballast is needed to immerse the 63 mm. (2.5 in.), 76 mm. (3.0 in.) pitch 4-bladed propeller. The steam plant for the tug weighs 1,5 kg. (3.3 lb.) which includes a water tank and donkey pump for the boiler feed. A home designed two channel proportional radio control system is normally carried, weighing 0.8 kg. (1.75 lb.) of which 0.45 kg. (1.0 lb.) is oversize (ex disposals) batteries. The engine is a V twin double acting oscillator of 6.3 mm. (.25 in.) bore, 19 mm. (.75 in.) stroke which, being self-starting and controlled by a 4-way stop/reversing rotary plate valve, gives simple speed and direction control from one channel of the radio system.

This engine and its boiler as used in the tug cannot be stalled by finger and thumb pressure on its 3.2 mm. (.125 in.) diameter shaft. Under the regenerative action of the induced draught from the engine exhaust, high rates of fuel consumption can be obtained and under these conditions this plant can readily drive the displacement hull into hazardous stability. Fuel consumption, again of methylated spirit, at a fast cruising speed is approximately 3.5 grams (.12 oz.) per minute. Installation of the Stirling engine required that the ballast be moved almost 100 mm. (4 in.) forward to correct for the rearward C. of G. of this engine and removal of the radio from the bow, and a dog leg offset of 20 mm. (.8 in.) aft in the flue to align to the funnel casing. Cooling water suction and outlet hoses were brought out through the engine room skylight and temporarily taped to the side of the hull.

In the only trial to date, the ship's speed was sedate, sufficient to provide good steerage in the light breeze, but somewhat disappointing to a steam enthusiast used to plants with an abundance of power. The propeller, suited to the steamplant, appeared too small to adequately load the Stirling engine and further trials using increased pitch and blade area are awaiting a visit to our up-country dam.

It must be stressed that a Stirling engine does not have large pressures (externally generated) capable of overcoming faults in machining and assembly and a satisfactory performance can only be assured by treating the engine as an instrument mechanism needing care and precision in its construction. Model engineering as demonstrated at exhibitions has established the capability of model engineers to undertake such work so there is no reason to jeopardise the performance by below standard workmanship. There is, I'm sure, a law of physics relating performance to standard of workmanship! Those that make the effort needed for good work are in for a most pleasant surprise, observing the capabilities of a Stirling cycle engine, producing mechanical energy without the noise of the I.C. engine or the complexities of boilers of steam plants.

Important to the smooth operation of reciprocating engines are the need for lightness in the reciprocating components and the freedom from slackness in any moving joints, of which this arrangement has somewhat more than usual. These must be free but not sloppy, reamed holes, either by hand or machine reamers, or the home-made D bits, with lapped pins, hardened for long life, provide my best solution. Fig. 5 illustrates a useful multisize lap for pins, made from aluminium or brass bar, a piece of sheet about 22 gauge of the same material being used as a temporary spacer whilst the lapping holes are drilled. A lap needs to be continuously adjusted to a firm fit on the pin if a round and parallel pin is to be produced. Fine automotive valve grinding paste, household metal polish and toothpaste provided readily available lapping compounds of descending fineness, the valve paste is a fast cutter and after use gives an adequate finish for pivot pins. If you wish to use finer materials, laps kept solely for these are essential, the only way to remove the coarser materials from the lapping surfaces is to drill it out to a larger size.

A diverting but interesting demonstration of a self-supporting air bearing can be given after lapping the displacer piston rod (No. 32 silver steel drill rod) to fit the .187 O.D. s.w.g. tubular power piston rod. If true and perfectly clean and dry, the tube will spin on the rod, after a flick with a finger, for many seconds and whilst spinning will slide freely along the rod if this is not horizontal.

On reviewing the machining and assembly of the various components of the engine, there is very little that is not common practice, and as constructional methods and materials are largely determined by the available facilities, only the regenerator, a feature peculiar to the Stirling engine, and unexpected difficulties will be discussed. For a regenerator not subject to excessive temperatures, aluminium foil has advantages over other materials in that the specific heat of aluminium is one of the highest of common metals, thus for the storage of a given quantity of heat within a given temperature change, the mass of the regenerator material is a minimum; its density is low so a larger surface area is available for a given mass and thickness of material; and its thermal conductivity is high, minimising temperature gradients within the material. If the aluminium could be anodised and dyed black it would be even better. Salvage, for no particular purpose, over a number of years of the aluminium foil diaphragms, usually about .08 mm. (.003 in.) thick, sealing vacuum packed malted milk and similar powder containers provided ample stock for experimenting and for the three sets of corrugated rings used so far.

Turbulent gas flow is essential for high rates of heat transfer and one way turbulence can be promoted is to cause abrupt changes in the direction of flow. This can be done quite readily by forming a regenerator in the gas transfer area around the displacer piston, as a series of narrow rings of corrugated foil, having the line of corrugations at an angle to the axis of the displacer, assembling successive rings with what is, in effect, right- and left-hand helix angles. Six rings each 4.7 mm. (.187 in.) wide are held in place around the displacer body by a thin highly perforated aluminium sleeve which is located axially and radially by twelve stepped lugs formed on the displacer end caps. The perforations in the outer sleeve, the thin wall of the steel displacer body, the small area of contact between the adjacent corrugated rings and the internal diaphragms of shim steel in the displacer reduce the unwanted heat transfer by conduction and convection from the hot source to the cold sink.

The regenerator rings are formed from strips cut from the aluminium foil by scoring with a sharp knife along each side of a 4.7 mm. (.187 in.) bar. The strips, about 100 mm. (4 in.) long are corrugated by passing, at an angle of about 40 deg., between a pair of intermeshing rolls made by coarse knurling (2 mm. pitch approx.) 75 mm. (3 in.) lengths of 19 mm. (.75 in.) dia. brass rod. The rolls are drilled 6.3 mm. (.25 in.) and mounted on spindles which are pulled together to hold the rolls in mesh, by 6 BA screws at each end. This length of roll is needed to allow the strip to pass through at the required angle producing the "helical" corrugations from the parallel straight knurling. Attempts to impress the corrugations using a soft rubber roller against a helical gear did not produce corrugations of an adequate depth. The corrugated strips are gently bent by hand around the displacer body, the surplus length then being cut off to give a butt jointed ring. The hand of the helix in the formed ring is dependent on which side of the strip is used for the inside of the ring, so right- and left-handed helix angles are readily provided. The perforated outer sleeve is machined to thickness from 25 mm. (1.0 in.) O.D. x 18 gauge aluminium tubing previously perforated with 4.7 mm. (.187 in.) holes at approx. 7 mm. (.3 in.) centres. The projecting lugs on the end caps, which carry the sleeve were cut out by a jeweller's saw and files from the recessed flange turned on the cap. Obviously milling would be far less tedious.

The engine as shown in the arrangement drawing, having the connecting rod to the power pistons coupled on the port side to the rocking levers, runs anticlockwise viewed from above the flywheel, and so through the bevel gears drives a left-handed propeller (anticlockwise rotation, viewed from aft for ahead power). If used on a propeller shaft by the common practice of a right-hand thread, this hand of propeller tends to tighten, not unscrew when running ahead or striking debris. The direction of engine rotation can be changed by assembling the linkage system with the connecting rod for the power pistons coupled to the starboard side of the rocking levers, in effect turning the connecting rods and rocking levers upside down. If the direction of rotation is reversed, it is recommended that the positions of the air and water pumps be interchanged in order that the offset of the air pump ram above the centre line of the driving crank and Scotch yoke will be set over towards the position of the crankpin on the delivery stroke.

A major assembly problem, not obvious from the mechanism layout, arose from the non-symmetry of motion of the power pistons and displacers in the two cylinders, due to the short connecting rods and the method of driving the displacers. This caused the point in the cycle where the power pistons and the displacer approach closest to each other to be somewhat closer to the cylinder head in the port cylinder (assembled as per arrangement shown) and requiring that the displacer in this cylinder be about 1.6 mm. (.06 in.) shorter than determined from the layout. This was fitted in on the existing components by judicious shortening of the power piston rod at the gland end, reducing the end thickness of the displacer caps, shortening of the displacer body, increasing the internal length of the hot chamber and increasing the length of the displacer piston rod by using a small washer between the rod and the little end. Another area of possible interference, this time predicted by the layout, is between the lug on the lower power piston rocking lever, for the little end pin of the power connecting rod, and the crank disc. Machining the disc concentric with the crankpin provided the additional clearance. It was also found that the lengths of the connecting link pairs for the power pistons were not identical for the two cylinders and the lengths required were determined from the otherwise complete engine.

After final assembly, the engine should be driven for some time to work out any initial tightness, dismantled and thoroughly cleaned. On reassembly the glands can be packed firmly with fine strands of graphited yarn and the engine again driven to bed in and free up the packing, the glands being left finally much looser than for steam use. One or two drops of Penetrene, a non-flammable penetrating fluid, has been found less contaminating to the regenerator than light oils as a cylinder lubricant. The water jackets should be primed before starting and if this is delayed due to engine stiffness, it may be necessary to connect up a cold water supply from the mains until the engine can drive its own pump. On the first run, starting will appear to be slow, but don't forget there is a large block of aluminium in the hot chamber to be heated first. The heat stored in this will run the engine for close on a minute after shut down. The engine will run quite well as a single cylinder. Seeing this engine go repaid me all the work put in over the eighteen months to final completion.

As part of this story thoughts on possible improvements ought to be included for anyone contemplating continuing development of this concept. Firstly aluminium as a material for the hot chamber anneals at the temperatures reached, with consequential distortion of the bolting flange at the cylinder head studs, and a possibility of stripping the threads in the soft metal. Stainless steel is the choice for those who can work it, otherwise mild steel or even a spun copper or brass dome with a brazed-on steel bolting flange and copper heating fins. Similarly, the aluminium end cap at the hot end of the displacer ought to be replaced by a steel component. Combustion would be improved by an increase of 10 mm. or more in the height between the burners and the heating fins, it is now seen that centre of gravity and overall height considerations for marine applications are not as critical in this engine as in steam plants with underfire boilers.

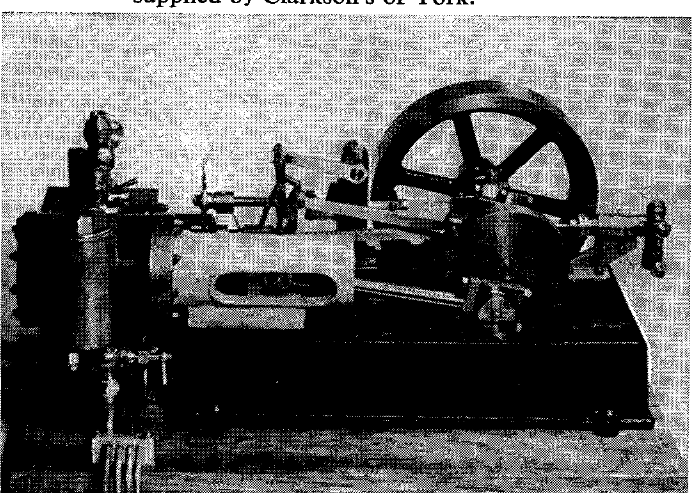
Perhaps some adventuresome experimenters would like to consider more radical changes, possibly locating the regenerator between perforated rings mounted in the joints at each end of the central cylinder section, in place of carrying it on the displacer where it adds to the moving mass; or providing a double walled firebox and flue for preheating the combustion air before it meets the burners; or even fully enclosing the mechanism and using a single refrigerator type seal on the output shaft to improve the sealing for pressurisation. These plus the feasibility of a square four layout of about 60 mm. (2.3 in.) bore, fitting within the loading gauge for $\frac{3}{4}$ in. scale locomotives are intriguing possibilities for the future. However before starting such a task, instrumentation of the existing engine to record temperatures, take indicator diagrams and measure output power would seem essential for assessing the practicability of such a project.

In conclusion I would like to thank *Model Engineer* for continuing to present articles on hot air machines and the Editor for this opportunity to describe yet another arrangement to add to the many recorded over the years of publication of this journal.

ANOTHER UTILITY STEAM ENGINE

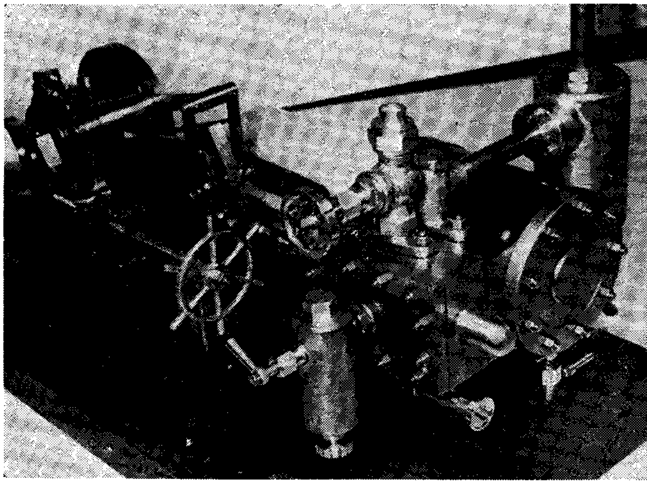
J. P. Bertinat

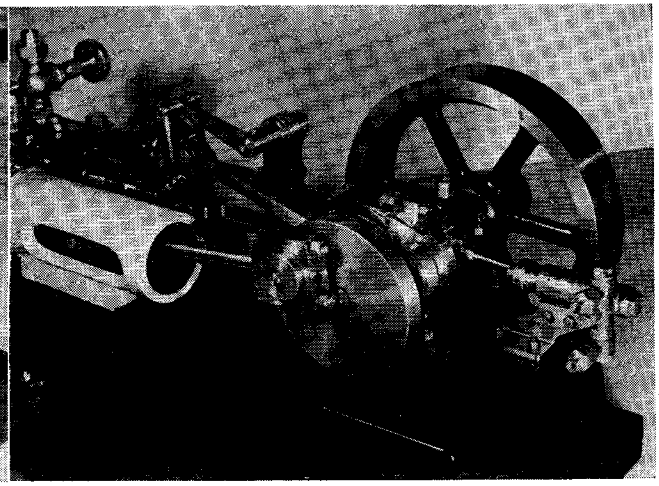
MY PHOTOGRAPHS show a horizontal steam engine which I have recently constructed, using castings supplied by Clarkson's of York.



Although commercially available castings were used, I like to introduce some of my own ideas into a model and in this case I reversed the normal engineering process and made my own drawings to suit the castings. Several changes from the published design have been incorporated, including: reduction of bore and stroke from 2 in. to $1\frac{3}{4}$ in., use of cast iron piston and rings, the provision of a substantial valve spindle guide, modified design of Stephenson link motion, and the provision of a boiler feed pump. Drain valves are fitted to both cylinder and valve chest (I consider the latter provision highly desirable for a cast iron cylinder that is subject to intermittent use). The exhaust system incorporates a combined oil trap and feed water heater, and the plug in the exhaust elbow is to enable the engine to be purged of water after a run by injecting oil through this plug and turning the engine backwards with the drain cocks partly open. All valves and steam fittings are fabricated.

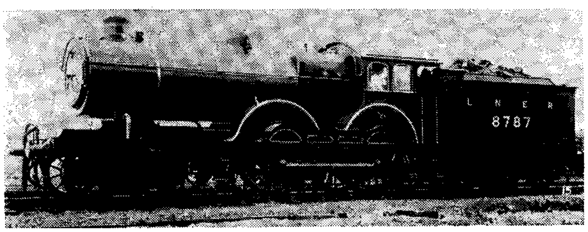
I have always been interested in Utility Steam Engines (the late E. T. Westbury's series of articles





on this subject in 1949 opened with a photograph of one of my engines) and I now have quite a collection, including the majority of the Stuart Turner range.

Two past *M.E.* designs, namely the *Trojan* single cylinder or the *Warrior* twin cylinder engine, have excellent possibilities for marine power plants, and using standard castings I have considerably up-dated these designs, giving greater bearing areas and, in my opinion, improved appearance.



SUPER-CLAUD

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

Part VIII

by Martin Evans

From page 1089 5 Nov. 1976

AFTER STRUGGLING with the complicated smokebox arrangements of *Fury, Royal Engineer* and *King's Own,* the simple internals of *Super-Claud* were doubly welcome.

The so-called "wet" header is made as described for nearly all 5 in. gauge engines over the last few years and I need not say anything about it except that stainless steel screws are well worth while in this position. Five of 4 BA are used, and they are spaced out to "dodge" the two superheater elements and the two 5/32 in. dia. copper pipes which lead to the snifter valves. I have shown these pipes fairly long with "reverse bends" in them as I think this will make the business of connecting them to the unions on the snifters quite easy.

The snifter valves (the Great Eastern always fitted two of these just to the rear of the chimney) are made in two parts, the upper part housing the usual ball and its seating and it is also threaded on the outside $\frac{3}{8}$ in. x 40, so that it can be inserted through a clearance hole in the smokebox and nutted up underneath. A Hallite or Walkerite washer would be advisable to ensure airtightness. The lower part of the snifters is cross-slotted so that the ball does not block the airway when the regulator is closed, and its lower end is a union connection using 5/16 in. x 32 thread. It should be screwed home in the upper part tightly, with plumber's jointing on the threads.

