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ONE SHILLING
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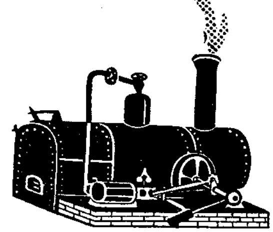
Smoke Rings

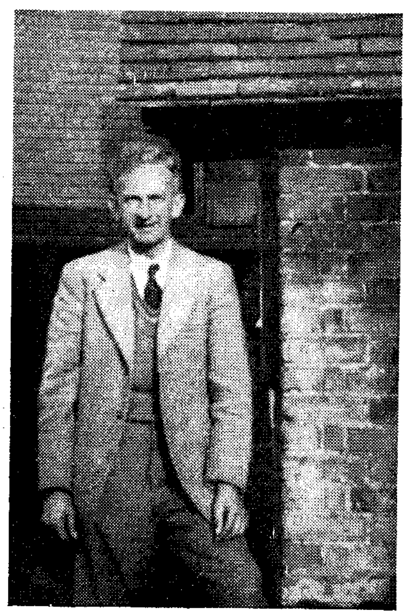
A WEEKLY COMMENTARY BY VULCAN



MARTIN W. McGRATH, the author of the article " A Simple O gauge Steam Shunter " in this issue can count himself a lucky man.

His wife, son and daughter, he tells me, are all sympathetic to mechanical matters and he is never short of that extra pair of hands which is so vital if an awkward riveting job is to be completed successfully.

Mr McGrath, now in his middle fifties, served a six years' apprenticeship in mechanical engineering and has pursued most branches of engineering activity in workshops and offices. He lives in Maidstone.



Martin W. McGrath

Turning, fitting, inspecting, selling, planning and estimating are some of the tasks which have occupied his professional career. For the past eight years he has been works manager to a general engineering firm.

The model engineering field which appeals to him most is the ever popular fold of live steam, particularly stationary steam plants and small gauge locomotives. His interest is nicely balanced between designing and subsequently building models of this type of engine.

Like many another model engineer he eschews the elaborate machine, preferring to use a small bench lathe —his maid of all work—a good vice and stout bench, with a copious supply of well tried hand tools.

" I get more satisfaction," he writes, " from a tricky piece of filing than by setting the work up in a new milling machine equipped with a differential dividing head."

Museum's service

A SERVICE not so well known to ship modellers as it should be is the supplying of photostat copies of the original Admiralty draughts of ships, by the National Maritime Museum, Greenwich. These are photographed direct from the original and nothing more accurate or authentic could possibly be imagined.

When the draughts were handed over to the museum by the Admiralty, Mr A. L. Tucker was appointed custodian and, being himself a ship modeller, he immediately realised their importance to the ship modelling fraternity.

Every type of vessel is included, from the line-of-battle ship down to the smallest boat or barge, and the period covered is from 1700 to the end of the sailing ship era in the Navy and includes steam frigates, early ironclads and some early turret ships.

At a recent lecture given to the

Smoke Rings . . .

Ship Model Section of the Thames Shiplovers' Society Mr Tucker showed a selection of prints from the collection, and all present were impressed by their value and importance. There are several thousand drawings in the collection and Mr Tucker is cleaning and repairing them and making lists of them. A preliminary catalogue has already been issued but a more complete one is in preparation.

In the meantime a series of albums containing reduced photographs has been made so that intending purchasers who can visit the museum can go through them and make their selection without needing to disturb the originals, some of which are several feet long. Ship modellers should be thankful that the work of caring for these draughts has fallen to Mr Tucker, who is well known to the London fraternity, and who is so enthusiastically making them available to those who are most likely to benefit from them.

Fine gesture

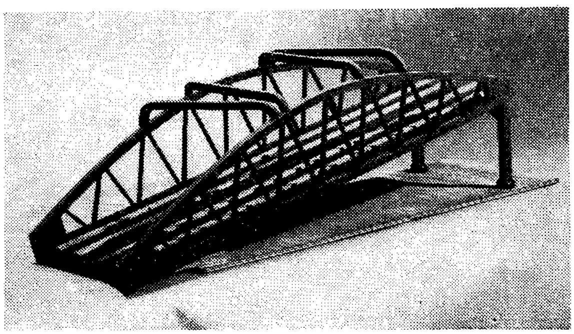
THROUGH the courtesy of George Cohen Sons and Co. Ltd, who are at present dismantling the Liverpool Overhead Railway, a link with this famous old line will be preserved in the Science Museum at South Kensington.

Cohen's have had two models built representing parts of the "Dockers' Umbrella" and these have been presented to the museum. One model is of Seaforth Sands Station. It is 4 ft long, faithfully follows the curve of the original, and has been made minus the buildings on one platform so that details of the canopy, rails and platform furniture on the other may be more clearly seen.

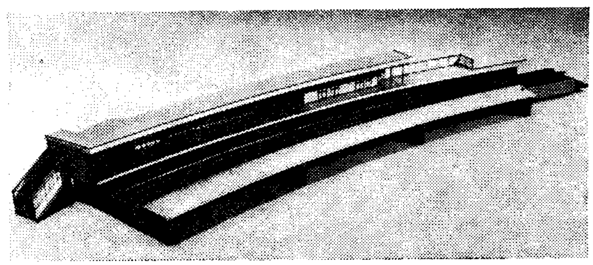
The other model shows the form of construction used by the builders in erecting the series of steel arch bridges along part of the track.

With these models Cohen's have also given the Science Museum various posters dating back several decades; an 1899 map of Liverpool showing the route of the railway; a schematic map of the line; and a bound book of photostats of Acts of Parliament concerning the Overhead.

I think this is a very handsome gesture; it is a pity that other organisations are not always so public spirited.



A model of one of the steel arch sections of the Liverpool Overhead Railway presented to the Science Museum by George Cohen and Sons



Another model presented by Cohen's. This is of Seaforth Sands Station on the "Dockers' Umbrella"

Tank testing models

IT is 20 years since the last series of races for the famous America Cup. Since that time the huge "J" class yachts have disappeared, except that in a few cases the hulls are still in use under a greatly reduced sail plan.

In the latest races, which are planned to take place in September, the 12 metre class will be used and in each case the entries will be provided by a syndicate.

The British challenger, to be named *Sceptre*, is well advanced and will be afloat before the summer so as to allow time for testing and tuning up. The Americans are building three new 12 metre yachts and they already have, in addition, *Vim*, which raced very successfully in British waters before the war. The defender will be selected from these. *Sceptre* is based on extensive tank tests.

The Americans, on the contrary, have carried out tank tests for their defenders for the last two or three races. I believe I am right in saying that *Sceptre* is the first British challenger to be based on tank tests with models. It will be interesting to see if our more scientific approach to the problem produces any better results than our previous reliance on the eye and instinct. Certainly the Americans have been able to hold their own against us for many years.

Cover picture

The Seal 15 c.c. four cylinder engine designed by Edgar T. Westbury being constructed by Douglas Reed, of Streatham Hill.

Live steamers in USA

LIVE steamers in the United States travel great distances every year to attend the Reunion of the National Threshers Association at Alvordton in Ohio. For lovers of the traction engine this occasion is a sheer delight.

Lucile P. Blaker, secretary of the association, kindly sent us pictures of engines owned by her husband Leroy W. Blaker, the association's president. One picture shows a Case engine whose 13-year-old driver is taking her up the earthen incline constructed each year for the reunion. Another [Smoke Rings, March 20] reveals the fine lines of the Case as she stands proudly at rest.

Mr Leroy Blaker also owns a couple of Port Huron engines and uses one of them to power his sawmill. Like all connoisseurs of the traction engine he has a general interest in steam and a knack of finding something of value wherever he goes. Mrs Blaker happily shares his enthusiasm.