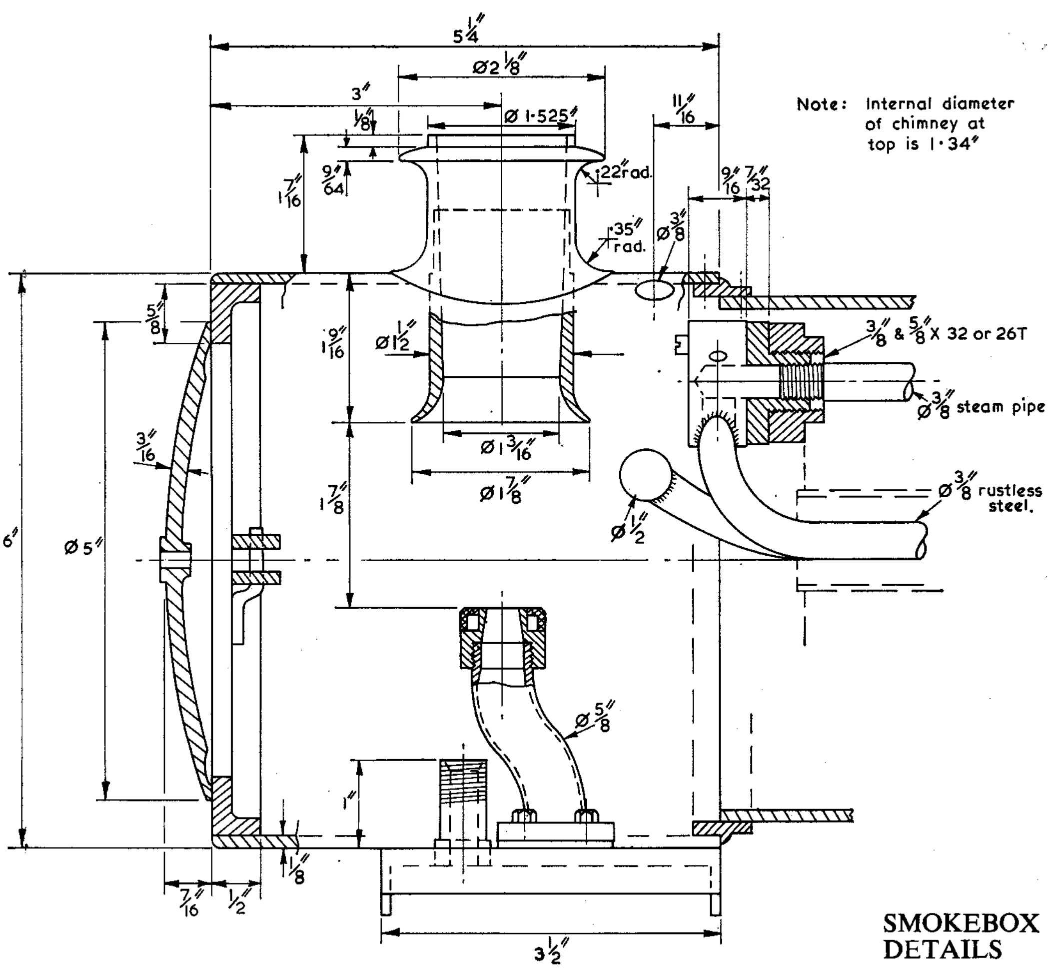
The superheater elements are made from $\frac{3}{8}$ in. stainless steel tube and are welded (or brazed) into the solid "return bend", which is cross-drilled and plugged as shown. (Reeves can supply a short length of stainless steel bar 1 in. x $\frac{1}{2}$ in. for this.) Note that the superheater elements are bent up-wards so that their extreme ends will not get in the way of the firing shovel, but the amount of bend possible will of course depend on whether the completed superheater can be pushed through its flue from the smokebox end.

The superheater elements in this engine are not unduly long; nevertheless it may be found desirable to give their rear ends some support to prevent sagging. This can be done quite easily by making up a little clip from stainless steel, inserted through the firehole and held with one or two screws, stainless again, about 8 BA, put into the backhead immediately above the firehole ring.

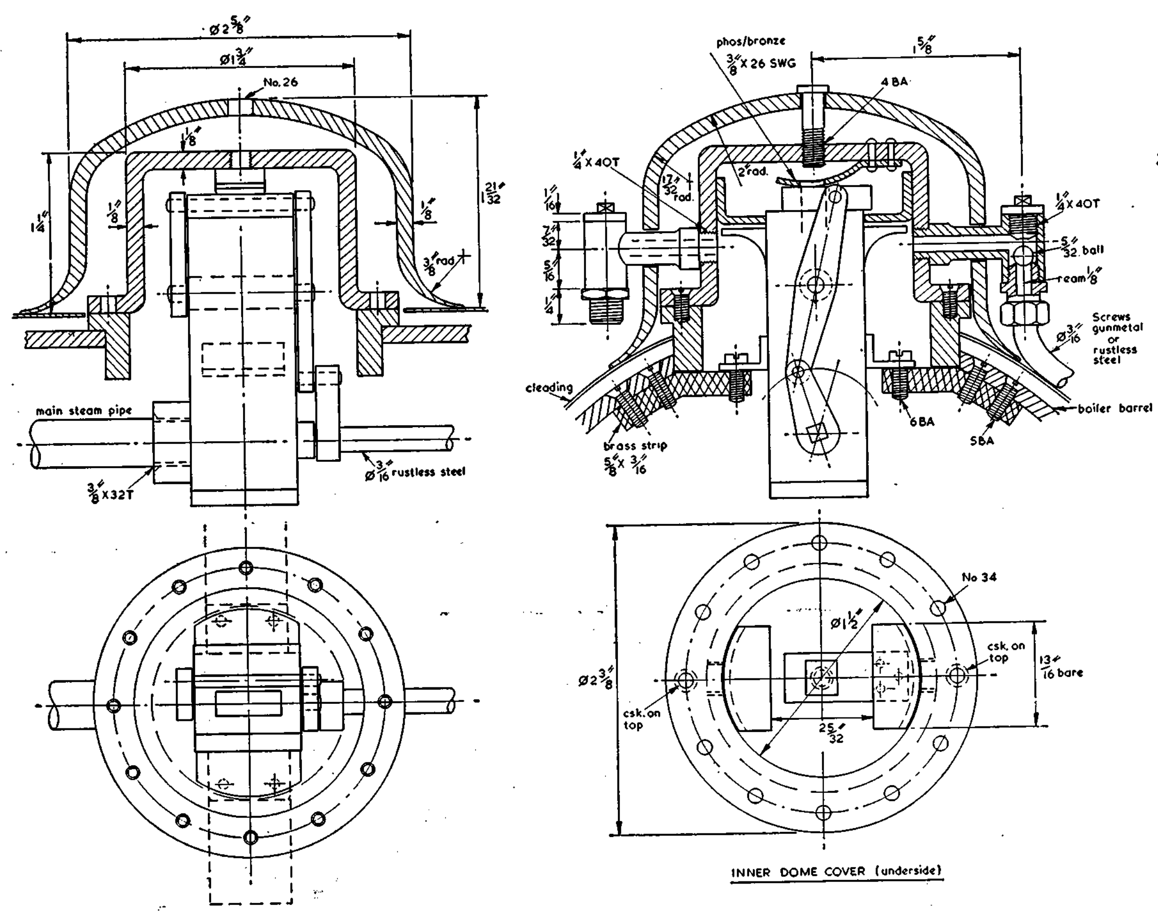
For a change, I have shown the built-up ring type of blower, this being screwed on to the end of the blast pipe, which is made from $\frac{5}{8}$ in. dia. copper tube 18 s.w.g. (about 3/64 in.). So that the thread can be cut on the end of the blast pipes without going right through the metal, a thin ring of bronze or gunmetal can be turned, a tight fit inside the end of the tube, this being given a touch of silver solder before assembly.

Returning to the "steam line", the "hot" ends of the superheater elements are inserted into a short length of $\frac{1}{2}$ in. dia. copper tube (about 18 s.w.g. again); the ends of this are then plugged and a single $\frac{3}{8}$ in. pipe from the left-hand end of this leads to the simple union fitting on top of the steam chest. This is given a fairly coarse thread ($\frac{1}{2}$ in. x 26) which should be reasonably easy to "pick up" in the confines of the smokebox.

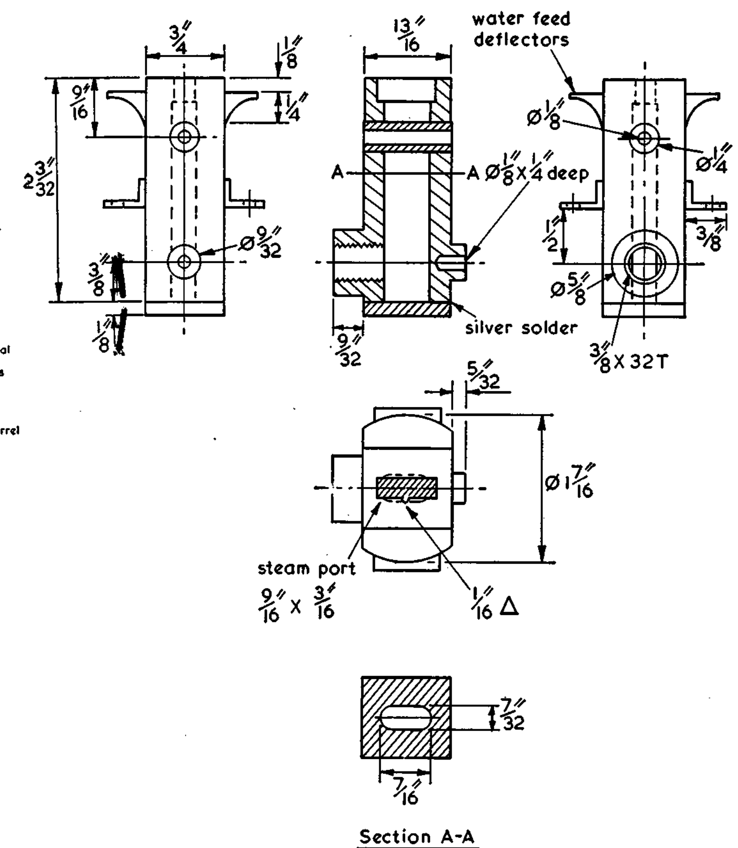
To connect the smokebox to the boiler barrel, we will need a special joint ring, which this time fits *over* the end of the barrel tube, but *inside* the smokebox tube — which by the way is a $5\frac{1}{4}$ in. length of 6 in. brass tube, $\frac{1}{8}$ in. thick—a stock size, or at least it was when I last checked with the metal stockholders! It may be that a gunmetal casting will become available for this joint ring, but if not, it could be made by the old dodge of bending annealed brass strip into a circle and silver soldering the joint, then turning in the lathe. A section about $\frac{3}{4}$ in. x $\frac{1}{2}$ in. will be required. The joint ring may with advantage be permanently riveted to the smokebox, the rivets being lightly countersunk on



SMOKEBOX DETAILS

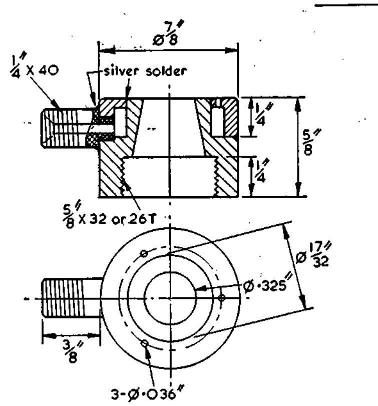


GENERAL ARRANGEMENT OF REGULATOR & TOP-FEEDS (X2)
AND DETAILS OF DOME

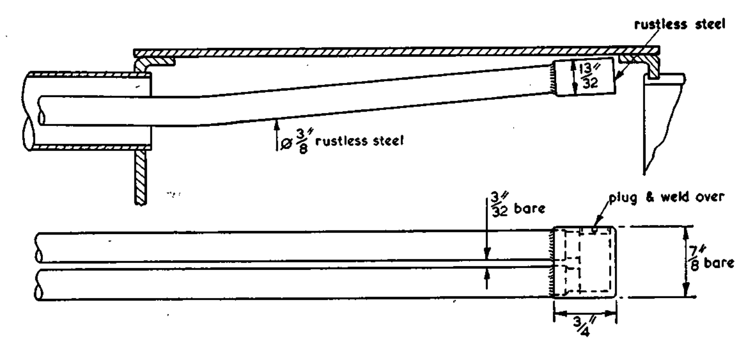


REGULATOR STAND: gunmetal

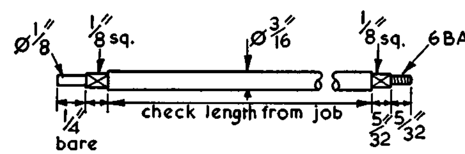
The chassis of Len Labram's "Claud".



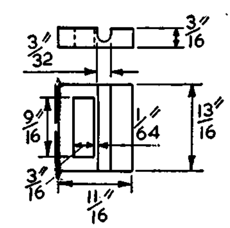
BLASTPIPE NOZZLE & BLOWER (X2)
(gunmetal)



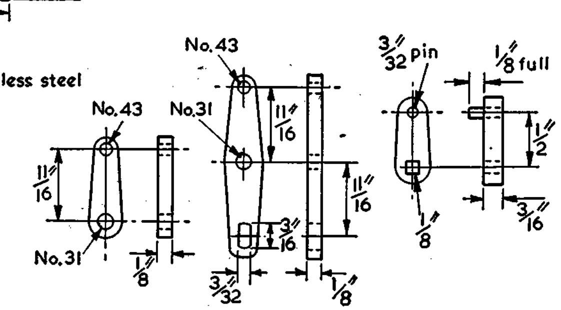
SUPERHEATER



REGULATOR OPERATING SPINDLE:
rustless steel



VAL'E rustless steel



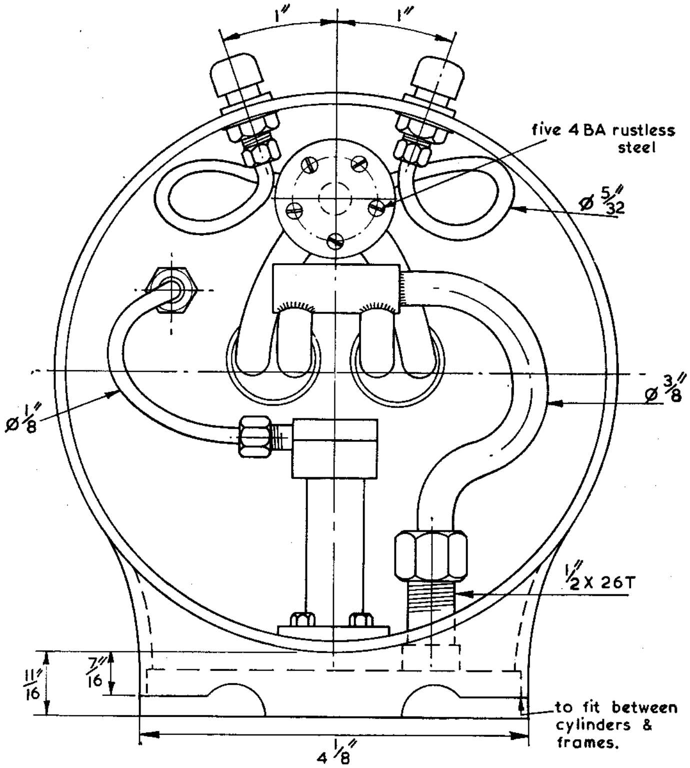
REGULATOR LEVERS: gunmetal or rustless steel

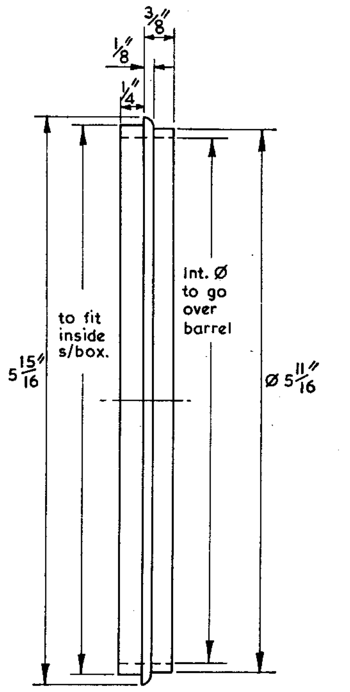
the outside and filed flush, about eight 8 BA countersunk screws being used to hold the ring to the barrel, the heads of which will be covered by the lagging and cleading.