The Blaker Christmas card for 1957 showed the two on board the steamboat *River Queen*—"Steamboat Round the Bend, Bradenton, Florida." In 1955 they wished their innumerable friends a merry Christmas and happy New Year from the cab steps of *The City of Bradenton*, a fascinating rail locomotive which runs among the Florida palms.

A simple O gauge steam shunter

Although there are certain shortcomings in design it is nevertheless considered that the interesting character of this industrial engine will appeal to readers

By M. W. McGRATH

I SUPPOSE that in most cases one has a reason for building a model. In this instance I had two.

Long ago, as a small boy, I possessed a German O gauge steamer, with a spirit fired, soft soldered pot boiler, steaming a single-acting oscillator of about $\frac{5}{16}$ in. bore, driving the rear wheels through a reduction gear. Taking everything into account I suppose this went quite well; anyway in the 1920s it was given to a neighbour's boy, at which period I should have been preoccupied attempting to obtain the maximum from a 350 c.c. o.h.v. two wheeler.

I had sometimes thought that something on those lines would be an interesting diversion, but it did not take active shape until the second reason materialised—in the person of my eleven-plus son, who inquired several times when I was going to build him a small steam locomotive.

I turned up some back numbers of ME, and showed him an illustration of a "Sentinel Geared Shunter." He agreed that such a project would be to his liking, and before long the engine began to take shape.

You may tell me that the engine is ugly. It may be, but the prototype does not possess classic beauty, and when the model is scudding around the track with coupling rods flying, its somewhat grim appearance is not without fascination.

All the materials required are readily available, and the total cost should not exceed 30 shillings.

THE CONSTRUCTION

The frames consist of two lengths of black m.s. strip 1 in. × 18 gauge × $7\frac{1}{2}$ in. Take one side member and scribe a line at each end 5/32 in. in and parallel with the ends, which must be exactly square. At $\frac{1}{8}$ in. down from the top and $\frac{1}{4}$ in. and $\frac{7}{8}$ in. down scribe and centre dot and centre drill, using your smallest drill. Clamp the side members together and drill the six holes, $\frac{1}{16}$ in. dia., very slightly countersink and rivet together.

Next cut two lengths of 3/32 in. × $\frac{3}{8}$ in. bright mild strip for the coupling rods, $4\frac{1}{2}$ in. long; mark off the crank pin holes on one strip and drill 3/32 in. Scribe a vertical line down each side member $1\frac{1}{2}$ in. from the front and clamp the coupling rod strips on each side of the frame sides, with the front 3/32 in. hole lined up with the scribed line on the frame.

Set the bottom edge of the coupling rods $\frac{1}{16}$ in. above the bottom edge of the frames. See that each side corresponds, and drill right through 3/32 in. the front one only; drop in a 3/32 in. rivet to prevent accidental movement, repeat with the second and complete the three holes. Mark the embryo rods n.s. and o.s. front and remove them.

Drill and ream the axle bush holes in the frame sides $\frac{1}{4}$ in. dia. Mark the frames o.s. and n.s. and de-rivet. Turn up the axle bushes from bronze, and press them in.

As there is not much substance to support them, it is permissible to lightly run round the portion projecting inside the frames with soft solder.

The front and rear cross members can be made up from $\frac{3}{8}$ in. × $\frac{1}{16}$ in. brass angle. I do not think one can call them buffer beams in this instance, although they are in the usual location. Mill the slots for the frame ends, use a cutter in the lathe if you do not have a milling machine; *don't* try to cut them by hand.

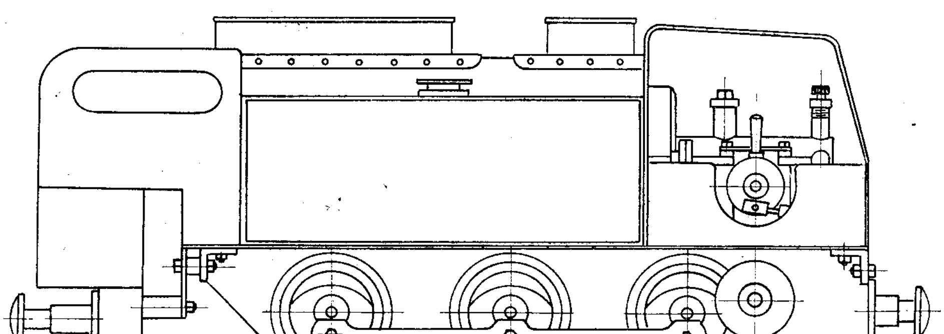
Slip the cross members over the frames—they should be a nice push on fit. Cut off and face in the lathe two pieces of $\frac{5}{16}$ in. square brass to fit in the ends of the frames under the angle.

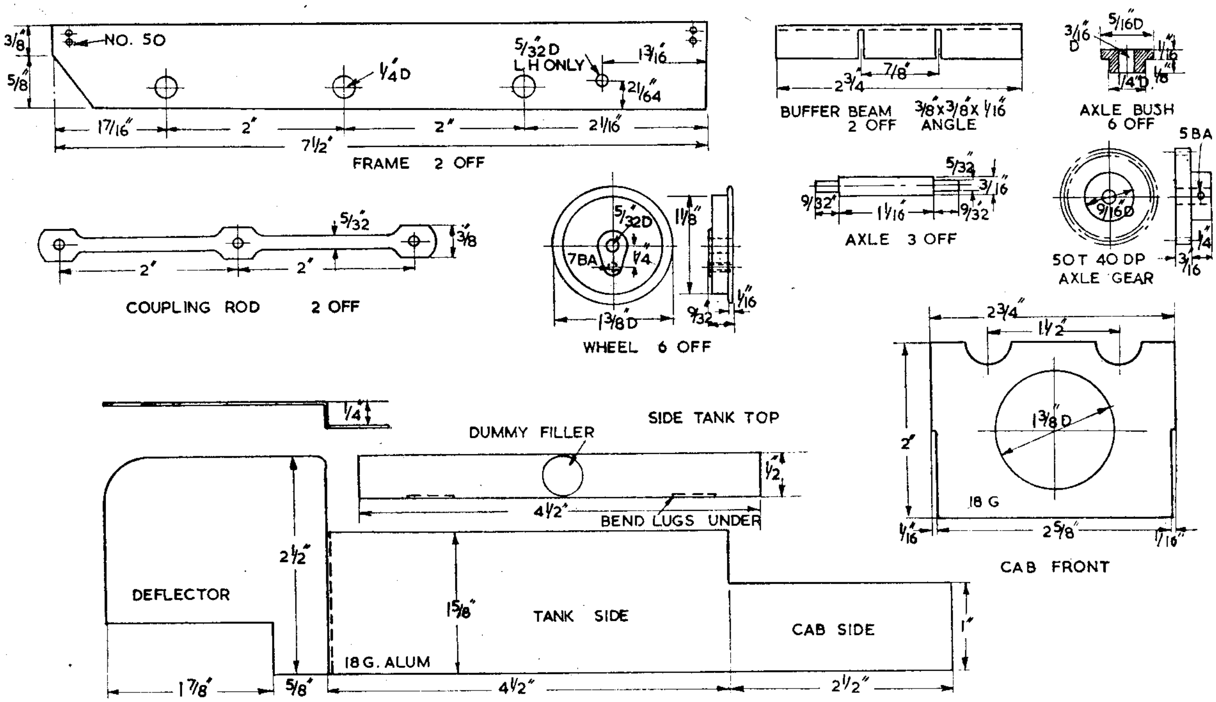
Now, using the $\frac{1}{16}$ in. rivet holes as a guide, and with a *short* $\frac{1}{16}$ in. drill, mark the ends of the filling pieces in position, remove them, drill No 56, $\frac{5}{16}$ in. deep and tap 10 BA. Open up the frame fixing holes to No 50. At $\frac{5}{8}$ in. centres along a line drawn across the top of the buffer beams and with the filling pieces in position, drill four 3/32 in. holes to just break into the filling pieces. Change your drill to No 50 and drill right through the filling pieces and tap 8 BA.