So far, I have not mentioned the smokebox saddle. I came to the conclusion that a drum type smokebox was a better proposition than following full-size practice and bending the complete smokebox from sheet metal with extensions downwards to bolt to the frames. This latter method is never easy. It is difficult to get the smokebox truly circular, the ends below the front and rear ring have to be filled in, and it is not so easy to get the whole affair airtight. So we may be excused if we use a conventional cast or built up separate saddle, and file the top edges to a knife-edge, blending them in to the smokebox tube using coarse and then fine emery cloth and then painting with several coats of primer and undercoat. As the late LBSC used to say in similar circumstances, "What the eye cannot see, the heart will not grieve over".

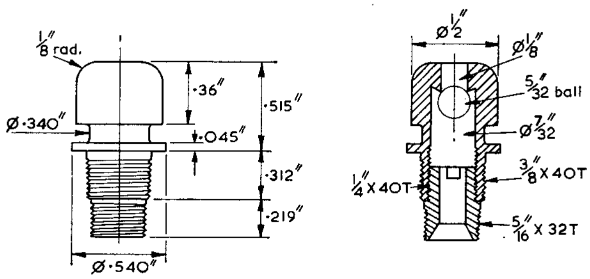
Regulator

We now come to the regulator, and here I have drawn up a slide valve type, which I think is the best of all for 1 in. scale locomotives, although there is a fair amount of work involved. But before making a start on this, the question of where the





SMOKEBOX / BARREL JOINT RING
(brass or g.m.)



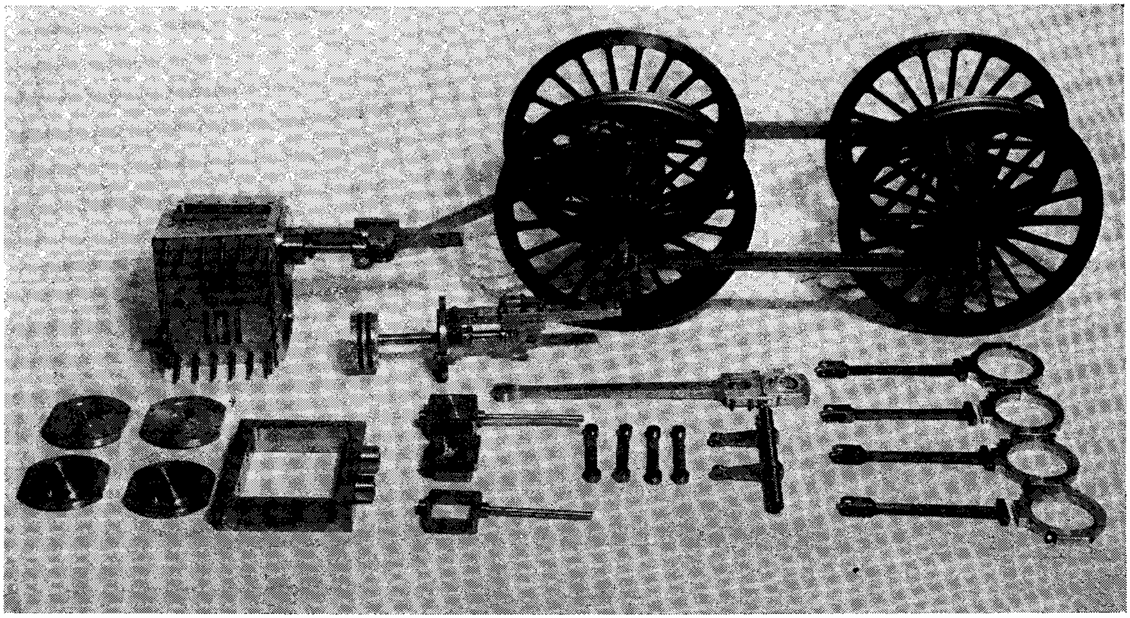
SNIFTING VALVES 2 off (gunmetal)

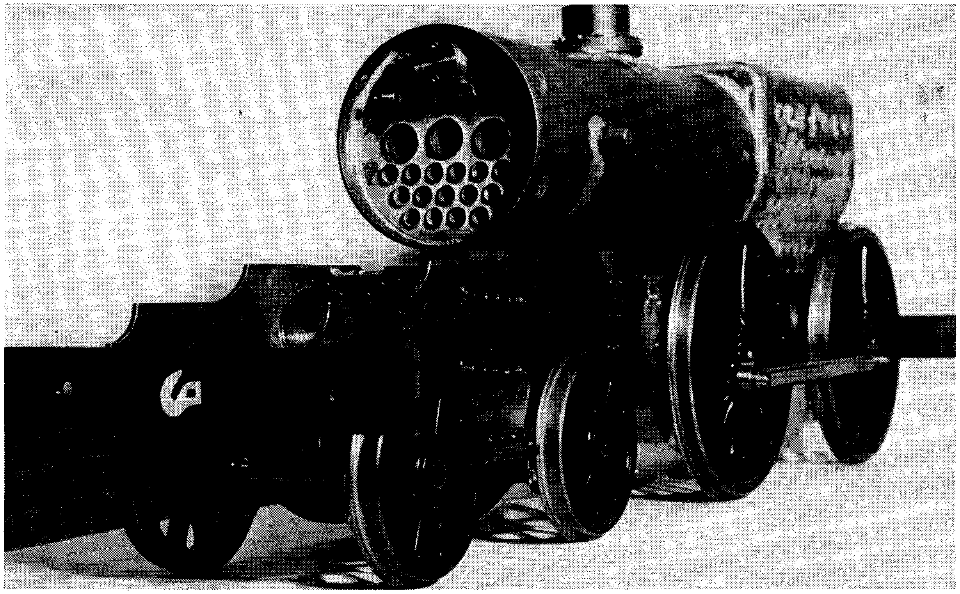
water is to be fed into the boiler will have to be settled. My original G.A. drawing showed side clacks, which were fitted for a time to some Clauds, but No. 8787, which was used by the L.N.E.R. as one of the Royal engines for many years, forms my heading picture, and I expect many builders will want to finish their "Clauds" as No. 8787, in which case top feeds will be required. (My back-head drawing showed two clacks here, but only one will be required if no engine pumps are fitted, the two injectors feeding into the top feeds.)

On the full-size engine, the pipes to the top feeds were hidden under the cleading, but with the out-of-scale diameter of our feed pipes, this will not be possible. However the biggest problem where the top feeds are combined with the dome containing the regulator is to ensure that the feed water is not carried straight into the regulator port! To try and prevent this, I have shown "deflectors" attached to the regulator body (they could be silver soldered before assembly) the full width (13/16 in.) and these are then radiused off a close fit inside the inner dome which will have been previously bored to 1½ in. dia.

As a second line of defence, curved angles are fitted inside the dome cover and these are filed to a close fit against the body of the regulator. The delivery from the clacks should come a little below the deflectors attached to the regulator body, as shown.

At assembly, after the supports for the regulator body have been screwed to the barrel, the regulator body, complete with its slide valve, levers, etc., is lowered into position and held firmly by two 6 BA stainless steel screws each side. The main steam pipe is then inserted from the smokebox end and guided into the tapped hole in the regulator body





Two further views of Len Labram's "Claud" during construction. Note the correct inside connecting rods and single bar crossheads in the upper picture.

by a loop of thin wire lowered through the dome bush. This pipe is then screwed hard home, with jointing on the threads (it will help if the tapped hole is deeply countersunk). The regulator operating spindle is next inserted from the backhead end and guided into the square hole in the crank and the $\frac{1}{8}$ in. dia. bearing hole in the regulator body, using the wire loop idea again. Incidentally, it pays to finish one end (the regulator end) of this spindle first, leaving the spindle over length, so that the exact length between the squares can be checked.

The inner dome cover is next put into position, checking that the phos-bronze spring bears nicely on top of the slide valve and that the angles inside the cover lie just above the deflectors on the regulator body. This may take a little trial and error, as the thickness of the gasket between the dome cover and the bush has to be taken into consideration.

I have not said anything about the regulator itself, as this type has been described several times recently, but the valve and port-face may be lapped in on the surface plate with advantage.

IMPORTANT. Don't forget to cut the slot in the phos-bronze spring which keeps the slide valve on its port-face, otherwise precious little steam will be able to get through the valve!

It may be asked what prevents the operating spindle from working out to the rear, but this will be prevented by a stop collar fixed to the spindle on the inside of the backhead gland; this will be shown next time.

To be continued

THE BRIGHTON AND HOVE ENGINEERIUM

A Report by D. E. Lawrence

THE ENGINEERIUM was formally declared open on 26 October 1976 by David Shepherd, the well-known artist and locomotive preservationist. The term Engineerium covers more than one aspect of engineering interest; it is a museum, a kind of educational establishment or industrial training centre for students and apprentices, a workshop, and it includes auction rooms. About three years ago Jonathan Minns obtained the old Goldstone Pumping Station and commenced restoration of the No. 2 engine and the buildings.

The old coal store, a large building, has been gutted and converted into the main exhibition hall, a mezzanine gallery has been added and this is almost fully walled in with glass-fronted cases containing models spanning more than one and a half centuries of mainly steam-orientated engineering. The ground floor has a large single-cylinder horizontal steam engine and many other "full-size" stationary engines, a couple of horse-drawn fire engines and an ornate hand printing press. The rear of this building has the old workshop with the original machinery including its own steam engine power plant.

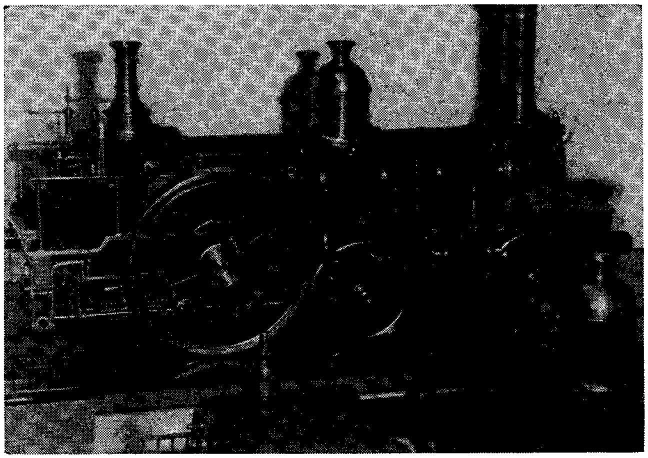
Starting from one end of the gallery, the models show the development and growth of engineering technology and practice and they include early steam models, such as two engines of Richard Trevithick, circa 1802-1803, a Maudslay engine of about 1812, prototype model for Brunel's *Great Britain* steamship and other model engines of historical interest which remain as the only evidence of original work of famous engineers. One is taken through the various types of steam applications, marine, locomotive, stationary and general purpose machines in their different groups, each showing the development of the group. For example, in the locomotive section there is a model of *Locomotion* (about $\frac{1}{8}$ of full size) made by Geo. Stephenson and a friend, a model 0-4-0 with two vertical cylinders made by Hackworth, a model A2 long boiler locomotive of 1848 made for Robert Stephenson in about 1864. There is a fine model of an Edward Fletcher N.E.R. 2-4-0 No. 926 in $1\frac{1}{2}$ in. scale, a $\frac{3}{4}$ in. scale modern Beyer-Garratt and several models in between the time span of these.

Probably the most fully detailed and equipped model on this floor is that of a Metropolitan Fire Brigade horse-drawn fire appliance which is complete with all its tools, axes, hoses, hose connections, nozzles etc.; the model appears to be about $\frac{1}{6}$ of full size. At the time of writing the models had not been fully catalogued and I regret that I can only give estimates of scales.

Set on a plinth in the middle of the ground floor of this part of the museum is a French horizontal engine made by Grépelle & Garand in 1889; the cylinder is 13 in. by 29 in. and the valve gear is the Corliss and Wheelock system. During the evening opening, this engine was gently ticking over at 40 r.p.m. almost noiselessly with only a regular quiet *sssthk* from the air pump. Set around the side walls are various types of engines and machines, some fully restored and some in the process of being restored.

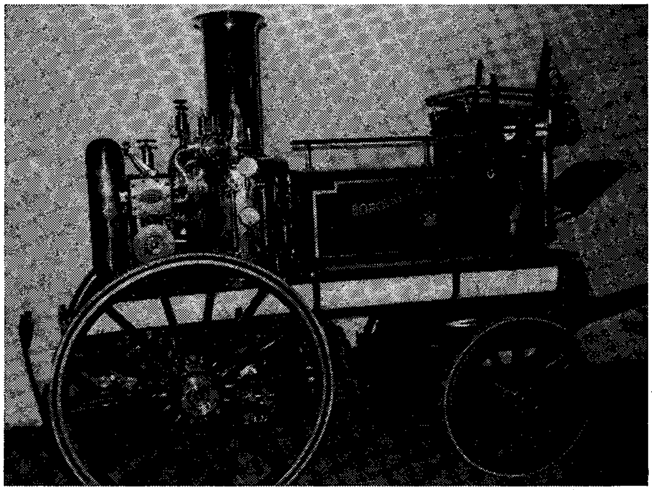
The workshop adjacent to the museum has a horizontal steam engine which was first used at the Great Exhibition of 1851 to run a generator to supply electricity for lighting the Crystal Palace. Later it was brought to the Pumping Station and has powered the machines there ever since. The engine has a single cylinder of 7 in. bore by 16 in. stroke and drives on to line shafting via belts. Original equipment includes an elderly lathe of about 4 ft. swing, a large shaper and forge; some modern machinery has also been installed and it is in this workshop that the practical side of the students' courses will be run.

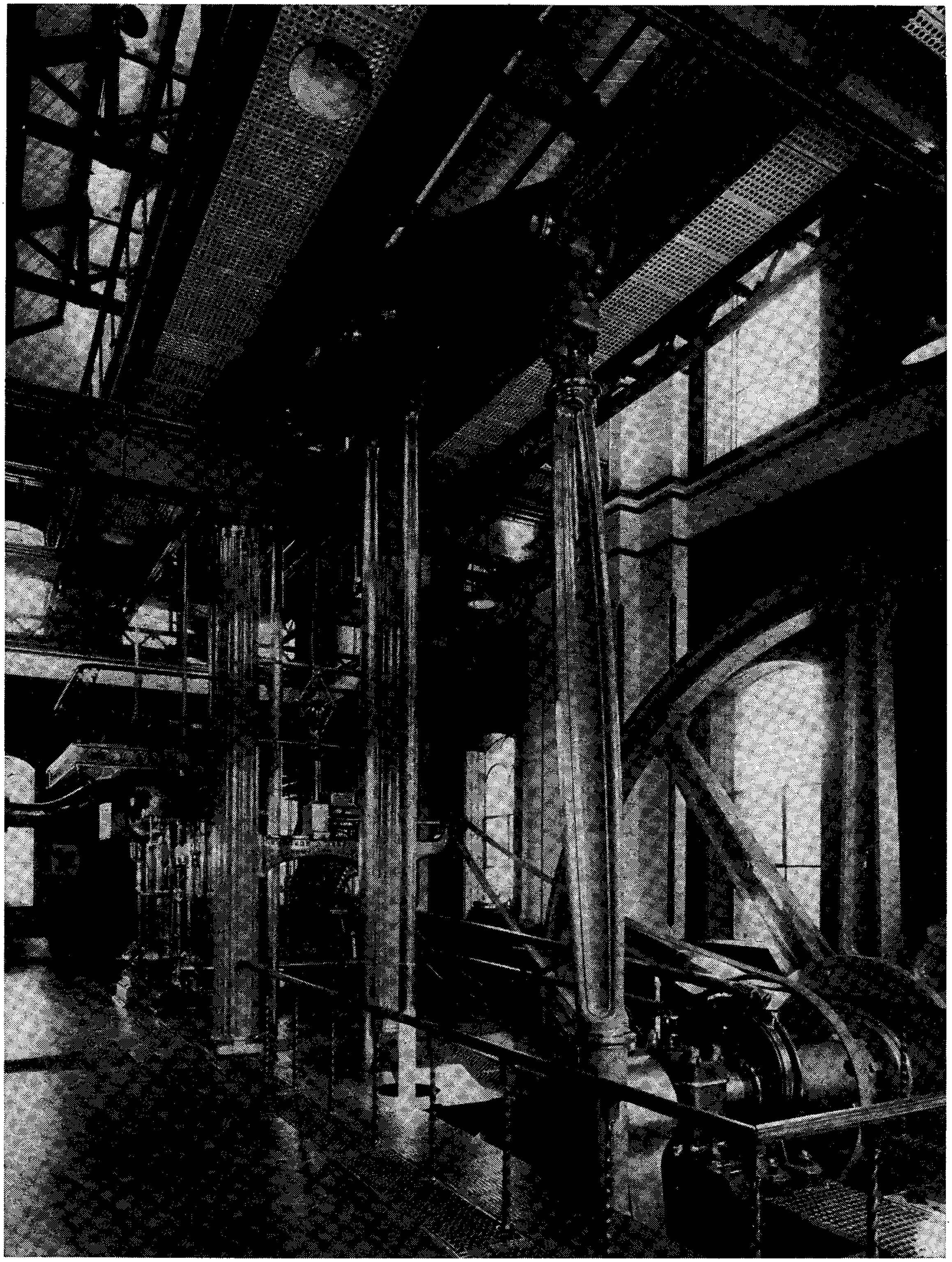
There are actually two separate engine houses, connected by administration offices etc., and, at sub-ground level, a boiler house. In here there are four Yates and Thom Lancashire boilers with the usual economiser and a little narrow gauge railway on which small coal trucks are pushed by hand. Like the rest of the establishment, the boiler house is very clean.