I don't wish to relight the gunpowder train: cheesehead versus hexagon head, but I used cheesehead (the small type).

The front ends of the side members may now be cut to shape. Reason? It helps the burner ventilation. At this stage the 5/32 in. hole in the n.s. member may also be lined off and drilled.

The axle gear (50 teeth × 40 d.p.) will have a 5/32 in. bore. Bore this in the lathe to fit the $\frac{3}{16}$ in. dia. axle, and re-tap the grubscrew hole in the





boss for a 5 BA Allen screw.

I do not propose to describe the machining of the wheels or axles; this has been covered many times in ME. I will merely add a few words about quartering the rods, which, please note, only applies to a simple engine with plain bushed axles.

Mill or file the coupling rods to shape—and if you think they look "hefty," remember that this is an industrial engine. Open out the crankpin holes to No 39. The crankpins are 7 BA hexagon head bolts, re-screwed so that the plain portion is just over 3/32 in. long.

Press one wheel on each axle, and thread them through the assembled frame, remembering to include the gear on the rear axle; attach one coupling rod.

Take the other three wheels and attach the coupling rod to these; push each wheel to start on each axle seat.

On the lathe bed or a sheet of plate glass set the pressed-on wheel side, with the coupling rod at its highest point. Set the opposite side exactly horizontal, either leading or following—it does not matter in this case—followed by each wheel a little at a time in the vice.

This is a job that is much easier with two pairs of hands, and a piece of $\frac{3}{8}$ in. brass about 1 in. long with the ends faced in the lathe, as a pressing agent.

Remove the coupling rods and open out again with a No 38 drill. Re-assemble, and if you have been careful, the coupled wheels will revolve freely.

The next move is to check the mesh of the driving gear. Push a piece of 5/32 in. dia. silver steel through the drilled hole in the n.s. frame side, hold it against a small square and push the driving gear over it.

The gears should mesh with just a trace of backlash; if it is too tight or loose in mesh draw the hole in the required direction and open up by stages of several drills to $\frac{1}{4}$ in. dia.

The running boards are strips of similar material to the frames. Cut and file them to the exact length required, in position on the cross members. They are secured with an 8 BA nut and bolt at each end.

The lower end of the power unit comes next. Turn up the crank disc, bore the centre so that it is a press-on fit with the driving gear boss, leaving some 0.010 in. clearance between the disc face and the edge of the teeth; face off the surplus flush with the disc.

Centre drill 5/32 in. and tap $\frac{3}{16}$ in. × 40 t.p.i. for the crankpin. Make up the crankpin from bright mild steel, use the tailstock die holder for a true thread and screw home tight. Brass clamps in the vice will do the trick, without damaging the bearing surface.

It will be found that pressing the crank disc in position has closed the bore so that it is a press fit on the crankshaft; this is intentional and the shaft needs no other fixing.

The shaft is simply a plain short length of 5/32 in. dia. silver steel. The gear is 20 t. by 40 d.p.

Turn up the crank bearing from bronze, drill and countersink the No 50 holes in the flange and, using as a jig, spot the holes in the frame, drilling No 56 and tapping 10 BA.

Machine the flywheel, drill and tap for 5 BA Allen screw and slip on the crankshaft, adjusting to give slight endplay and lock.

The engine frame bracket is cut from $\frac{3}{8}$ in. × $\frac{1}{8}$ in. brass angle and is sawn and filed to the dimensions given. Drill the top two holes 3/32 in. dia. and set in position to line up with crank centre line; clamp in position, drill right through the running boards and bolt up by two hexagon head 8 BA bolts and nuts.

Drill two holes in the side frame member 3/32 in. to just mark the position in the vertical portion of frame bracket. Remove the bracket and drill No 50 and tap 8 BA. Attach at this point by setscrews; they should not project beyond the vertical bracket face. You may be able to obtain a casting for the cylinder. If not, it can be built up quite simply.

Take a piece of $\frac{7}{8}$ in. dia. bronze and machine to a bobbin shape. Slot the end flanges to take a piece of rectangular bronze $\frac{1}{2}$ in. × $\frac{1}{4}$ in. Leave a finish machining allowance in the bore and on the end faces.

Finish the top $\frac{13}{16}$ in. dia. of the flanges and tie the block on steel wire and silver solder.

Finish-machine the cylinder, paying particular attention to the bore. As a plug gauge for size, a small piece of $\frac{7}{16}$ in. dia. silver steel is useful.

As to finishing the backface on a spigot I will pass on a tip I received from an old craftsman. He always skims up a piece of hardwood in the chuck for this purpose, claiming that the coefficient of friction is high, while he has yet to suffer "jamming" or a scratched bore. To the best of my knowledge he has been machining for 66 years, so you can conclude that one is on pretty safe ground in this respect.

Take great care in drilling and tapping the pivot pin hole. To keep it square use the tailstock, in the same setting when the joint face is machined.

Drill the ports in a drilling machine, sighting the run of them after starting them by hand with a centre drill in the handbrace.

I did think of milling the rectangular portion, but there are only two and a bit of filing is good for the temper!

Accordingly I ground the end of a $\frac{1}{8}$ in. square file to $\frac{1}{16}$ in. wide for $\frac{1}{2}$ in. or so, leaving two "safe" edges. The finished, slightly wedge-shaped ports took a surprisingly short time to complete.

Use bronze or gunmetal for the bottom cover; brass will serve for the top. The piston rod is simply a 3/32 in. dia. piece of stainless steel with a few 7 BA threads on each end. The piston is machined from dural.

The spring adjusting nut, thrust pads and pivot pin are all easy except, possibly, the thrust washer acting on the reverse valve. I used hardened cast steel for this, and it seems to pay a dividend in reducing friction. Cast steel is not an ideal material to handle in very small lathes, so I drilled a No 30 hole in a piece of 0.040 in. gauge plate and cut around to produce a rough $\frac{5}{16}$ in. dia. circle.

This was mounted on a screwed spigot and nipped up by a 5 BA nut. The o.d. was then turned to an easy fit in the reverse valve. Finally, the washer was removed, heated to a cherry red on the gas ring and dipped in oil and cleaned up with fine emery-cloth.

The steam block now claims attention. You will not find much bother with it if you take things easily when drilling the passages that break into the other holes.

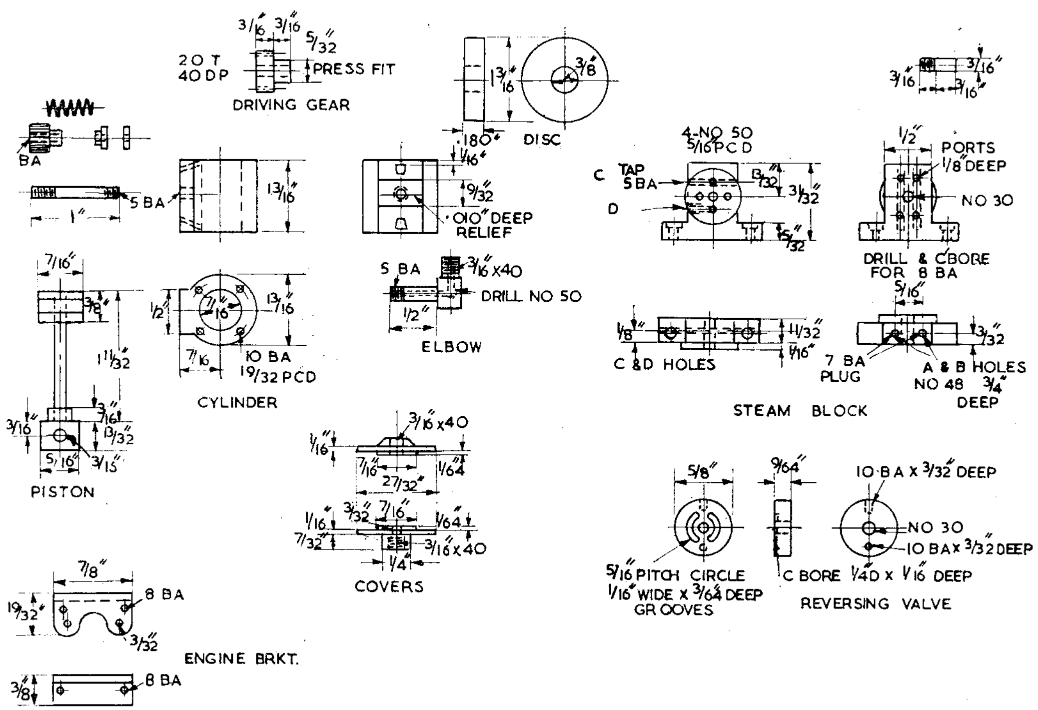
Machine the stepped-rectangular portion to finished size, taking care that the No 30 hole is dead square for steam face alignment. Next a $\frac{5}{8}$ in. dia. disc $\frac{1}{16}$ in. thick with a No 30 hole should be made; use gunmetal for both parts. Bolt them together and silver solder the joint and afterwards clean up the front and rear faces with emerycloth laid on a flat surface.