The Robert Stephenson long-boiler model.

Below: One of the Shand Mason fire engines.



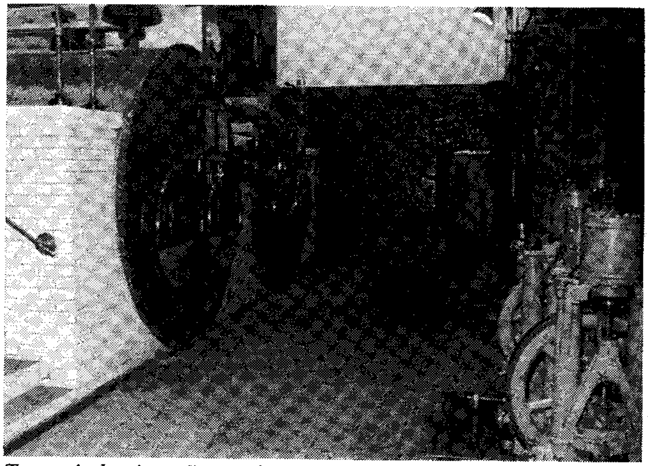


The magnificent Easton & Anderson beam engine, built in 1875.

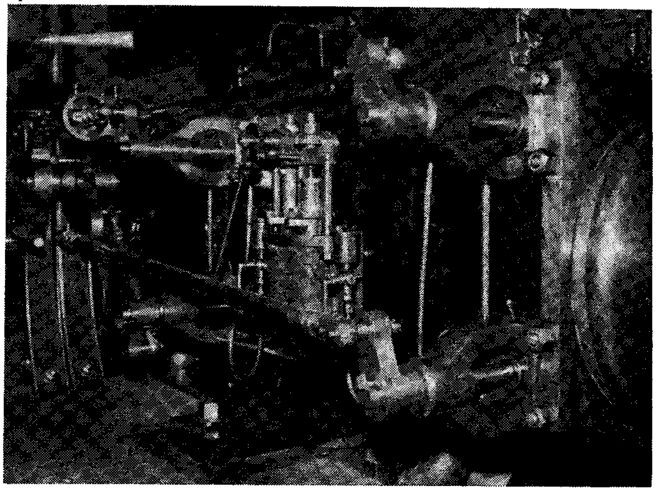
The last major exhibit is the Easton and Anderson beam engine, known as No. 2 engine, built in 1875. The engine is compound and worked two pumps, each pump stroke being recorded on a mechanical counter so that the amount of water pumped daily could be known. The size of the engine is considerable; the flywheel is about 20 ft. dia. and the huge fluted connecting rod about 20 ft. long driving on to a crank of approximately 10 ft. swing; the beam, I think, is about 30 ft. or so long. These are estimates on my part as details of the engine have not yet been published. On the day of the opening, the engine was put in steam and gently turned over soundlessly at 16 r.p.m. while we all had our lunch around it. The engine had been given the full treatment and aside from a little unfinished work on the wooden cylinder lagging, it looks in first-class condition. The style of painting suits the engine very well and a good deal of bright metal, brass and steel is complementary to it. Not only has the engine been restored, but the building also, and the decoration is in keeping with that of the engine.

All this has taken a great deal of money of course, and with some initial assistance from official bodies, the restoration went ahead and it is apparent that Jonathan Minns was, and continues to be, assisted by an exceptionally enthusiastic and knowledgeable staff. The basic purpose of the Engineerium is to broaden the experience and knowledge of students and apprentices and give them a better understanding of engineering growth and development which is not generally available from other educational bodies. Christie's, the word-renowned auctioneers, are the main financial sponsors of this major function of the Engineerium. Additionally. they will hold their auctions of models and allied works there.

I am assured by Jonathan Minns that special arrangements can be made for any responsible and serious model engineer to get details of any particular item in the museum. Having spent all day there. I found a great deal of rewarding interest and, as the museum is open to the public, I think that any model engineer who visits there will be equally rewarded.



Two of the four Lancashire boilers in the spick and span boiler house.



Right: Corliss valve gear on the French engine. Mechanical lubricator in centre of cylinder block.

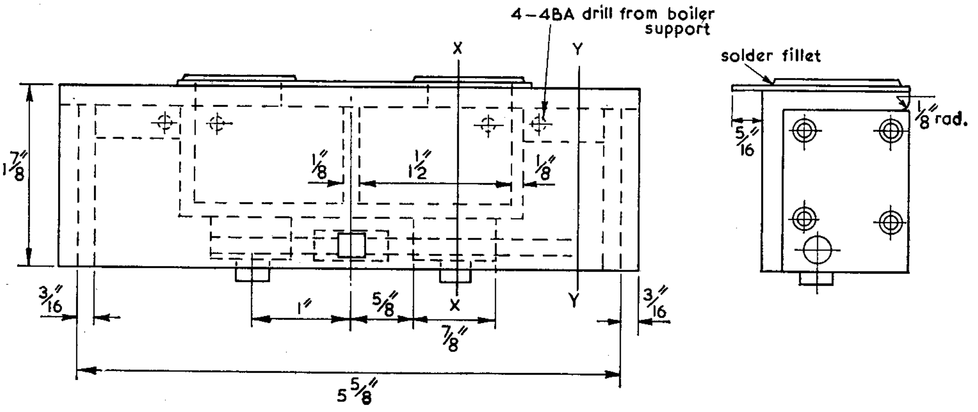
"ELLA", A $3\frac{1}{2}''$ GAUGE HEYWOOD LOCOMOTIVE

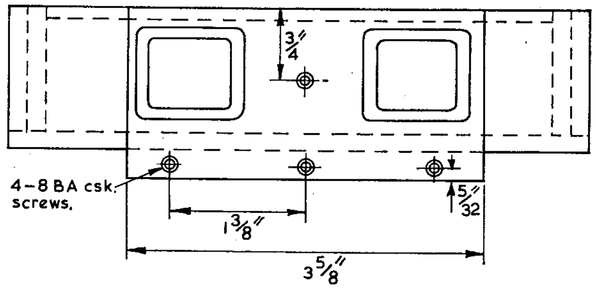
B. G. Markham describes the final details — beams and sanding gear

As explained earlier (*M.E.*, 5 March), Heywood used cast iron buffer beams incorporating the sand boxes, but I have used steel angle beams with the boxes screwed to the undersides of the angles. However, few builders actually use sand on a model and unless one is going to reproduce the unseen parts more accurately, one might just as well fit dummy sand box covers and controls. I therefore show fabricated buffer beams intended to represent more closely Heywood's cast iron ones, but the representation cannot be exact because no drawings or detailed description of the prototype beams are available.

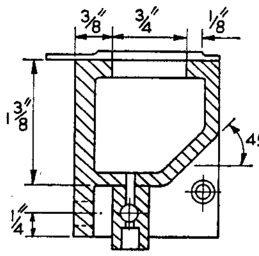
Both the front and back sanding are controlled by ports drilled in 3/16 in. dia. rods working in valve bodies integral with the beams. In the case of the front valves the rods are rotated to open the valves but for the back sanding the rods are moved laterally and act as piston slide valves. The front valves are worked by a long reach rod from a lever on the reversing stand (page 639, *M.E.* 2 July).

The back sanding valves are worked by a double-ended horizontal lever which the driver kicked round with his boot. This lever is attached to a kind of Scotch crank arrangement which slides the valves.

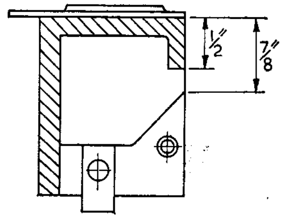




FRONT BEAM (LOOKING BACKWARDS)



Section X-X



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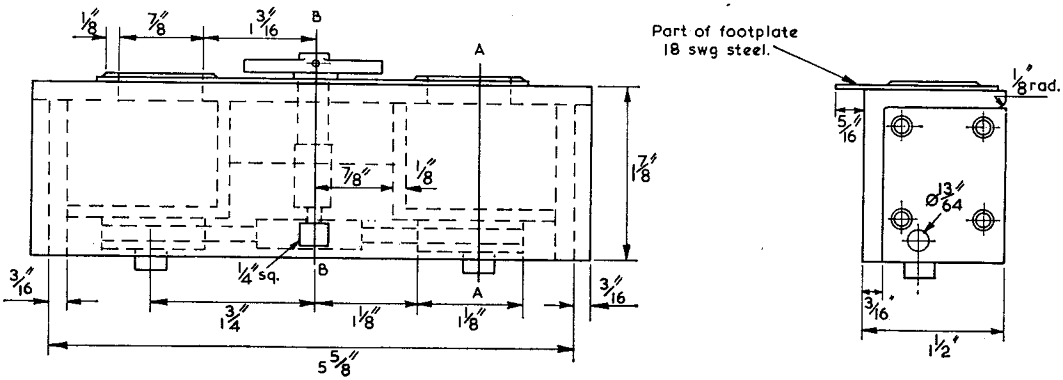
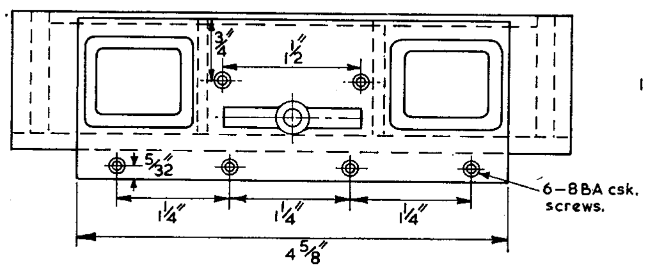
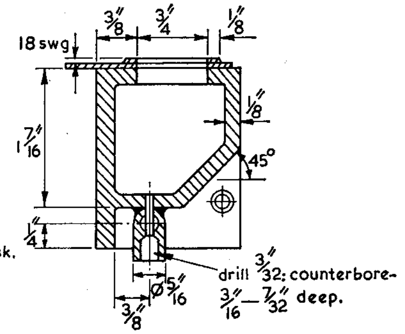
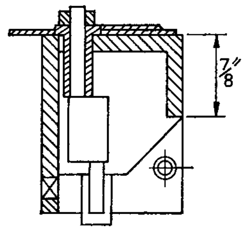




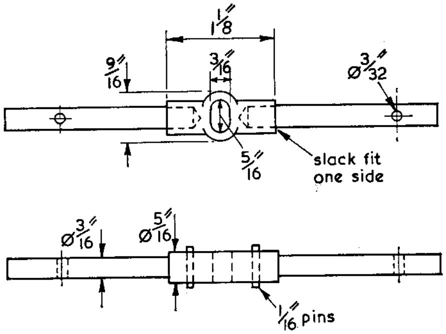
REAR BUFFER BEAM (LOOKING FORWARD)



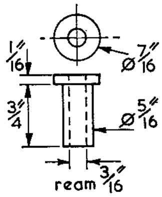
Section A-A



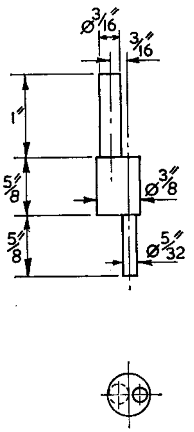
Section B-B



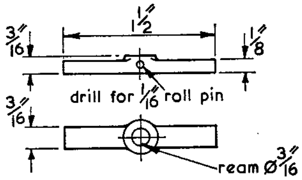
VALVE (BACK SANDING)



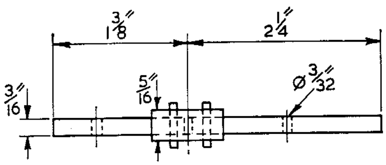
BUSH G.M.



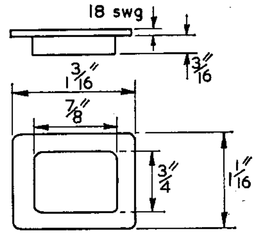
CRANK b.m.s.



FOOT LEVER



VALVE (FRONT SANDING)



SAND BOX COVERS: b.m.s. 4 off
(not shown in position)

For the buffer beams I think it will be necessary to use black angle as bright angle in the size required may not be obtainable. The end plates to which the frames will be fitted must be accurately located before bronzing and it will be best to pin or screw them in position. The beams are covered by the footplating which has a "frame" soft soldered round the sand holes to prevent rain water running into the sand boxes.

The sand box covers can be soft soldered up from 18 s.w.g. steel sheet and 3/16 in. plate. I used $\frac{1}{8}$ in. plate but the covers are easily knocked off and then the boxes get bits of coal and ash in them which is an annoyance.

Sand pipes are more bother than they are worth on a working engine, and I only stuck mine on for show. They could be just pressed into the 3/16 in. holes in the sand valves with perhaps a touch of solder.

These details of a suggested design of hollow buffer beams for *Ella*'s sanding gear completes the description of my model. I am open to criticism for leaving the buffer beams to the end, but I do not think that many people would choose to adopt this rather complicated fabrication which is non-functional and cannot be seen. It is rather like the actor who blacked himself from head to foot to play Othello!

Ella took me just under 24 months to first steaming and was completed in 33 months. Writing these articles and preparing drawings from my rough sketches for tracing by *Model Engineer* have taken just under 12 months.

Electric Ships

Sir,—D. E. Lawrence in his report on the Bristol Exhibition wondered if there ever was a "straight electric" drive applied to ships.

There was the *Monarch of Bermuda* completed 1931, and the *Queen of Bermuda* completed 1933, both four-screw ships with an electric motor to each shaft developing 20,000 h.p. and a speed of 20 knots with a tonnage of 22,500.

There was also the paddle vessel *Talisman* on the Firth of Clyde with an electric twin armature motor of 1300 b.h.p. at 48 to 50 r.p.m. with direct coupling to the paddles; she had a speed of about 17 knots. The motor was by English Electric.

Hastings, Sussex. W. Whybourne

The shop with a thousand drawers

Kennions of Hertford

by D. J. Laidlaw-Dickson

TOWARDS THE END of October 1898 young George Kennion might have been seen closing his recently opened shop in Old Ford a little early and hurrying along the gas-lit streets to the West End. That night what was to be the Society of Model & Experimental Engineers had its inaugural meeting. It was the year, too, that *Model Engineer* first appeared, so that the name of Kennion can be linked with "ours" from its very beginning.

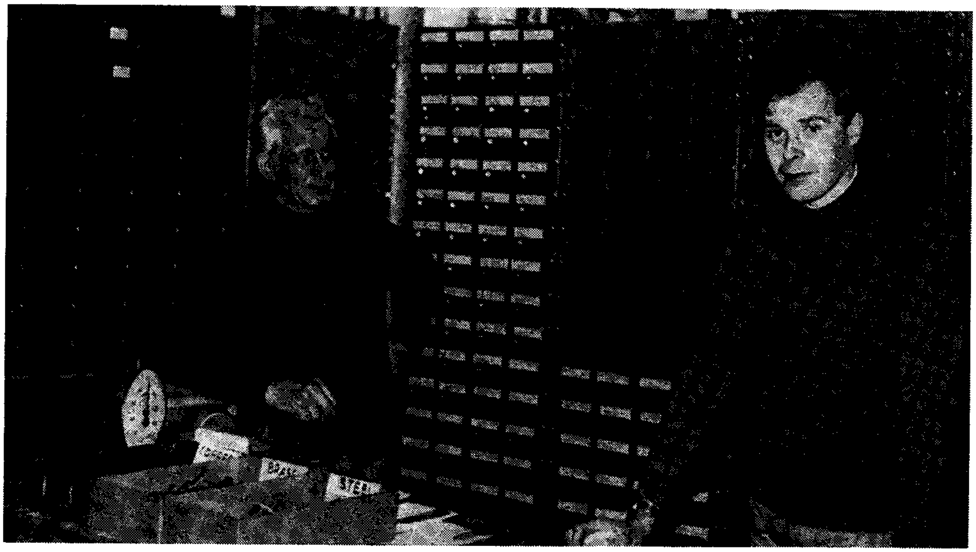
His name does not appear in that first list of officers but he was soon a force to be reckoned with in the world of model engineers. In 1910 when son Charles was still in the nursery he won the S.M.E.E. Challenge Shield for the first time, did it again the year after and then had a run of three wins 1923, 1924, 1925 to win it outright. (He returned it to the society as the Kennion Trophy to be awarded for non-engineering work of benefit to the movement—the author has the honour of being current holder!)

The shop in Old Ford gave way to another in Kingsland Road, and here a shy fourteen-year-old Martin Evans bought his first locomotive castings from the then middle-aged George Kennion. George was an outstanding model engineer with a penchant for larger scale locomotives but once finished and performing as he intended he lost interest so that none of his work was retained in the family. Son Charles has since acquired one of his earlier models in a sad state and hopes one of these days to restore it.

George undoubtedly inculcated much of his skill and enthusiasm to son Charles but the boy nevertheless left home to see the world, served in the Royal Signals in India for some years, returning home to work through the war as machine shop foreman. The end of the war saw him free to carry on his father's business. It had never made a fortune but had established an enviable reputation for quality and expertise. Alas, however, George was an old-fashioned type of master craftsman with no great head for business who had allowed his shop lease to run out without provision for renewal. New rent demands were such that Charles decided to move and so came to Railway Place, Hertford, in the late 'forties. Very different premises they were then; stock was hard to get and it was a problem to make ends meet. With time on his hands he designed and built his now famous G.S.W. 0-6-0 tank "Butch" in 5 in. gauge. Thirty years later it is still a popular choice as a club workhorse and is winning efficiency trials as far away as New Zealand. Unknown then, Charles built a second one and offered them for sale at £250 each. No takers! Then he sold one for £175 but the second lingered on until he took a mere £125 for it. Those were the days!

In between building up stock—no easy task in the early post-war years—Charles worked on improving the somewhat ramshackle premises. Today it presents a neat and orderly façade of double-fronted shop with spacious yard at the side and what appears to be a range of substantial garages. This was Charles' provident way of arranging an income for his dependants should anything happen to him. As it is they serve magnificently for stores, workshop, brazing bay and even their ostensible purpose of garages! There in a purpose-built home of its own stands his Bentley—a thirty-year-old Mark VI close-coupled saloon in pristine condition. A bit heavy on the steering for town work. Charles nevertheless licenses it for the summer months for country touring. His regular transport is a Marina Estate, but he has a Scimitar on order for he has really fallen for the ease of repair with a fibreglass body after mending a Robin for one of his weekend helpers.

As for the shop, the store and the works, they are all such pictures of neatness that it is easy to understand the strong friendship that existed between him and that other apostle of order and locomotives,



Charles Kennion with his young assistant Peter Irons behind the counter.

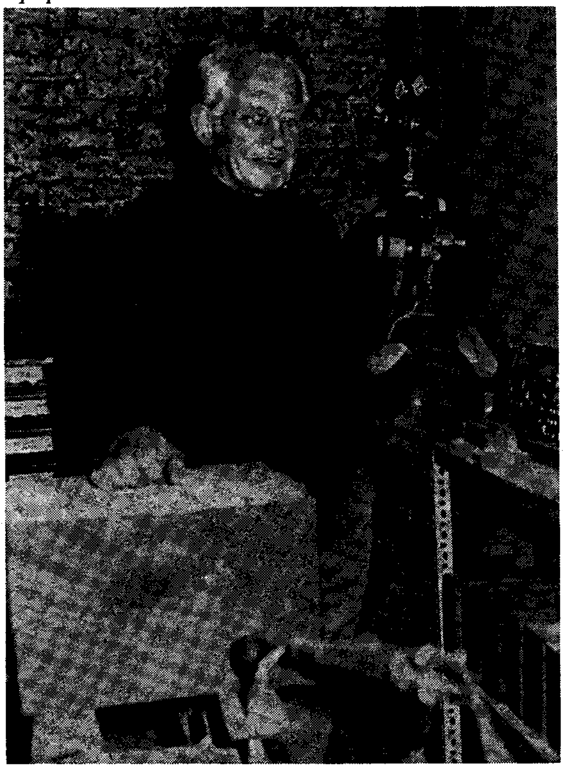
Some Kennion boilers ready for despatch: "King John", "Maid of Kent", 7¼ in. gauge "Tich" (two), "Royal Scot" and 3½ in. gauge "Firefly".

"Curly" Lawrence. A glance at the Kennion catalogue —still marked as in Dad's day "for Model Engineers, Inventors, etc."—and separate designs list will show how many LBSC designs are featured including the rarer coal-fired "0" gauge designs such as Bat, Josie, Sir Morris de Cowley. Significant too are the many accessories, blower valve, whistle valve and turret, injector steam valve, mechanical lubricator, all to LBSC designs—plus one or two designed by "LBSC & Charles Kennion".

Going up the gauge scale are more of Charles' own designs including his successful twice-size "Tich" in 7¼ in. gauge, examples of which have been built all over the world. Other Charles Kennion designs include the 5 in. gauge Peckett Type 0-4-0 saddle tank, another 0-4-0 tank "Chub" and the big 5 in. gauge King Class 4-6-0 "King John" designed with K. E. Wilson.

Probably Charles' greatest skill lies in his boiler-making. Usually booked up for at least nine months ahead, he always has a dozen or more on the go. Nowadays, with his seventieth birthday just behind him, stepson Neil and partner Peter Irons handle the tongs at the pickling stage!

Charles Kennion with some of his boiler-making equipment.



Expansion has often been mooted, but Hertford is mainly agricultural and not good for his kind of staff. Packers and pickers-out of mature years plus week-end youngsters to help in the shop are all he employs. A bigger set-up might so easily destroy the intimate nature of a family business now coming into its third generation.

We have entitled this profile of a model engineer "the shop with a thousand drawers"—an understatement we are sure—but every one of them is filled with hard-to-get model engineers' "goodies", nothing in the catalogue is lacking, plus an infinite variety of drills, end mills, taps, dies, rivets to occupy a lifetime's riveting . . . Then in the stores beyond, brass, steel, castings, copper, tube, wire. Much of it patiently cut to portable sizes for the next M.E. Exhibition. Even the stand he will occupy is marked out full-size in chalk on the floor with counters and drawers assembled and labelled. A large stock of ex-bakery tinloaf tins has come his way and are now sprayed in the Kennion house colour of metallescent green ready to display small items plus a number of ammo boxes also being painted to hold larger items.

With Charles it is a seven-day week—not a job. just a lifework. Even at home as he watches TV he is busy coiling loops of stainless steel wire into convenient small packs. Ordering and accounts are normal Sunday tasks. With partner Peter now fully integrated into the business there is more time to step out and get after some of those elusive outworkers who make the "bits and bobs", keeping them up to scratch and quality. Even so, many items have to receive a little personal attention from the management before they pass the Kennion standard.

What sort of a man is Charles Kennion? Thousands who go to the M.E. Exhibition each year to stock up could tell you of the man behind the counter . . . He would like to be remembered as "one who enjoyed life and helped a few others to enjoy it too". But, off duty we have a Charles who is happily married to Joy, very much his accounts "Girl Friday", with a beautiful home, splendidly landscaped garden, and a faithful hound Susan who comes each day to the shop. Rotary and Masonic duties give him a great deal of pleasure and he really enjoys good company and good food. Joy, as a cook of Cordon Bleu standard, can provide exciting dishes at home. but Charles is a *bon viveur* who plays as hard as he works.

As a final thought may we paraphrase the poet and "often wonder what he buys one half so precious as the goods he sells"?

ACCESSORIES FOR THE UNIMAT LATHE

by R. L. Tingey

HERE ARE FOUR small accessories for the Unimat user which are simple to make, but can be a great help in carrying out work on the little lathe.

A Slitting Saw Mandrel

Slitting saws can be purchased in a variety of diameters and thicknesses and are useful for many purposes on the lathe, from cutting away to decorative grooving. Slitting saws are made with several different hole sizes. Up to the largest size the Unimat owner will use, 2½ in. dia., the centre hole can vary from ¼ in. to 1 in. In the bunch of saws I have one is ¼ in. and the others are ⅝ in., ⅞ in. or 1 in. hole, and so I made the mandrel to accommodate these larger sizes and use a ¼ in. mandrel for the other.

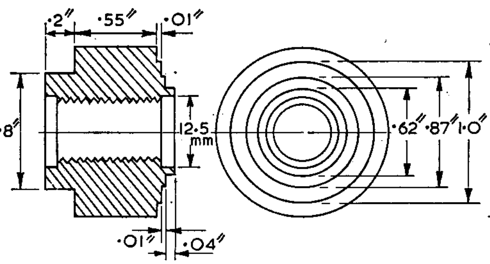
The mandrel is made from a piece of 1¼ in. dia. aluminium alloy, and screws directly onto the nose of the spindle. First set up the threading attachment with the 1 mm. leader, then chuck the piece in the 3-jaw. Centre drill and drill through 4 mm., bring up the tailstock with a live centre and face back to the workpiece, turn down the step. Drill through 7 mm., and, with a boring tool in the tool-post, bore right through to 11 mm. Take the first 3 mm. out to 12.5 mm., then thread right through 12 mm. Try the grinding wheel bolt in the thread. Lightly face off again, then remove the work to drill a 4 mm. hole, 9 mm. deep, on the outer surface, for a tommy bar; screw the work onto the spindle nose, faced side to the headstock. Turn the outer surface concentric and face back. Take the first 3 mm. of the thread out to 12.5 mm. Turn down the steps to match the saw centres. A dial caliper is useful here to compare the steps, as they are turned, with the saw centres to ascertain exactly how far there is to go; the saw blade should snap into place. It may be necessary to turn up a large hollow washer for the bigger saws, but the one from the grinding wheel mandrel can be used for most, together with the bolt.

A Tailstock Die Holder

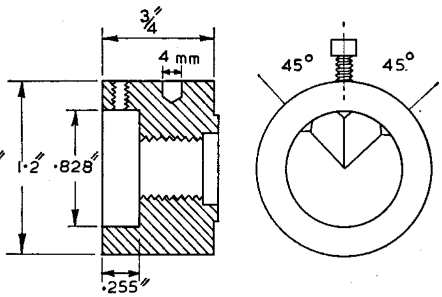
This is made in the same way as the slitting saw mandrel, but instead of being stepped back, after fitting to the spindle nose, a hole is bored out to take a 13/16 in. die.

For the Unimat owner it is the only sensible way to thread, it provides a dead square setting for the die to work, and avoids irregularities. It is used in conjunction with the square-toothed gear on the pulley hub to provide positive rotation and backing off by hand; the belt is slipped off. A good inch of material can be threaded into the tailstock tube.

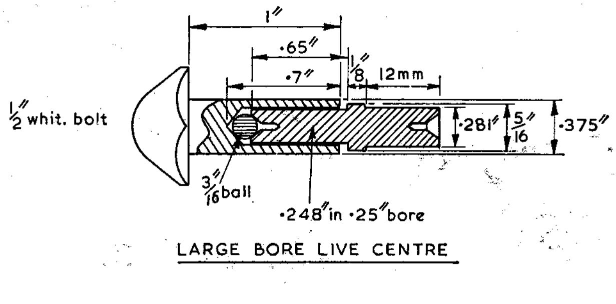
The hole is bored out to 0.828 in., 0.255 in. deep, after facing. The holder is fitted to the tailstock and the screw hole drilled down vertically with a No. 33 drill, for the 4 BA hex. cap head screw. At



SLITTING SAW MANDREL



TAILSTOCK DIE HOLDER



LARGE BORE LIVE CENTRE

45 deg. each side drill for the 4 BA set screws.

The smaller ISO Metric dies are 20 mm. in diameter, and a thin shim should be rounded and placed at the bottom of the holder to compensate. In use the headstock spindle tube is loosened to provide the feed.

A Large Bore Live Centre

The centre with the Unimat lathe is only 8.5 mm. at its widest diameter, so any hole over 5/16 in. cannot be centred in the tailstock. This accessory overcomes this limitation to enable bores up to 13/16 in. to be centred with the tailstock.

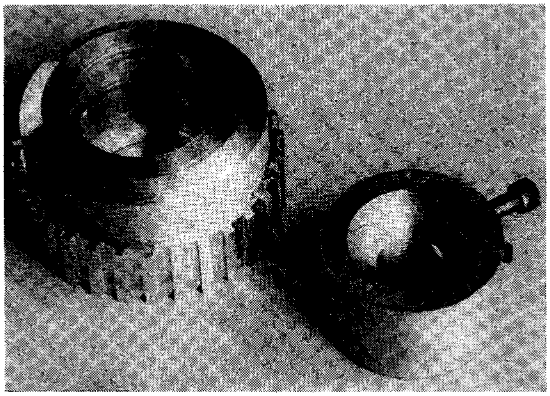
The centre is all of steel, the turning head being made from a ½ in. Whitworth bolt, and the shaft from 5/16 in. dia. b.m.s. It runs on a single ball accommodated in the angles left by the tip of a drill and by a centre drill.

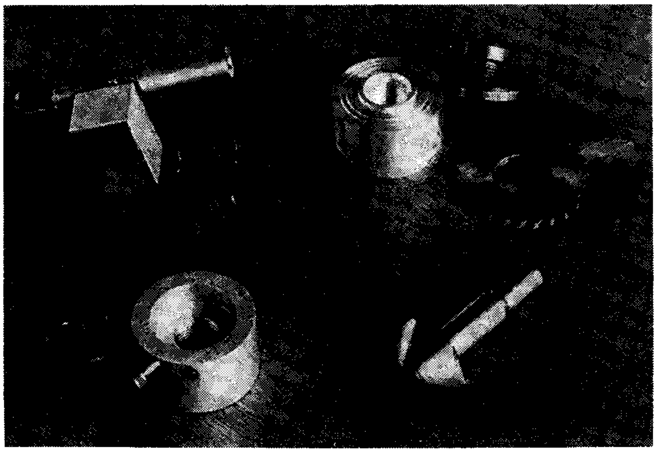
Cut the bolt to leave just over 1 in. of shaft, and find the centre of the cut end, centre pop and drill with a centre drill, No. 3, as far as the flutes allow, holding the head of the bolt deep in the 3-jaw. Face off the cut end and drill 0.7 in. deep with a ¼ in. drill; use a good drill for this and run the work fast for the last little bit of the bore to make it smooth at the bottom. Bring the tailstock along with a centre to turn the shaft concentric, outside.

Hold the bolt by the shaft and turn the headstock to 40 deg. and take the head down straight at the sides to a curve to just leave the front surface as a point. Cut a piece of 5/16 in. dia. mild steel and face each end down to a length of 1¼ in. With a No. 1 centre drill centre each end just up to the shaft of the drill. Chuck 12 mm. of one end in the 3-jaw, centre with the tailstock and with a knife tool turn down 0.65 in. of the shaft to 0.248 in. Hold this in the drill chuck and turn down the 12 mm. to 0.281 in.

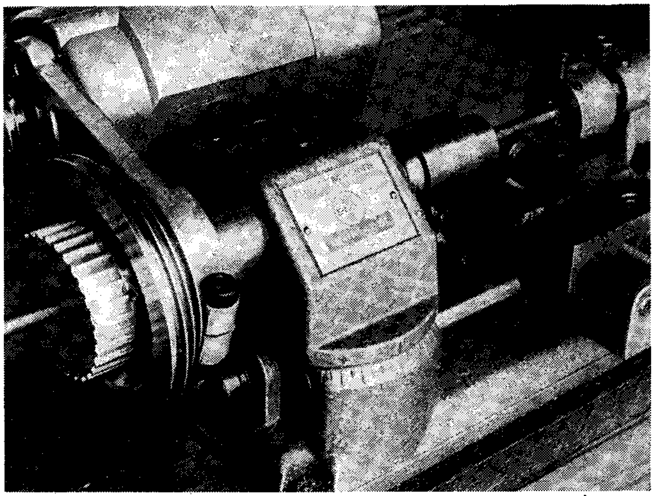
Clean out both parts, put a drop of oil into the head, drop in the 3/16 in. ball and slide the shaft in; it should turn freely, even under pressure.

Below: The die-holder and toothed wheel.



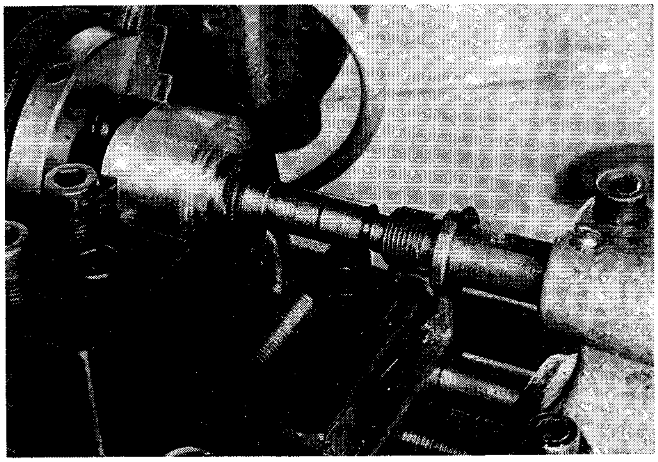


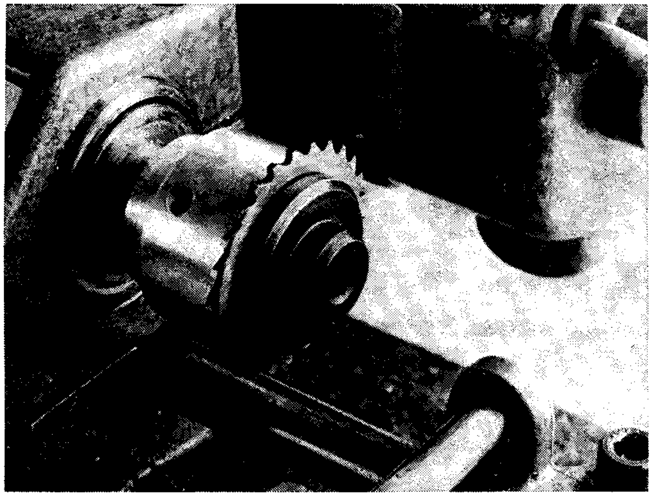
The four accessories for the Unimat lathe.