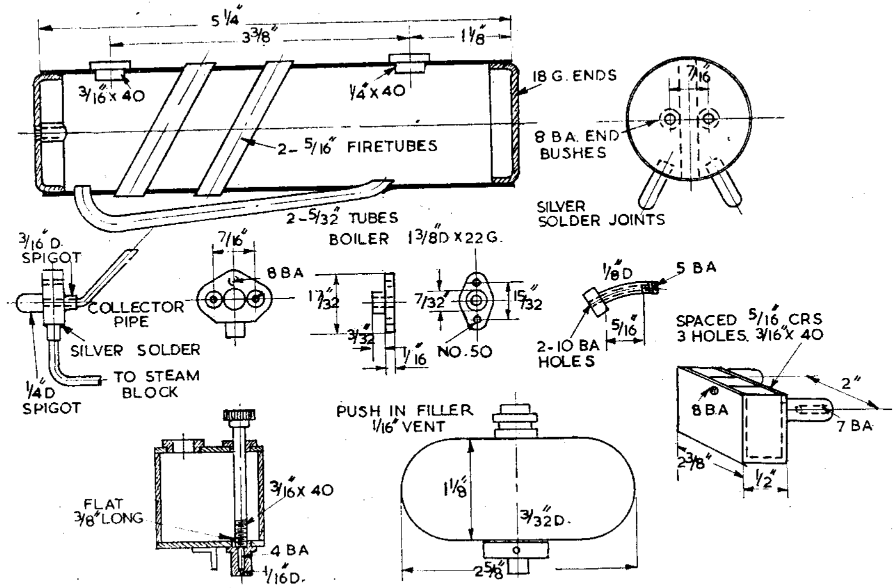
Drill the vertical passageway holes No 48—use the lathe or a drilling machine—and drill the No 37 hole right through and tap each end 5 BA for about 5/32 in. deep (*C*). Drill the $\frac{1}{8}$ in. hole halfway through and open out to 5/32 in. dia. × $\frac{1}{8}$ in. deep (*D*). Then drill four No 50 holes on a $\frac{5}{16}$ in. dia. pitch circle, to break into *A*,*B*, the vertical passages; *C*, the steam inlet and lubricator bore; and *D*, the exhaust holes.

Next come the ports in the steam block mating with the cylinder face, and I think the simplest way to tackle them is to drill four $\frac{1}{8}$ in. holes on a 9/32 in. radius, $\frac{1}{8}$ in. deep, spacing them so that the space in between them is slightly greater than $\frac{1}{16}$ in. on the centre line. File them to produce an inside edge on each to correspond to the ports cut in the cylinder and take care that the edges do not overlap.

Tap the tops of the vertical passages 7 BA, and with a syringe and paraffin blow out the holes in the steam block and make up and fit two 7 BA brass plugs. (Most cycle shops have a wide selection of springs.) Choose one $\frac{1}{4}$ in. o.d. by about $\frac{7}{16}$ in. free length, but not too stiff. Turn up an adjusting nut and end-pad to suit the bore of the spring, and make up the reversing valve from an odd piece of $\frac{5}{8}$ in. dia. brass.

I found that the easiest way to cut the curved slots was to drill four No 50 holes $\frac{1}{16}$ in. deep then, with a





small round nosed tool in the toolpost, turn the chuck by hand from hole to hole, feeding in about 0.005 in. at a time. It took ten minutes and resulted in a pair of very clean slots.

Drill and tap 10 BA for the handle and damper pin. The handle is plastic and is drilled and tapped 10 BA and screwed over a steel stud.

Clean up all the faces and assemble the engine with a drop of oil all round, plug the steam inlet for the time being with a screwed brass plug. Take a short length of $\frac{1}{8}$ in. dia. copper pipe and screw one end 5 BA, cut the nut end off a cycle connection and thread the remains over the pipe binding with steel wire.

Set the piston on top dead centre and give a stroke of the tyre pump, with the reversing handle back; it should revolve clockwise looking at the flywheel. If it does not revolve, turn the engine gently by hand a fraction and try again. Check the up stroke from bottom dead centre in the same way.

If it does not pick up immediately after passing centre, file the steam block port edges a little at a time until the desired results are obtained. A little hard h.m.p. grease pushed into the bottom of the ports will keep out filing dust while you are operating; it can be picked out with a match end.

Carry out the same in reverse. Ideally, you should be able to pick up and buzz like a bandsaw in any position a ghost off-centre, but with no leaks, by bridging the exhaust and inlet in the exact centre position.

The displacement lubricator is unusual in that the needle valve and the outlet are at 100 deg. instead of the usual straight line, the object being to fit this tidily into the cab while keeping the "handled" parts readily accessible.

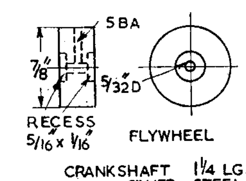
The body is a piece of thin section brass or copper tubing $\frac{1}{2}$ in. o.d., and the two ends, the filler stem, drain stem and spindle guide are all turned up from brass and silver soldered in place at one heat. The oval foot is screwed on afterwards up to the end of the drain stem thread and soft soldered; just to lock it in place.

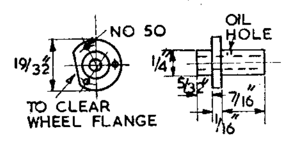
The drain cap that seals the end has a little lead melted into its blind end to form a seal. It is also drilled in the side by a small centre drill some three threads down from the top, so that the condensate may be drained without completely removing the drain cap.

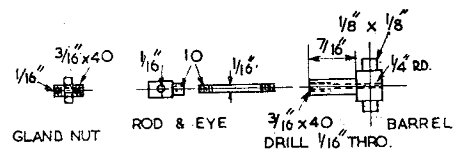
Connections are by a right-angle union 5 BA × $\frac{3}{16}$ in. No 40, screwed into the steam block. A similar straight union is screwed into the lubricator. They are joined by a length of thin wall $\frac{1}{8}$ in. copper tubing with plain ring nipples and $\frac{3}{16}$ in. union nuts. The 5 BA threads are lightly tinned before screwing in place.

The throttle damper is a worth while fitting, as it prevents the reversing valve creeping shut when running. A frictional resistance is created by an asbestos string packing in the usual "gland." The securing bracket is bent to shape and sprung over the trunnions. The bolt which secures the running board and also holds this in place is quite sufficient as the bracket is also butting against the cab rear plate.