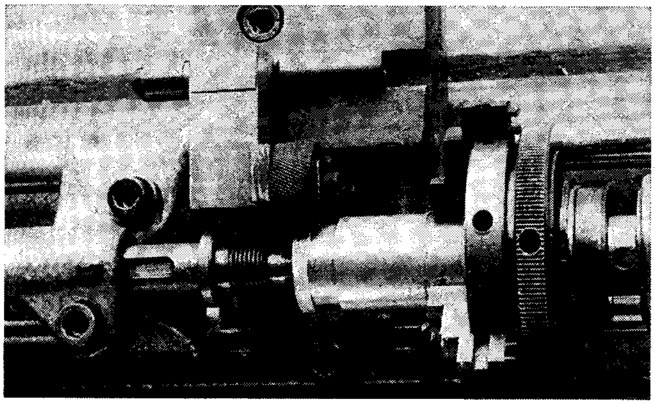
The die-holder in the tailstock threading a ¼ in. dia. rod.

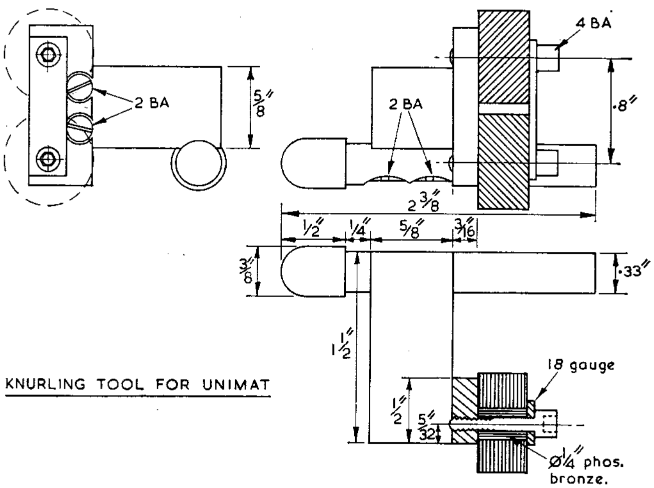
Below: The large bore live centre assisting in turning the saw mandrel.





The slitting saw mandrel with a 1½ in. dia. cutter.
Below: The knurling tool at work.





KNURLING TOOL FOR UNIMAT

This centre enables concentricity of work to be maintained more accurately with larger bores since the larger bore can be made first and the outside turned from it, instead of the outside having to be turned first and then the bore being made unsupported by the tailstock.

A Knurling Tool

The knurling tool rests and swivels on the T-slot of the Unimat cross-slide, and self-centres onto the work to be knurled. The knurling wheels can be obtained from Reeves and Co., and are ¾ in. dia. by ⅜ in. with a ¼ in. bore. The ones I use are a fine spiral, in a pair, one left hand one right.

The knurls are mounted on a piece of 3/16 in. mild steel, with phosphor bronze bearings secured with 4 BA hex. cap head screws, and a keep plate of 18 gauge steel. The bearings should be about ten thou. longer than the bore to allow float for the knurl to find continuity of pattern. The bar is mounted on a short length of aluminium alloy, ⅝ in. square, with 2 BA countersunk screws. These screws and mating surfaces are cleaned and secured with Loctite 601.

The swivel bar is made from a piece of ⅜ in. dia. b.m.s. The main part is turned down until it does not quite fall into the T-slot of the cross-slide, approximately 0.33 in.; the end is left as a stop. Drill two holes No. 12 and countersink, drill the dural No. 24 to correspond and tap 2 BA. File a flat on the back of the round to fit the dural block and try the swivel bar in place. If all is well clean up with C.T.C. and secure the bar and screws in place with Loctite 601.

Oil the knurls, place the tool on the cross-slide and approach the workpiece, which should be centred with the tailstock, and gently allow the knurls to self-centre on the turning work; then move the cross-slide forward until the required depth of knurling is achieved. Only attempt to knurl soft materials on the Unimat, such as aluminium alloys, soft brass or plastics.

Hacksaw Machines

SIR,—Mr. R. Atkins' letter (*M.E.*, 15 April 1976) is of great interest. Whilst it is always advisable to *pull* the hacksaw blade rather than push it in order to avoid breakage, and Mr. Atkins has clearly achieved this as evidenced by his diagram and his remarks, in default of a drawing showing the disposition of the saw carriage arm, and the counterbalancing mechanism if any, it is difficult to assess the extent of blade relief that may be expected from Mr. Atkins' layout.

I would welcome more information and an amplification of the statement, "I guess I now have some relief". Did Mr. Atkins "guess" at the amount of relief or did he actually measure it? If so, how? I found satisfactory measurement an impossibility until positive relief was provided for the hacksaw blade.

Hungerford. Ian Bradley

MODEL STEAM BREAKDOWN CRANE

Part II

by E. Cheeseman

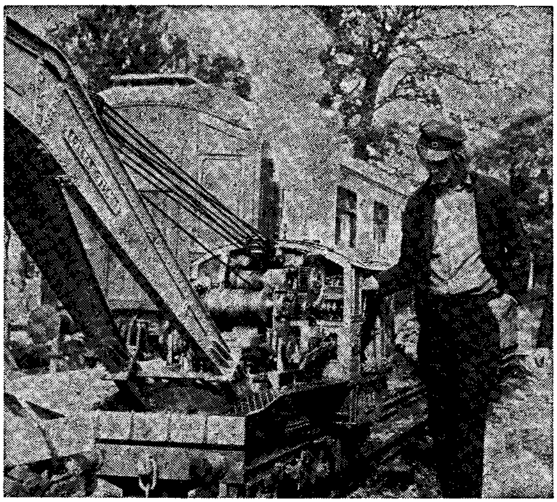
From page 1293

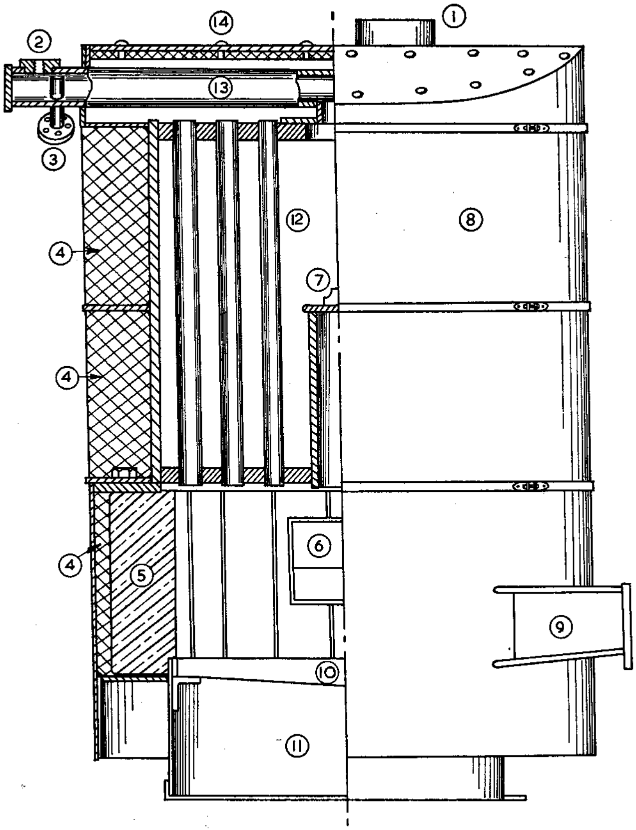
THE FIREBOX extends the whole area of the boiler shell diameter, and the refractory lining holds the heat, after working, practically equivalent to a damped fire, so that 5 lb. steam pressure can be showing 10 minutes after lighting the fire next morning. The smokebox is the same diameter as the outside of the firebox, and the stainless steel cladding is carried over both of them, the exhaust pipes are taken up through the boiler lagging, the outside of which is encircled by two narrow brass bands for appearance sake. The boiler shell is $\frac{3}{8}$ in. thick, and the fusible plug is mounted in an unusual position, to allow it to be removed or replaced from the top; a hole of sufficient size in the top tubeplate was made to allow this, being covered by the large flange of the steam collecting drum when this is bolted in position. The steam drum projects out of the front of the smokebox, forming a turret for the safety valve and two steam take-offs. One feeds the blower, two pressure gauges (main and repeater at control position) and the flexible soot blower. The other supplies the injector and the engine. The throttle is a parallel sleeve packed plug type fitted into the main steam pipe, which picks up the connections for the displacement lubricator before it divides below the footplate, the steam chests being fed on the underside. The exhaust pipes have drainage at their lowest points.

The short chimney is fitted just to the rear of boiler centre point and the smokebox lids are shaped to the contour of the cab roof to gain maximum height. The working pressure is 120 p.s.i.; the heating surface is 3660 sq. in. The cylinders cast from my home-made patterns are $2\frac{3}{4}$ in. bore by 5 in. stroke; the cylinder drain cocks are spring loaded, movement of the lever removes the loading spring pressure from the valves. Incidentally, the boiler was welded by a coded welder and tested to a pressure of 420 p.s.i. The flexible soot blower previously mentioned is used after steaming, being connected up and used through the fire charging door, and does a thoroughly good job, leaving the tubes etc. quite clean. The large grate area is responsible for the non-formation of clinkers. There are 62 ball and roller bearings fitted from $\frac{1}{2}$ in. up to 8 in. dia., and 127 grease nipples and over 60 oiling points to take care of the lubrication. Altogether over 3500 separate pieces of metal were fashioned for the construction of this model.

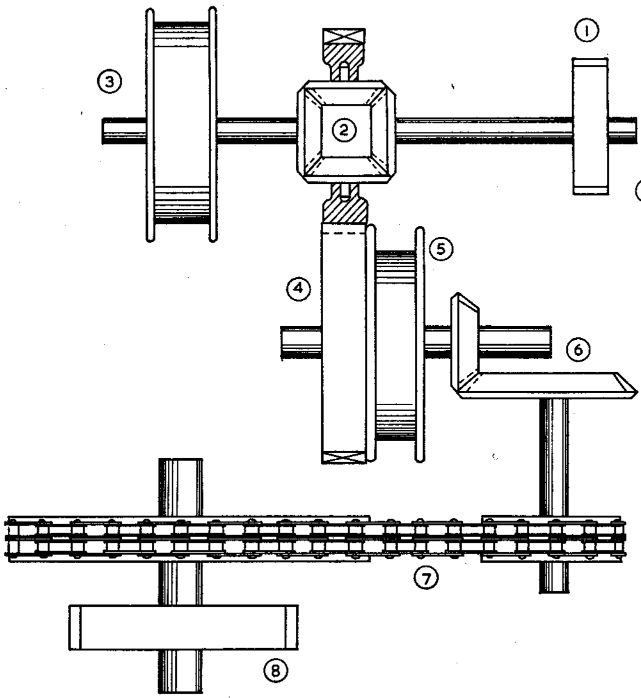
The match truck is an attendant to the crane, as the tender is to the locomotive, although it carries neither coal nor water. It supports the lowered jib when the crane is being transported by rail; it has two large tool-boxes and also carries the stabiliser beams which have screw jacks at each end to deal with inequalities of ground levels. The weight of the crane and its match truck is 2 tons 6 cwt.

Finally, I would say the crane is not a model of any actual prototype and was designed simply to satisfy an overwhelming desire to actually build something that works by steam; as well as having something to relieve our backs in the event of the odd derailment when operating at Haswell, the home of this breakdown train. In this description I have taken for granted that the reader is conversant with the function and action of differential gears.



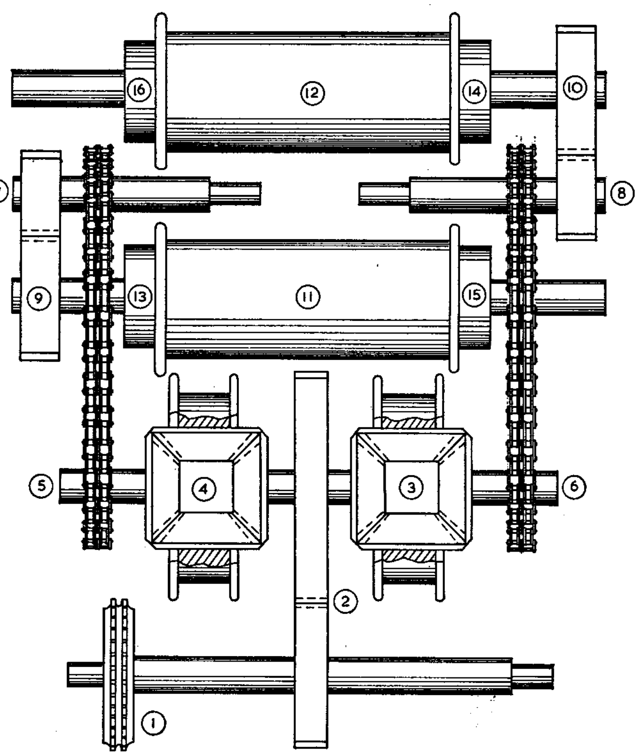


GENERAL ARRANGEMENT OF BOILER ASSEMBLY. Fig. 1



GENERAL ARRANGEMENT OF THE SLEWING DIFFERENTIAL CONTROL MODULE.

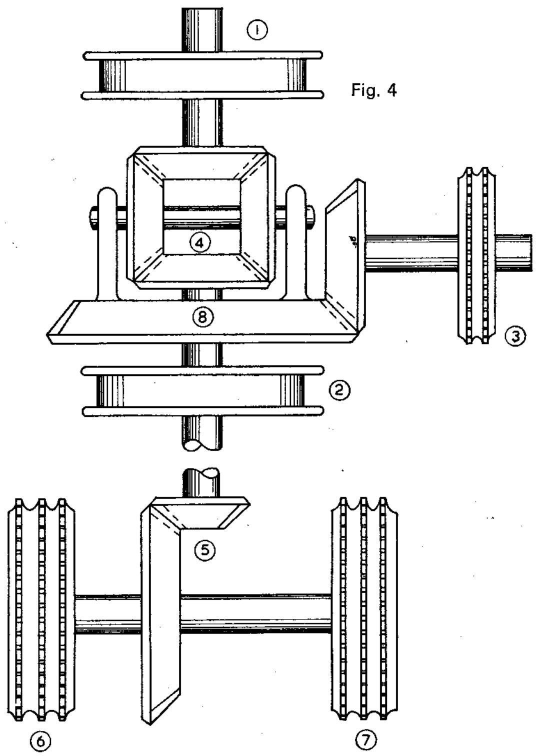
Fig. 2



GENERAL ARRANGEMENT OF THE "LUFFING" & "HOISTING" DIFFERENTIAL CONTROL GEAR MODULE.

Fig. 3

Fig. 4



GENERAL ARRANGEMENT OF THE TRAVELING GEAR MODULES

Hunslet Saddle Tank

SIR,—I would like to correct the impression given by Mr. K. Blackham of Kenilworth in "Postbag", 5 November, where he says that I supply castings for my little Hunslet saddle tank locomotive. I regret that this is not so. I supplied drawings and castings and lent patterns to John Milner (builder of *Pendle Witch*) some years ago, but since then I have not supplied any others and it is not my practice now to supply parts for locomotives that I supply finished.

Readers may be interested to know why I came to settle on this particular design. Originally I had planned to construct a batch of Darjeeling Railway locomotives in 3½ in. gauge, in fact I was well on with these when Jonathan Minns persuaded me to change to 7¼ in. gauge, which he thought would be the gauge of the future—this was in 1968. But because Mr. Minns wanted to be able to supply a complete "package" railway (locomotive, wagons and track) for £1000, a much simpler locomotive had to be found to get the price of this down to £500. It had to be built in under 200 hours work! To reach this target many jigs and fixtures were made and a great many castings used.

A great deal of time was spent on devising a boiler that would be acceptable to the insurance companies, and ascertaining what materials and fits were permissible on the moving parts, as the engines had to be assembled rather than "fitted". Although in 1968 I expected to be able to build and sell an engine for £500, today this figure would hardly cover the bought-out parts.

Hinckley. Roger Marsh

$7\frac{1}{4}$ in. Gauge Society visit Malden

by Bob Jones

SUNDAY, 17 October, was the day that the M.& D.S.M.E were hosts to the $7\frac{1}{4}$ in. gauge Society. This has now become an annual event, and is always eagerly awaited by everyone. The Malden Society has one of the finest ground level $7\frac{1}{4}$ in. gauge tracks in the country. It is basically a large oval with a total track length of approximately $\frac{3}{4}$ mile.

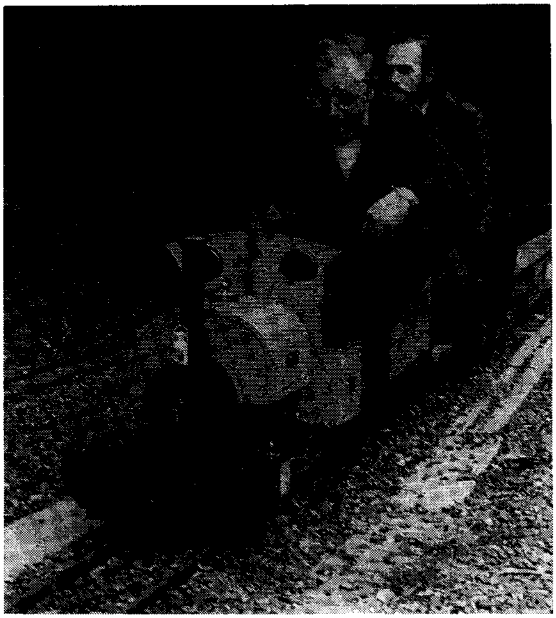
Several $7\frac{1}{4}$ in gauge Society members, coming from fairly far afield, began arriving on the Saturday afternoon. For most, by the time they had unloaded their locos and put them in the shed it was too late to think of steaming a loco. However, Jim Haylock from Caterham decided to run his narrow gauge type petrol loco *Triumph*. It is powered by a 50 cc. moped engine and the loco is quite unusual as one can sit inside with a roof over one's head. In the evening, after a very enjoyable meal of fish and chips, there was a film and slide show held in the clubhouse which lasted until the early hours.

Sunday turned out a nice bright day. Everyone was up early despite the previous late night (the extra hour gained by putting the clocks back came in most useful).

Geoff Oughton's *Romulus*, a 0-4-0 N.G. well-tank fitted with Hackworth valve gear, was the first loco to be steamed. *Romulus* is a very attractive freelance loco designed by Roger Marsh from Hinckley. Geoff has made a very neat job of *Romulus*, and it looks just right. An item of great interest is the steam-driven water pump which can be set to work as slow as a full-size pump.

Roger Marsh brought his Hayward type loco *Tinkerbell*. This is always a great favourite wherever it appears, and it is fitted with Hayward valve gear and a marine-type boiler. Jim Haylock had brought his rake of recently completed N.G. coaches and these formed the train behind *Tinkerbell*, a sight I am sure the late Sir Arthur Hayward would have loved to have seen.

Remus, the sister loco to *Romulus*, owned by Doug. Kempton and built jointly by R. Marsh and G. Oughton, arrived about 10 a.m. This was a pleasant surprise as we had heard on Saturday that it was doubtful if Doug. could come, but he was soon unloaded and in steam enjoying the lengthy run and a different track layout to that which he is used to.

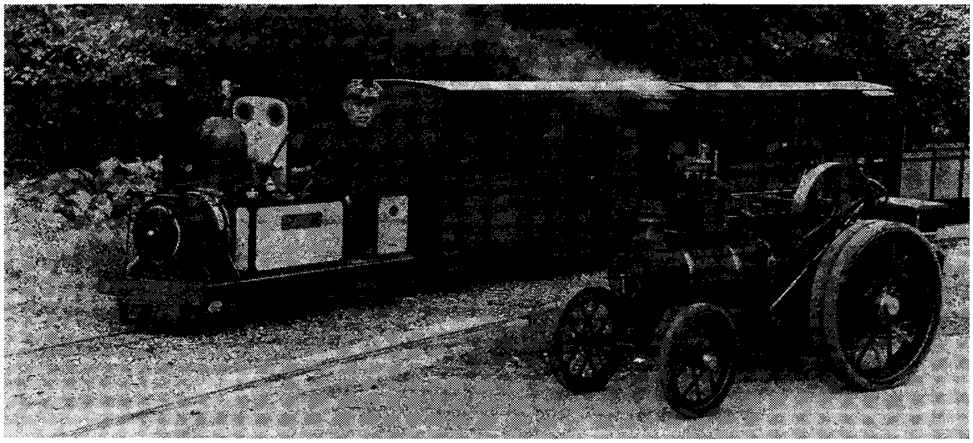


John Drury driving his saddle tank "Topsy".

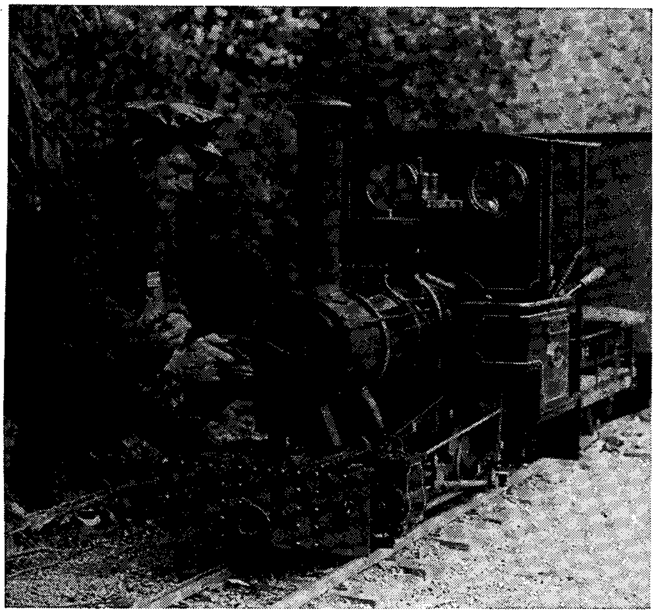
John Drury from Coventry brought his delightful 0-4-0 saddle tank *Topsy*; this is painted in a very attractive yellow. *Topsy* has Hayward valve gear and a marine type boiler. John is well-known in the Midlands for the number of excellent models he has built in the past, one of which is a fine 3 in. scale Burrell traction engine.

One of the smallest locos on the ground level track was *Rosabell*, built by David Walters from Kenilworth. *Rosabell* is a 0-4-0 saddle tank with inside valve gear. She is David's first attempt at loco building and a real credit to him. I have often seen *Rosabell* in action and shall never cease to be amazed at the loads she can handle. David left her in the very capable hands of Ken Blackham for most of the day while he watched from the line side for a change.

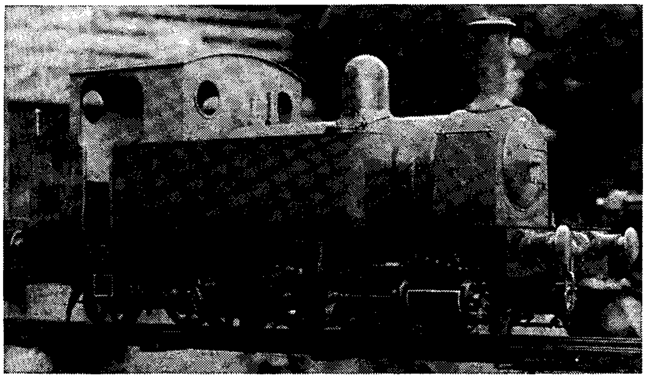
No $7\frac{1}{4}$ in. gauge meeting these days would be complete without one of Ken Swan's "Bridgets". George



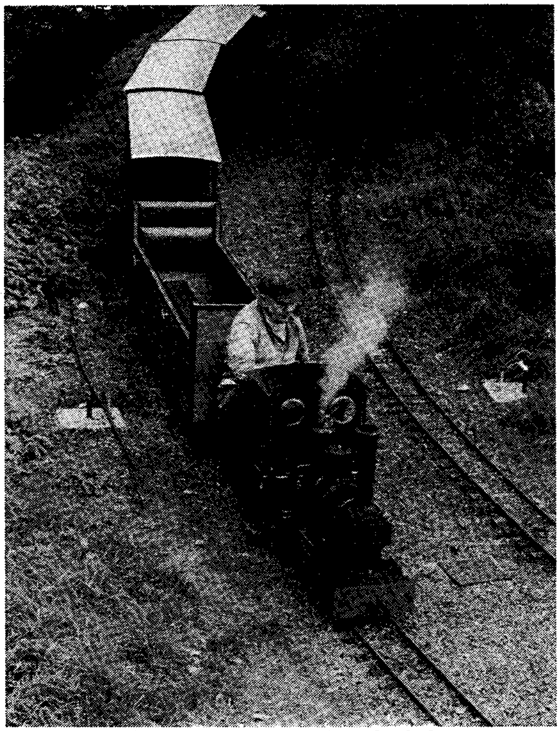
"Tinkerbell" by Roger Marsh with train of coaches by Jim Haylock. In foreground is the $4\frac{1}{2}$ in. scale Burrell by J. G. Clarke.



Geoff. Oughton with his "Romulus".



George Smith's delightful "Brigette".
Below: Ken Blackham driving David Walter's saddle tank "Rosabell".



George Barlow driving "Romulus" built by Geoff. Oughton.

Smith from Leatherhead has recently finished a fine example of one of these locos and it runs as well as it looks. George ran on the raised $7\frac{1}{4}$ in. track that forms part of the $3\frac{1}{2}$ in. and 5 in. gauge track. George is an old hand at $7\frac{1}{4}$ in. loco building; he has built in the past an N class S.R. "Mogul" and a S.R. "Schools" class.

We were very pleased to welcome several well-known visitors to the track in the course of the day, including Dr. Brian Rogers, Founder Chairman of the $7\frac{1}{4}$ in. gauge Society, George Barlow and Tony Crowhurst from the R.H. & D.R., and many others who have a great interest in small railways.

John Limming ran his large and very powerful petrol-electric locomotive which is based on a Santa Fe type diesel. Last year John replaced the original engine with a Fiat 850 cc. engine, and now the loco can pull almost anything one can put behind it. This is very useful on Malden's busy track days held on the first Sunday of every month from Easter till October.

A very fine "Royal Scot" No. 6155 *The Lancer* and owned by Bill Brown joined the many locos already running. *The Lancer* is one of Malden's regular locos and is in use every track day. Bill tells me he estimates that his loco travels approximately 450 miles a year. I think it is a great credit to him and his helpers that *The Lancer* runs and looks better than ever.

In the siding next to the station an American N.Y.C. & H.R.R.R. 4-4-0 was on display although not in steam, together with a chassis for a petrol loco in the course of construction. Last but not least, a $4\frac{1}{2}$ in. scale "Burrell" traction engine was in steam. A few visitors tried their hand at driving it up and down the club driveway. The engine was built by J. G. S. Clarke from Denbigh and is owned by Bob Jones.

A most enjoyable day was had by all. The $7\frac{1}{4}$ in. gauge Society wish to thank the members of Malden & D.S.M.E. for making such a day possible, also many thanks to the canteen ladies for providing the endless cups of tea.

Anyone wishing to join the $7\frac{1}{4}$ in. gauge Society should contact the Secretary, David Walters, 16 Station Road, Kenilworth, Warwicks. CV8 1JJ.

CLUB NEWS

East Sussex Model Engineers
The East Sussex Model Engineers participated in the "Hastings Day" celebrations in October for the first time last year (1976), setting up their portable track at the Fire Station. The day proved warm and sunny and the public took full advantage of this, the demand for rides requiring double-heading throughout the day, which greatly enhanced the interest for both visitors and members alike.

Secretary: R. W. Taylor, 24 Mitten Road, Bexhill-on-Sea.

News from Wigan
Among the subjects discussed at the September 1976 meeting was the re-roofing of the hut at Haigh. This work has now been completed and at a cost substantially less than the sum allocated, for which members responsible can be congratulated.

At the recent "Bits & Pieces" meeting, Gordon Jackson brought along boiler fittings for his "King Arthur" and briefly described his construction methods. Barry Harrison had the chassis for his *Firefly*, and spoke about the making of the valve gear components.

Parkside is the subject for Don Slater's latest painting. It depicts the Allan 6 ft. "single" *Diamond*, where the Golborne-Winwick road crosses the Liverpool-Manchester line.

Secretary: K. D. Moffitt, 32 Sedgefield Drive, Beech Hill, Wigan, Lancs.

From Northern Ireland
The October number of the *Phoenix*, the journal of the Association of Model Engineers, Northern Ireland, contains, among other things, a very interesting design for "swing points". These enable a connection to be made from the main line of a conventional raised track to a siding or branch line. The design consists of two tracks, laid at radii of approximately 30 ft. and 45 ft. "convex" to one another, so that by swinging the whole unit, connection can be made either with the main line or with the branch or siding, so having the same function as a point or turnout on a ground level line. The design is by W. J. Gilles.

News from North London
At the October meeting of the North London Society of Model Engineers, Tom Mallett spoke about the output of hot air engines, Terry Hammer talked about sandblasting as a preparation for painting, and Tom Luxford then introduced the main speaker, Mr. Hughes of British Oxygen. Mr. Hughes is an expert instructor in welding and allied techniques and he described a typical outfit for welding and brazing. He also demonstrated the various types of reducing valves and gauges used in connection with oxygen and acetylene, and the variety of nozzles used.

Alan Ashberry recently had the first run with his 5 in. gauge L.N.W.R. "Jumbo" based on LBSC's *Mabel*. The engine ran without a hitch, the only problem being to restrain the speed.

Secretary: M. J. R. Radford, 80 Holden Road, Finchley, N.12.

CLUB DIARY

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

JANUARY

7 Romford M.E.C. Competition Night. Ardleigh House Community Centre, Ardleigh Green Road, Hornchurch, Essex. 8 p.m.
7 Torbay M.E.S. Meeting. Foxhole Community Hall, Paignton, Devon. 8 p.m.
7 Hastings S.M.E. "Recent Developments on the R.H. & D.R." talk by George Barlow. Mercatoria Hall, Mercatoria, St. Leonards-on-Sea. 7.45 p.m.
7 Stockport & District S.M.E. "Bits and Pieces". Wellington House, 324 Wellington Road North, Stockport. 8 p.m.
7 Dublin S.M.E.E. Slides. K. Meade. In the Star of the Sea School, Sandymount, Dublin 4. 8 p.m.
10 Clyde Shiplovers' and Model Makers' Society. Old Glass Slides—Wm. Forth and John A. Smith. Kelvingrove Art Gallery and Museum. 7.30 p.m.
10 Swansea S.M.E. A.G.M. Club H.Q., Derwen Fawr. 7.30 p.m.
10 Wirral M.E.S. Film show—members' movies.
11 Guildford M.E.S. Executive Committee Meeting.
11 Stroud S.M.E. Starting a Workshop—Mr. P. Norman. Society's Workshops, Old Workhouse, Bisley Road, Stroud, Glos. 7.30 p.m.
12 Sutton Coldfield Railway Society. French Interlude—SNCF films introduced by Ivan Davies (Cine). Wylde Green Library, Emscote Drive, Little Green Lanes, Sutton Coldfield. 7.30 for 8.15 p.m.
13 Hull S.M.E. Safety in the use of Grinding Wheels. Talk by Mr. E. G. Bass. Trades & Labour Club (Room 3), Beverley Road, Hull. 7.45 p.m.
13 Sutton M.E.C. Aluminium Production and Use.—F. Kasz. Clubhouse, off Chatham Close, Sutton. 7.30 for 8 p.m.
13 Harlington L.S. Nomination Night—Members' Slides.
14 The Thames Shiplovers and Ship Model Society. Spar Making by J. Blight. St. Botolphs Church Hall, Bishopsgate. 7 p.m.
14 Chichester & District S.M.E. Films and talk by Dave Nicholls—"Pilot's Eye View". Chichester High School for Boys, Kingsham Road, Chichester. 7.15 p.m. Ladies welcome.
14 Wirral M.E.S. A.G.M.
17 North Staffs. Models Society. Talk and slides by Mr. David Bradbury "Traction and Stationary Engines".
17 City of Leeds S.M.E.E. "The Last Steam Loco's of the World", a Praktica taped lecture by C. Garratt. Salem Congregational Church, Hunslet, Leeds 10. 7.30 p.m.
19 Southampton & District S.M.E. Talk and slides by Mr. Peter Hollins—President of the Steam Boat Society of Great Britain.
19 Sutton Coldfield Railway Society. More views of Shildon by Peter Johnson (slides). Wylde Green Library, Emscote Drive, Little Green Lanes, Sutton Coldfield. 7.30 for 8.15 p.m.
19 Guildford M.E.S. Bits and Pieces Competition. Headquarters, Stoke Park. 7.45 pm.
20 Leyland, Preston & District S.M.E. Meeting. Roebuck Hotel, Leyland Cross, Leyland, Lancs. 8 p.m.
20 Sutton M.E.C. "The Big Little Giants"—H. A. Sandys. Clubhouse, off Chatham Close, Sutton. 7.30 for 8 p.m.
20 Harlington L.S. A.G.M. 7.30 for 8 p.m.
20 Warrington & District M.E.S. Talk by H. Pugh on "Bearings". Clubroom, Daresbury. 8 p.m.
20 Bedford M.E.S. Bring and Buy Sale. Clubhouse, Wilstead. 7.30 p.m.
20 Nottingham S.M.E.E. Talk on the Royal National Lifeboat Institution by Captain A. D. H. Jay D.S.O. D.S.C. Clarendon Street. 7.30 p.m.
21 Romford M.E.C. A.G.M. Ardleigh House Community Centre, Ardleigh Green Road, Hornchurch, Essex. 8 p.m.
21 Dublin S.M.E.E. "Springbok's Valve Gear". G. Drumm. In the Star of the Sea School, Sandymount, Dublin 4. At 8 p.m. Sec: H. R. Mapother, 8 Evora Park, Howth, Co. Dublin.
21 Hastings S.M.E. Members Slides Evening. Mercatoria Hall, Mercatoria, St. Leonards-on-Sea. 7.45 p.m.
21 Stockport & District S.M.E. Members' Films and Slides. Wellington House, 324 Wellington Road North, Stockport. 8 p.m.
24 Clyde Shiplovers' and Model Makers' Society. The Year on the River—Michael Campbell. Partick Halls, Burgh Hall Street. 7.30 p.m.
24 Bedford M.E.S. Informal Meeting. Clubhouse, Wilstead, 7.30 p.m.
24 North Wales M.E.S. Society Meeting. Penrhyn New Hall, Penrhyn Bay, Llandudno. 7.30 p.m.
25 Stroud S.M.E. Railway Films—Mr. Rainbow. Society's Workshops, Old Workhouse, Bisley Road, Stroud, Glos. 7.30 p.m.
25 Chelmsford S.M.E. Monthly Meeting—Film Show. Clubhouse, Waterhouse Lane. 7.30 p.m.
26 Sutton Coldfield Railway Society. Here, There & Everywhere—A peep at David Beardmores' collection (slides). Wylde Green Library, Emscote Drive, Little Green Lanes, Sutton Coldfield. 7.30 for 8.15 p.m.
27 Hull S.M.E. Slide show of M.E. interest (members can bring own slides). Trades & Labour Club (Room 3), Beverley Road, Hull. 7.45 p.m.
27 Sutton M.E.C. Travel Slides on Mexico—Dr. Settle. Clubhouse, off Chatham Close, Sutton. 7.30 for 8 p.m.
27 Harlington L.S. L.M.S. Loco. Night.
28 The Thames Shiplovers' and Ship M.S. Talk on German Sail Training Ships, by a speaker from the German Embassy. St. Botolphs Church Hall, Bishopsgate. 7 p.m.
28 Colchester S.M.E.E. Annual General Meeting. Clubhouse, Old Allotments, Lexden. 7.30 p.m.
28 Torbay M.E.S. Films of the Dart Valley Railway & Locomotives. Foxhole Community Hall, Paignton, Devon. 8 p.m.
29 S.M.E.E. A.G.M. Caxton Hall (2.30 p.m.).
31 Willesden & West London S.M.E. A.G.M. Kings Hall Community Centre, Harlesden Road, London NW10. 8 p.m.
31 Stafford & District M.E.S. Annual General Meeting. Doxey Arms, Stafford. 7.30 p.m.