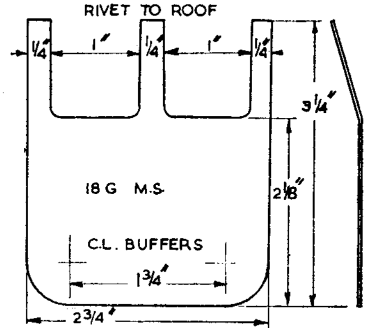
A few words now about the tablespoon size kettle. The inner shell is 1$\frac{3}{8}$ in. o.d. × 22 gauge. The ends are flanged 18 gauge, both copper. The front end has two stepped blind end nipples, pressed in and tapped 8 BA. These are for attaching the steam pipe flange. Two 5/32 in. watertubes and two $\frac{5}{16}$ in. firetubes are used. I like a few firetubes in a spirit fired boiler; they are simple to fit and help to keep the pot boiling. Silver solder the lot, including the two top bushes.



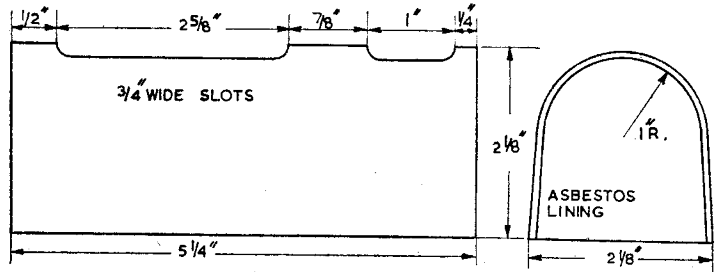




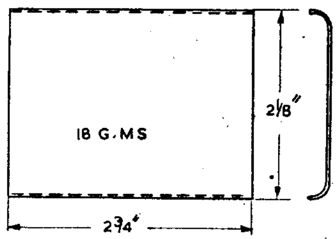
Details of the throttle clamper



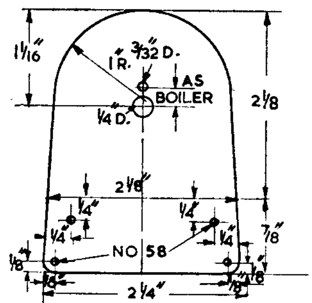
CAB REAR PLATE



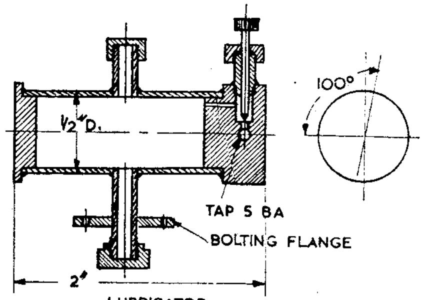
OUTER BOILER CASING



CAB ROOF



SMOKE BOX FRONT



LUBRICATOR

The cab front and smokebox door follow: 18 gauge sheet iron or steel is best. Cut the hole for the inner shell with an abrafile, in the cab front. Attachment is by two pieces of $\frac{1}{4}$ in. × $\frac{1}{16}$ in. angle and two 8 BA screws in tapped holes in the running boards. The smokebox front is bolted by 6 BA bolts with distance pieces to the front cross member.

The inner shell is located by a spigot on the steam flange which extends into the smokebox front. There is also an 8 BA shouldered stud and nut immediately above the spigot. The shell is free to slide in the cab front to allow for expansion.

The oversize area chimney and safety valve casing provide a natural ventilation for the burners, as there is not much forced draught from a single cylinder "waggler." Should their appearance cause some misgiving consolation will be found in their efficiency. They are both made from strips of 22 gauge brass, the ends being formed round a piece of $\frac{5}{8}$ in. dia. rod. Leave some tags inside—along the straights—and butt the front on one side and secure with copper rivets.

I used 26 gauge sheet iron for the outer casing. It can be bent with the fingers over a former (rolling pin). It is secured by two 8 BA screws (bottom front) which engage in tapped holes in two pieces of angle riveted to the smokebox front.

Two small pieces of angle are riveted to the outer casing (rear bottom edges), and have 10 BA tapped holes for countersunk screws. These are inserted upwards, through holes in the running boards.

Line the casing with $\frac{1}{8}$ in. thick asbestos and cut two slots for the chimney and valve casing; push these through from the inside, then cut two saddles from 22 gauge copper or brass to slide over the tops. The saddles should already be drilled for $\frac{1}{16}$ in. rivets.

Call in the fitter's mate again to prop up the lot and drill through the casing and tag and follow with a couple of rivets through the saddle, casing and tag. Using the saddle holes as a guide, drill and rivet the remainder.

Dummy tanks

The smoke deflectors and dummy side tanks are cut from 18 gauge aluminium sheet and may be shaped to your fancy. The cab is in three pieces, excluding the side sheets which can be cut to individual choice.

The rear sheet is cut with two large windows, and resembles a small garden fork. The tips are riveted to the slightly downswept rear run of the roof.

The front of the roof is turned down to match up with the cab front, already doing duty as a boiler support. The cab front windows are circular, and have half a hole in each. Riveted to the front of the cab roof is a small plate that slips between the outer casing and cab front. This has two 10 BA tapped holes for screws securing the cab roof.

Two 7 BA nuts and bolts fix the cab rear plate to the cross member, and the lower portion of the plate carries the buffer sockets.

The safety valve has a $\frac{1}{8}$ in. stainless ball on a 3/32 in. reamed seating and should be set to blow off at 45 p.s.i.

Now a word on the steam and exhaust systems. The front flange is cut to shape from brass; the collecting pipe is screwed in and the main steam pipe silver soldered in place. I was at a loss, when fitting up the prototype, to devise a suitable connection for the steam block as room at this point is not over plentiful.

I eventually solved the problem by turning a $\frac{1}{16}$ in. thick flange with a $\frac{1}{8}$ in. dia. stem, screwing this to suit the steam block. It was then screwed into the block, and marking the vertical position I removed it and, after annealing, screwed it into a tapped hole in an odd piece of scrap and set it in line of the steam pipe.

The main steam pipe was removed and a few 5 BA threads added with a screwed flange made up to suit. The two flanges were drilled and tapped for 10 BA screws, filed to an oval shape and the faces lapped together with very fine abrasive.

The exhaust pipe is a length of 5/32 in. dia. thin wall copper tubing, having a small lug silver soldered on the lower end. It was bent to shape, to discharge at a convenient point in the chimney, and the lower end was pushed into the steam block and held in place by a screw through the cab front and lug.

●*Continued on page 500*

TRACTION ENGINE

In the eighth article in this series ERNEST A. STEEL describes the boiler, smokebox and chimney construction

Continued from 3 April 1958, pages 420 to 422

BY 1926 the almost complete absence of the portable steam engine which had been a main source of power on the farm for thrashing and chaff cutting could be accounted for by the introduction of the oil engine. However, a few firms were still producing the once familiar type engine and among them Sentinels of Shrewsbury were the most enterprising.

The design of this portable engine was very simple from the point of view of assembly. A standard Sentinel vertical boiler and a horizontal totally-enclosed poppet valve engine, also produced by Sentinel, were mounted together on a steel framed wagon. The boiler was fitted with a firebox larger than that normally employed in the firm's famous steam wagons in order that fuels of an inferior grade could be used. For power transmission purposes a pair of pulley flywheels was also fitted to the crankshaft. The boiler was pressed to 200 p.s.i. and the engine developed 55 b.h.p. The total weight in working order was 4¼ tons. At about this time Sentinels were also manufacturing a steam-driven farm tractor in which the standard boiler and engine were installed.

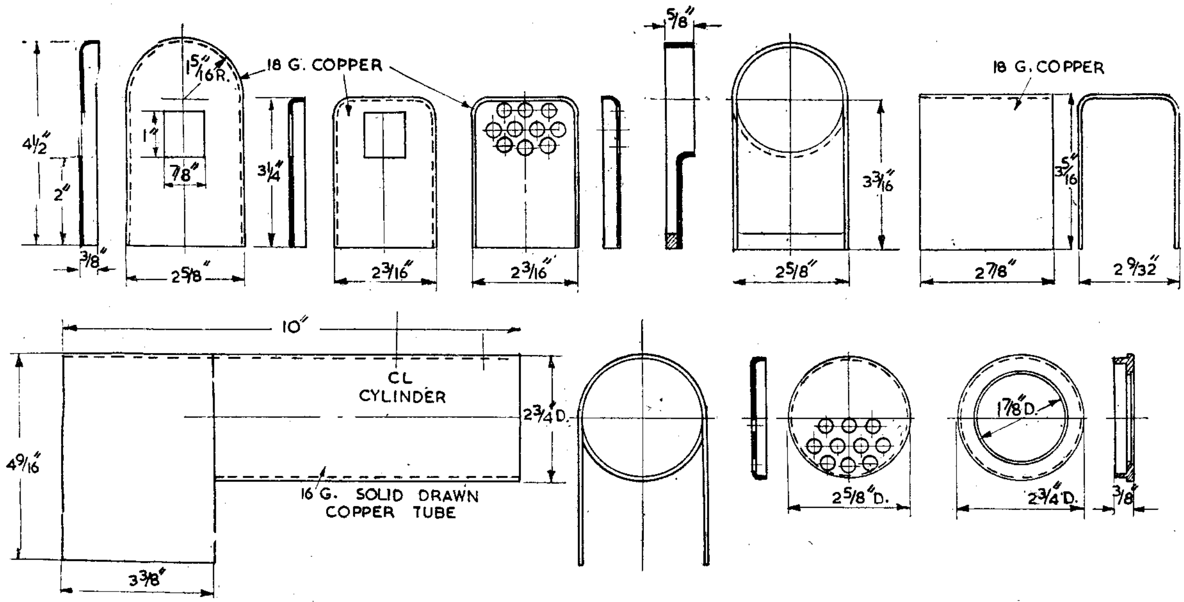
While the portable engine has been largely overshadowed by the steam tractor type, here is a field but little explored by the model engineer, providing as it does a useful vertical boiler unit, horizontal steam engine (simple or compound) and a simply designed steel truck. There are, of course, various other excellent designs for reproduction to scale, most of which are self-contained units on wheels; for example, the Garratt compound, the Marshall twin-cylinder, and Clayton and Shuttleworth's 12 h.p. twin-cylinder portable. These are but three I have found at random among my old catalogues and records of road and field engines.

Richard Garratt and Sons were the inventors of a compound portable engine and were awarded prizes at the Royal Agricultural Show at Carlisle in 1879. The standard types ranged from 7 to 14 h.p. and were fitted with corrugated fireboxes.

In this design the crankshaft was carried on three bearings, the two outer bearings being supported by what were described as "double-grip" pattern plummer blocks. Other features of the design were the feed water heater, circular crosshead guides of the trunk type and double safety valves. For 10 h.p. engines and over extension piston rods with gunmetal cases and glands were fitted. The larger engines were also supplied with a pair of platforms, ladders and rails for the convenience of the driver. Mollerup's cylinder lubricator was fitted to all engines. A footnote in one of these early catalogues states that "the engines can be fitted with Rider's automatic expansion gear in the place of the usual Pickering governor." Other and more powerful types—up to 30 nominal horse power—were also manufactured.

Designs for working model portable steam engines are almost limitless when searching back to the years preceding the 1914-18 war. Around 1904 Marshalls of Gainsborough introduced their new design of single-cylinder engine in the 2 to 12 h.p. range and a twin-cylinder portable in the 8 to 40 h.p. range. In the re-modelling of the engines the cylinders were steam jacketed, felted and encased with sheet iron cleading. The

Fig. 1: *Details and dimensions of the boiler plates*



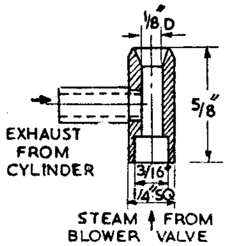


Fig. 2: Blast pipe and nozzle dimensions

exhaust steam served to heat the feed water to the boiler. The cylinders were made with the outer barrel and valve chest in one casting, the inner liner or working barrel being cast separately and made a force fit into the main casting, thus forming the jacketed cylinder.

THE BOILER

Live steam from the boiler passes through the jacketed space to the valve chest. In engines of the 3 to 7 h.p. class the cylinder base flanges were extended beyond each end as well as the sides, whereas the larger units were constructed with a machined base mounted on steel girders. This girder was riveted to the boiler shell and a stay rod was fixed between the cylinder and the sliding crankshaft carriage.

This class of engine could also be supplied with link motion reversing gear, automatic expansion gear or with an enlarged firebox if required for colonial use.

So extensive is the subject of traction engines—one which might well be found equal to that of the steam railway locomotive—that for the model engineer there is every inducement to make a study of and to work upon models of kindred types of engines; namely, portable and semi-portable engines, "locomobiles," over and undertype engines, not forgetting the wide range of road locomotive types themselves. The notes above have been written for the reader with these considerations in mind.

Since the boiler is so much a part of the traction engine chassis further notes on its construction are appended especially for the beginner. At the outset it will prove an advantage if a limited number of castings are used in construction provided they are a good quality gunmetal cast to the appropriate BSS. Many of the features of the full-size engine are reproduced, but different methods of construction are involved. Emphasis has been given in the past to the fact that in no case should brazing be attempted by an amateur possessing very limited workshop equipment.

The inner firebox is hard soldered. The two flanged endplates should be riveted together to form a close-fitting joint and the seams silver soldered. A casting is indicated for the throatplate as this item may prove somewhat difficult if fabricated out of annealed sheet copper. In that case the outer wrapper is secured to it with 7 BA screws at about ⅜ in. pitch. The rear firebox tubeplate is also flanged, riveted and silver soldered, but the front tubeplate can be a turned gunmetal casting. The boiler is then generally caulked by tinning and sweating with a good quality solder such as grade B to BSS No 219 which has a melting point of 385 deg. F. For the screwed stays and screws generally a bronze rod or hard-drawn copper should be used.

The throatplate casting is mounted on the faceplate of the lathe and the ringed portion for the barrel turned and made a good interference fit for the latter. By heating the end of the copper tube it may even be expanded on to the ring in order to obtain a close fit on cooling. Separate views of the various boiler plates are shown in Fig. 1.

THE SMOKEBOX

The smokebox barrel is a continuation of the boiler and is of such a size internally as to permit the fitting of the exhaust steam pipe and connection for the blower only. The door ring is a machined casting of either gunmetal or cast iron which should be a good fit inside the tube. When clamped in position the door must make a sound air-tight seal since any leakage here will reduce the smokebox vacuum and consequently the overall efficiency of the engine as a power unit.

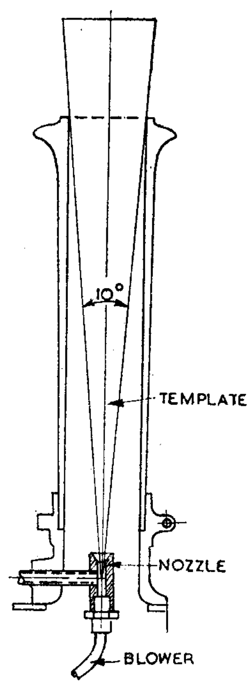


Fig. 3: Greenly's method of locating the blast pipe

Some attention must now be devoted to the essential features of smokebox design—in addition to the importance of a well fitting door—which will ensure an efficient blast of exhaust steam and furnace gases up the chimney in order to create the necessary vacuum. Faults in the raising and maintenance of steam in a model locomotive can often be traced direct to the smokebox although there may be other drawbacks undiscovered and attendant upon the mechanism itself. Here the road locomotive is no less vulnerable than its first cousin of the iron way.