FEBRUARY

1 Taunton M.E.S. Sub-Committee Report on Proposed Track. Rugby Football Club, Taunton. 8 p.m.
1 N.W. Leicestershire M.E.S. Talk by Professor Chaddock "You can't scale nature". Miners Welfare Centre, Coalville. 7.30 p.m.
2 Guildford M.E.S. Members' Films and Slides. Headquarters, Stoke Park. 7.45 p.m.
2 North Staffs. Models Society. Annual General Meeting.

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.

Testing Pressure Gauges

SIR,—I was delighted to see the article, "A Pressure-Gauge Tester", by E. W. Sheppard. I was about to write to you on this subject. Bourdon pressure gauges are certainly not a safe standard for pressure. Even though a gauge has just been calibrated, if it is shocked mechanically, thermally or hydrostatically, it may lose its calibration.

Dead weight calibration gives a completely reliable standard of pressure. I have done pressure testing at pressures up to 12,500 p.s.i. and I have used several dead weight testers which gave me complete peace of mind.

No two engineers will ever solve the same problem bv identical means. I do have some alternatives to Mr. Sheppard's construction. Since, for precision, the weight of the table and piston should be considered, and the weights will probably be made, there is no special virtue in having the area precisely 1 sq. in. Also, since little of the piston is unsupported, a $\frac{1}{8}$ in. piston may be used. This has the virtue of making it possible to use $\frac{1}{8}$ in. silver steel and a standard $\frac{1}{8}$ in. reamer.

If one lives near the coast, marine propeller shops are an excellent source for bar ends, in stainless, monel and bronze. If 2 in. bar can be obtained, a 6 in. length will be enough. I have calculated the dimensions for a weight set, covering 20 lb. intervals, to 300 lb. These weights are based on handbook values, but if the bar in question can be accurately weighed the weights can be calculated. I have assumed a 3 in. length of $\frac{1}{8}$ in. rod, pressed into a $1\frac{1}{2}$ in. platform, $\frac{1}{8}$ in. thick, with a $\frac{1}{2}$ in. x $\frac{1}{4}$ in. hub, with a computed weight of 0.1261 lb.

The weights should be machined "hat shaped" with a $1\frac{1}{2}$ in. recess, perhaps 1/16 in. deep, so that they will nest and be perfectly centred. It will be noted that the complete weight set is less than 4 lb., giving easy portability. A fiducial groove should be cut in the piston and filled with paint, at a point where it will just be revealed with the piston barely off-bottom.

Two comments completely unrelated to the foregoing:

I have found tobacco pipe cleaners very useful in the shop for cleaning the threads on chucks, cleaning out holes etc. They are also the best method I have found for applying cutting oil, when machining small diameters at high speed. A pipe-cleaner dipped in oil provides an adequate film without having it spray the machinist.

I have read some discussion of the difficulty in making small governors, particularly in obtaining a low friction shaft seal. I wonder if anyone has tried a chevron seal machined from fluorocarbon plastic? It would seem to have the correct properties of low friction, minimum wear and leakage.

Table of Weights for $\frac{1}{8}$ in. Piston

Pressure given by Weight (lbs)	*Gross Weight*	*Length of 2 in. Round Bar in inches*		
		Brass	*Steel*	*Cast Iron*
20	.2454	.123	.135	.149
40	.4909	.384	.420	.464
80	.9817	.881	.946	1.065
160	1.9635	1.893	2.071	2.287

Boca Raton, U.S.A. — R. B. Nottingham

Metrication

SIR,—I read Mr. R. K. Harper's letter on the above in your "Postbag" in the current issue of *M.E.* with interest.

In this letter he asks for more information on the I.S.O. series of metric screw threads. I am happy to oblige him by rendering the chart which I have compiled. This gives information on the preferred sizes up to M14 which, I think, will be large enough for the model engineering and jobbing enthusiast.

The sizes given are the preferred diameters, thus when working on a design one should stick to these diameters for spindles, shafts, etc. In other words they can be reamer and end mill sizes also.

In the furtherance of metrication in model engineering it will be necessary to have a fine thread range of taps and dies comparable to the 40 T.P.I. series used at present. Consequently I suggest, if it has not already been suggested, that your magazine should use its influence on model engineering suppliers to supply a metric range of screwing equipment with a pitch of 0.60 mm. in the preferred sizes from 4 mm. to 14 mm. dia. 0.60 mm. pitch would be most suitable as it is very close to 40 t.p.i. It is also easily screwcut on model-making lathes equipped with metric changewheels.

I notice on your gauge 1 "Southern Belle" locomotive design you use the fine thread M.E. series for boiler fittings etc. If the above fine thread metric series was available you would not have to do this.

I, as an individual, do not hold with the production of a design with half of the dimensions in metric and others including threads in Imperial. I feel that you should stick fully to metric and let enthusiasts who wish to work in Imperial convert from the design to suit themselves.

Please let us have designs completely in either Imperial or metric—the one or the other. In closing I would like to say how much I enjoy reading *Model Engineer.*

ISO Metric Threads
(Preferred Sizes)

Dia (mm)	*Thread Pitch (mm) (Standard Series)*	*Thread Pitch(mm) (Proposed Fine Thread Series)*	*Equivalent Dia (inches)*	*Tapping Drill Dia (mm)*		*Clearance Drill Dia (mm)*
M1	0.25		0.0394	0.75		1.05
M1.2	0.25		0.0473	0.95		1.25
M1.6	0.35		0.0610	1.25		1.65
M2	0.40		0.0788	1.60		2.10
M2.5	0.45		0.0985	2.05		2.60
M3	0.50		0.1182	2.50		3.10
M4	0.70		0.1576	3.30		4.20
M5	0.80		0.1970	4.20		5.20
M6	1.00		0.2364	5.00		6.20
M8	1.25	(1.00)	0.3152	6.80	(7.00)	8.20
M10	1.50	(1.25)	0.3940	8.50	(8.80)	10.20
M12	1.75	(1.25)	0.4728	10.20	(10.80)	12.20
M14	2.00	(1.50)	0.5516	12.00	(12.50)	14.25

Edinburgh. — Stuart W. Blackley

Cleaning Boilers

SIR,—Regarding the de-furring of boilers ("Smoke Rings", *M.E.* No. 3548), I can confirm that phosphoric acid or "Jenolite" will dissolve carbonate deposits without attacking copper. I have not tried this on a boiler myself, but the reaction of "Jenolite" with carbonate is fairly vigorous, and a dilution of about three to one with water would not only reduce foaming but economise on "Jenolite".

Another safe method of de-furring model boilers is by treatment with sodium metaphosphate, sold commercially as "Calgon". Boilers should be filled with a solution of this and warmed by a small burner in the firebox for an hour or two, after which the fur may be rinsed out with water as a fine sediment, though a further treatment may be necessary.

Whilst on chemical matters, a word about pickle bath acid. I have seen in the literature various references to the need to add acid carefully to water when diluting commercial (specific gravity 1.83) sulphuric acid, but never any explanation for this precaution. The reason is that a large amount of heat is liberated when this acid is diluted from the concentrated form, sufficient indeed to cause the solution to boil, with obviously dangerous results, if the diluting water is not below 60 deg. F. Once the acid is diluted by about four to one, little heat remains to be liberated, so that battery acid (specific gravity about 1.2) may be mixed either way, but avoid splashes as these will cause holes in clothing if not rinsed fairly quickly.

As to my credentials, I am a chemist with a County Analyst's department, and have been model engineering for three years during which time I have completed one locomotive and commenced a second. I hope some of this information will be of interest to your readers.

Durham. T. P. Coles

Model Foster

SIR,—Writing on the assumption that a reader somewhere may be interested, might I point out a slight error in Peter Wilkes' article on Expo '76?

Whilst I have met and indeed have reason to be indebted to Mr. "Bill" McAlpine, the owner of Burrell showman's locomotive *Ex-Mayor*, it is because of an invited club visit to his steam museum near Henley where I did in fact see and admire *Ex-Mayor* that my admiration did not extend to using it as a basis for building a model Foster.

Again, assuming someone may be interested, the engine upon which my model is based belongs to the collection of traction engines of Mr. Tom Paisley of Hollywell, St. Ives, Hunts., who kindly gave me permission to measure his Foster showman's road locomotive, *Admiral Beatty*. This engine was owned by East Anglian showman Henry Thurston. and worked the local fairs for many years. It began life, I believe, in 1912 as a road locomotive and was converted at William Foster's Lincoln Works to model 7LR showman's specification about 1918.

Now I admit to slight deviation in the model from Mr. Paisley's engine, namely, the fitting of a regular pattern showman's chimney top, as opposed to the double bell type of *Admiral Beatty*. Also, the cylinder saddle on *Admiral Beatty* is a separate casting from the cylinder block whereas in the model, these two items are integral as in the big 65 b.h.p. Fosters.

Whilst I have never claimed absolute authenticity for the model, except perhaps to certain fellow members of the Bedford M.E.S., it did rather deflate my ego to read Peter Wilkes' description of it as being modelled on the Burrell *ex-Mayor*. I didn't think it looked that much unlike a Foster, even an idiot, a status for which, according to certain fellow members of the Bedford M.E.S. I have reasonable qualifications, would hardly use a Burrell to model a Foster! Finally, although I did not see Peter Wilkes at Expo '76 this year, I did meet him there last year and carefully explained all these details to him. Perhaps we shall bump into each other next year when we could finalise the "Foster Saga" over a pint or so. No offence intended, Peter.

Clapham, Bedford. Eric A. Two

Garratt Locomotive

SIR,—Could one of your South African readers please tell me if G. E. A. Garratt's Nos. 4046-4050 retain the Beyer-Peacock steam reversing gear with which they were originally built? Is No. 4048 still in existence? Many thanks.

Saltburn, Cleveland. T. M. Robinson

Small Lathes

SIR,—May I have an opportunity of expressing my complete, indeed enthusiastic support for the letters of S. J. C. Tinker and R. H. Purkiss regarding small lathes, in *M.E.* 19 November.

Although I always read *M.E.* with interest and have done so for over 40 years, my firm impression nowadays is that it seems to cater almost entirely for the very highly-skilled and experienced craftsman with a well-equipped workshop. Yes, of course, you now have an item "Lathework for Beginners"; excellent. But is it possible to develop this somewhat so that the interests of many people who have neither the money to buy, nor the space to install, nor the skill yet to use, say, a splendid Myford or similar lathe, but have quite good ability with hand-tools, an interest in using them and a little money to spare for the very expensive materials which must sometimes be bought?

I recall with pleasure the encouragement *M.E.* gave many of us old readers during the dreary years of the last great war and after, with frequent articles from ingenious model engineers who made-do with all kinds of odds and ends and when many tools were quite unobtainable, whatever money you might have been able to spend. My own quite well-equipped workshop was a complete casualty in an air-raid on London. I have been able to replace much of it since then but at comparatively huge cost and it has taken me years to do so. I think also of those people who did remarkable work "on the kitchen table".

You show a photo of a 60-year-old 1¼ in. scale portable made entirely by hand (p. 1144). What a joy it would be were it possible to read an account of how it was done.

Of course you can't please us all, all the time; but it would be nice to feel that the less well-equipped, the less skilled, could be more catered for.

St. Leonard's, Sussex. Howard J. Kelleher

Drummond Lathes

SIR,—I have been very interested to read the various letters about the 4 in. round bed Drummond lathe, in particular the one by Alan Roscoe-Hudson who wishes to compile a register of these machines. I have one, purchased a few years back, that had been lying under a bench for about twenty years.

The said machine was reconditioned to the best of my abililty and has been in use ever since, mainly in making bits and pieces for the restoration of old clocks. With it were ten change wheels as follows: 64, 44, 40, 36, 32, 30, 28, 24, 20 and a second 20. Ten change wheels in all. Stamped on the bed of the lathe at the change wheel end is MCHA 6678.

Backgearing has been added by several readers. I have done this by adding an intermediate countershaft between the normal overhead one and the motor which is mounted behind the tailstock. This arrangement gives me a range of speeds from 28 to 1,000 plus.

It is also noted that the cross-slide is not as rigid as the cross-slides on the modern machines. To overcome this I have fitted an adjusting screw at the rear end and a plate on the casting below it. This gives good support to the rear end of the slide and of course is easily adjusted by the screw when the slide is raised or lowered.

Dawlish, Devon. G. H. Tucker

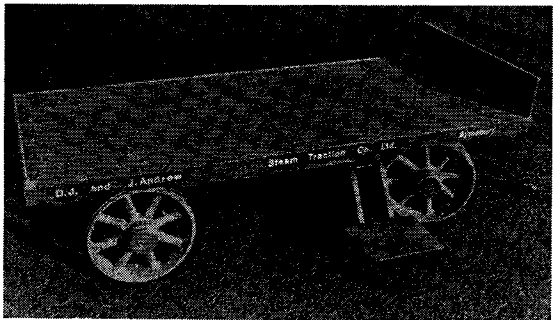
SIR,—I joined the ranks of model engineering last November, being a proud possessor of a round bed 4 in. Drummond lathe. It had been modified to take an electric motor, and in doing so, the screw cutting had been completely dismantled, and all the relevant parts mixed up in a cardboard box (together with other oddments).

Now my problem is, I have very little idea how to rebuild the screw cutting gear (from the connection from the lead screw onwards). Is there any reader with this "knowall" who could advise me the correct sequence of rebuilding?

Crayford, Kent. K. A. Thompson

Driving Trucks

SIR,—My reason for writing to you is to express an opinion of mine regarding the models that most of us build. When visiting shows or open days I am always fascinated by the excellent models on display. They exhibit a very high degree of workmanship, yet often



the driving trucks or trailers, in the case of traction engines, are a far cry from this standard. I can recall instances of seeing excellent traction engine models hauling their owners on trailers that appear nothing other than an old wooden box mounted on four push chair wheels, which to me is so disappointing.

I have been building a 1½ in. Allchin traction engine during the past two years and it is now well on the way towards completion, but I was determined to have a driving trailer which was worthy of being pulled by my engine and consequently set about designing and building something which was strong enough to carry a full-size driver yet still maintain an approximate scale appearance of a haulage wagon. The results of my efforts are shown in the photographs attached. If other model engineers would be interested in building a trailer of this type I would be pleased to share my ideas through the pages of your magazine.

Aylesbury. D. J. Andrew

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