The story has often been recounted of a driver of a train who was puzzled as to the cause of a sudden falling off in steam pressure. The engine had previously been driven that same day with little or no trouble in the matter of steam, but it so happened that at the last station the locomotive had been inspected by local running shed staff. Immediately upon recalling the incident as his train struggled along its journey with inadequate steam, the driver decided to stop and investigate the trouble. It was as he suspected; the smokebox door although shut had not been properly locked. He found that the spear end of the central fastening was not in position in the crossbar and so the handwheel had had no tightening effect on the door. Hence there was not enough vacuum in the smokebox to draw the fire; not enough steam pressure to provide an efficient blast for inducing that vacuum; a fire too dull to make enough steam. In a matter of seconds the fault was rectified and by judicious handling of his charge, steam pressure was made up to normal as the journey proceeded.

HISTORICAL NOTE

In the case of a model traction engine that will not steam it is as well to make a close examination of the setting of the blast pipe. Unlike the conditions obtaining in the smokebox of a railway locomotive, the blast pipe of a traction engine, with its comparatively small boiler and tall chimney, is located at the base of the stack and not in the smokebox proper. There is, in fact, a direct relationship of blast orifice to chimney in full-size practice which can be used effectively in the setting out of the model.

A brief reference to the history of the blast pipe is appropriate here as it was William Nicholson of Soho Square (not above 200 yards from the ME offices) who, in 1806, obtained a British patent for his "steam blasting apparatus." It has been claimed that William Hedley of Wylam, Northumberland, was the first engineer to turn the exhaust pipe up the chimney and contract its end in order to intensify the draught through the fire and tubes. He did in fact build a locomotive in 1813 with such an apparatus which earned for the engine the now famous sobriquet, *Puffing Billy*.

However, a year before Nicholson's patent, Richard Trevithick had already carried out experiments on one of his locomotives at Merthyr Tydfil, South Wales, and a contemporary report states that "while the engine moved at the rate of a few strokes in a minute, all agreed in declaring that the fire brightened each time the steam obtained admission to the chimney."

Yet it was not until a quarter of a century later that it is alleged that alterations were made to the *Rocket* prior to the Rainhill trials of 1829. Indeed George Stephenson had reached the conclusion that Timothy Hackworth's engine *Sanspariel* (which eventually broke down) with its exhaust pipe inside of the chimney was an excellent steamer. Following hard upon these historic trials it would appear that the device soon became more widely known. By the 1850s the blast pipe as it is generally known today was well established and in general use.

EXHAUST ORIFICE

A critical dimension in steam production is the diameter of the exhaust orifice. Given a correct size of nozzle it should be unnecessary to use the secondary blower once the engine is in motion. The purpose of the blower is simply for steam-raising or for making up pressure of steam in the boiler. It should, therefore, be shut off as soon as the regulator is opened. Small models work better with a somewhat sharper blast at the orifice, whereas larger engines will work quite satisfactorily with a softer blast.

There is a relationship between the size of the blast orifice and that of the cylinder bore. For the 1 in. scale model fitted with an $\frac{11}{16}$ in. bore cylinder, the minimum size of nozzle recommended is 3/32 in. In general terms it should not be overlooked that the natural draught induced in the chimney serves a useful purpose although the efficiency is very low for a model, probably not more than 8 per cent.

Having determined the blast orifice the next operation is to align the blast pipe and nozzle with the centre line of the chimney (Fig. 2).

It is essential that the jet should be concentric with the chimney opening. To determine the correct height in relation to the chimney, the method as devised by H. Greenly many years ago can be adopted and is shown in the diagram (Fig. 3). The template is cut from a sheet of brass or aluminium. The nozzle will be at the correct height when the edge of the template resting in the orifice fits exactly across the top of the chimney.

BLAST PIPE

While there is little to go wrong in the setting out of a simple blast pipe arrangement for a small model, the subject is one of considerable interest in large scale and also full-size practice.

Considerable research has been undertaken in the past, the main object of which was to raise the efficiency of the locomotive-type boiler, and to do this it is necessary to examine all parts of the equipment that make up a boiler.

THE CHIMNEY

The chimney is built up of a length of brass tube and two castings. The tube is 1 in. o.d. with $\frac{1}{8}$ in. or 10 gauge (0.128 in.) thick wall. It should be long enough for setting up in the lathe so that it can be turned down to the dimensions shown in Fig. 4. One of the operations involves the turning of a very gentle taper, no more than 1 in 38 inclusive or 0.32 in. per foot and, plugs having been made and fitted into the ends of the tube, it can be turned between centres, the tailstock being offset 0.05 in. for this purpose. (Note that this does not conform to any of the standard tapers.)

The base of the chimney is a simple casting, but it does not conform exactly to the Davey Paxman type of fitment; it is more in accord with that of the Fowler general purpose machine.

The setting out of the blast pipe and nozzle and its correct position in the base of the chimney has already received some attention, but I have not dealt with the assembly of the unit. It is quite evident that the exhaust passage at the front end of the cylinder casting must be in alignment with the hole in the side of the chimney casting. The short length of $\frac{1}{4}$ in. o.d. copper pipe is screwed into the exhaust passage at the front end of the cylinder block. The cast chimney base can now be fitted in position by sliding it longitudinally over the smokebox to engage the exhaust pipe to a depth of $\frac{1}{8}$ in. Before assembling it, however, the

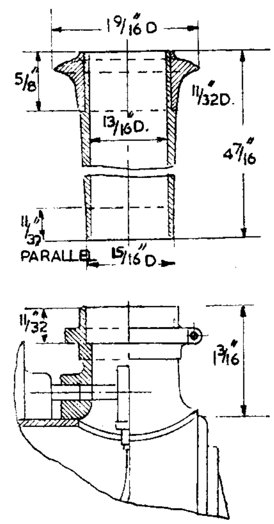


Fig. 4: Dimensions of the chimney

exhaust nozzle together with its short length of pipe must also be fitted in position inside otherwise it will be impossible to fit the nozzle afterwards. This length of pipe is fitted from the inside, the blower steam pipe being connected to the base of the nozzle.

Before leaving the subject of smokebox arrangements attention should be drawn to the fact that in the closing years of the steam traction engine there was a tendency for designers to make the smokebox longer. While some people considered this to detract from the neat and compact appearance of the engine, it was soon established in practice that spark emission from the chimney was being effectively reduced.

● *To be continued*

Pocket-size novelty

HERO OF ALEXANDRIA built some 2,000 years ago a fountain which mystified those who saw it in operation. A small quantity of water is poured into its basin and immediately a jet, almost equal in height to the fountain itself, is thrown in the air and continues for some minute and a half. Constructional details of this pocket-size novelty appear in the May issue of *Home Mechanics*, on sale tomorrow at all bookstalls, price 1s. 3d., or from Sales Dept, Percival Marshall, 19-20 Noel Street, London W1, 1s. 7d. including postage.

ALIGNMENT IN GEARING

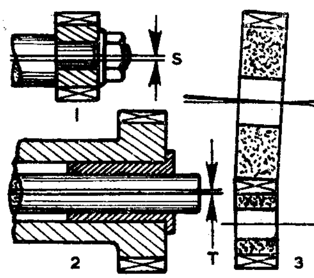
WORKSHOP HINTS AND TIPS

By GEOMETER

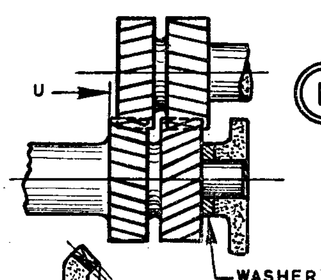
SHAFTS driven one from another by gearing may be disposed parallel, at an angle or crosswise—according to the type of gearing employed—and satisfactory operation can often depend as much on alignment of the gears on the shafts, as on the spacing of these or on precision in the gear teeth profiles.

In theory, a pair of gears runs with its "pitch circles" rolling together in contact, part of each tooth being above the pitch circle and part below; and spacing or centre distance of the shafts is equal to the radii of the two pitch circles. Anything resulting in marked divergence from that spacing is likely with good-class gearing to cause noisy or jerky operation.

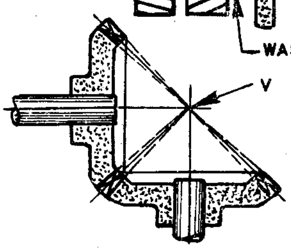
Thus, in the case of change gears on the quadrant of a screwcutting lathe, it is necessary for them to be set just right—neither too deep, or they will be stiff and harsh, nor too shallow or they will be loose and noisy. Where centres of gear shafts are not adjustable like that, but "fixed" by the bores of brackets or casings, divergence may still occur from wear of shafts, bushes or ball races.



A



B



C

With a ball race, a scarred ball or locally-worn area on the outer (fixed) track, can cause intermittent noise, and to discover such a fault the race must be cleaned of oil and carefully tested.

Assuming there is no fault in the gears or in the spacing of the shafts, there are two circumstances in which eccentricity can occur, as at *A*1 and 2. Where a gear is mounted on a stub or spigot on a shaft, this must be concentric with the shaft or the gear will run eccentrically *S*. Where a gear (or cluster of them, as on a car layshaft) is hollow to turn on a fixed shaft it is important for any bush to be of uniform wall thickness, avoiding eccentricity *T* and varying mesh.

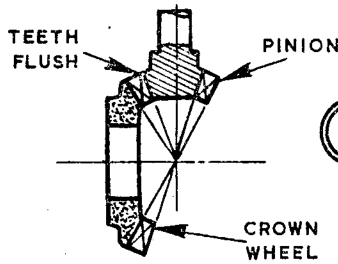
To a smaller extent mesh can vary where a gear is wobbling in relation to the shaft, when in the course of each revolution it will take on an angular attitude *A*3. Such a fault may be due to an error in the facing of the boss of the gear or the face of a flange against which it is mounted. Testing to a fixed pointer (or dial indicator) reveals this fault—and likewise the other two.

In situations like car gearboxes, where on occasion gears with double helical teeth may be used, ordinary sideways alignment can be very important for smooth, quiet operation. Owing to clearances on the teeth a pair of such gears, as at *B*, can be pushed sideways slightly giving an overlap *U*. The thickness of any washer which is fitted must not, however, be so great as to cause malalignment, but only sufficient to keep the faces of the gears in line.

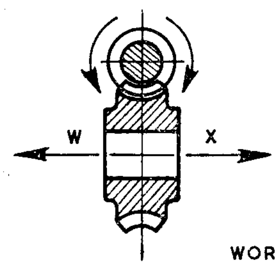
With bevel gears, pitch circles become pitch cones, the apex of each lying on a point, as at *C*, *V*. If one gear is drawn back and the other pushed forward, running clearance may be the same as when the gears are correctly positioned. But the pitch cones will be out of alignment and contact will not occur over the whole length of teeth, so noise and wear may be increased.

In a first test, as at *D*, on a pinion and crown wheel, the teeth may be flush one side, but a final check should be made with marking blue or red lead and oil on the teeth and revolving the gears together.

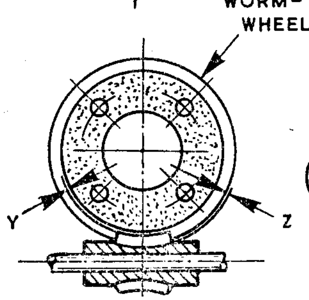
In worm gearing with a straight worm, positioning of this may not be vital; but the worm wheel must be properly centred for clearance on the worm. As at *E* clockwise rotation of this causes thrust in direction *W* while



D



E



F

anti-clockwise rotation causes thrust in direction *X*. Incorrect centring or too much play can cause binding in one direction.

Where the worm is a "waisted" or enclosing type, as at *F*, its positioning is important to maintain clearances *Y* and *Z* on the worm wheel. ■

This instalment continues with the main deck fittings and includes the ladders, windlass and the deckhouses

CUTTY SARK

By Edward Bowness

Continued from 3 April 1958, pages 416 to 418

I BROKE off last month in the description of the cargo winches. To continue, then, with the details of these fittings, if a tiny wheel from a watch can be found to represent the big wheel on the lower spindle well and good, but if not a disc 5/32 in. dia. should be cut and threaded on. After assembling the long drums between the frames, the short ones should be threaded on, leaving a short length of wire projecting at each end of the upper spindle to receive the handles.

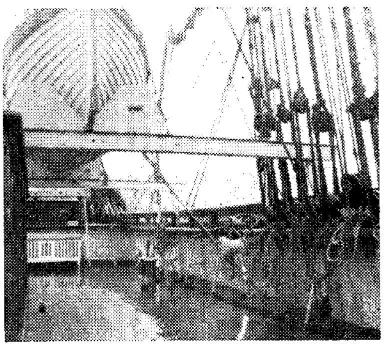
In the winch at the foremast the two cable lifters which are shown in the drawing (Fig. 20) should be threaded on the lower shaft between the frames and the outer drums. This calls for a longer shaft, which must be kept in mind when cutting off the wire. One of the cable lifters is seen in the picture of the winch at the foremast (3 April, page 416).

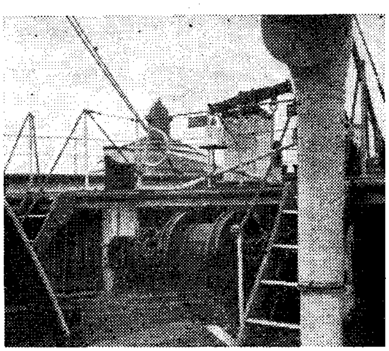
The anchor cable is to be seen passing over the cable lifter and down through the spurling pipe to the chain locker below. These cables pass forward over the fore hatch, around the barrel of the windlass, under the fo'c'sle head to the hawse pipes, and thence to be shackled on to the anchors.

The illustrations also show clearly the rectangular pillars supporting the forward fife rail, each with three sheaves for certain items of the rigging fitted at their lower ends.

In restoring *Cutty Sark* the windlass, which she had carried for many years, was removed and a replica of the older type windlass, which was used during her first years, was fitted. The one which was removed was of a newer type, driven from the capstan through gearing, whereas the one which replaces it is of the old up-and-down type. In this the drum is rotated by a ratchet, the pawls for which are moved up and down by rods from a horizontal lever on the fo'c'sle head. This lever has cross handles which are operated by a number of men on each.

There are two ratchet wheels on the drum and two vertical rods with pawls which are coupled one on each side of the fulcrum of the horizontal lever. Between the two ratchet wheels is a third with its teeth set the same way as in the other two. Two or three pawls are provided for this ratchet, which fall into engagement by their own weight and prevent the windlass running backwards.





Top: Break of fo'c'sle showing windlass. Above: Break of poop, showing hen coop, the rail winch and bollards

A stout post is built into the ship just forward of the windlass—in smaller vessels this would be the samson post—and the retaining pawls are pivoted in this. The horizontal lever is pivoted on the top of this post, the rocker being provided with sockets into which the handles are fitted.

The photograph in this issue shows these details very clearly. When not in use the handles are lashed crosswise inside the rail just aft of the post. As will be seen, the ship's bell is mounted on this post. One of the mooring posts, which are at each end of the windlass, is also shown. The bearings for the spindle of the windlass are carried on the after sides of these posts.

The booby hatch, referred to in the previous instalment, is also shown in this photograph. In the foreground will be seen a sloping cover over the anchor cable as it passes aft from the windlass. This is provided so that visitors to the ship will not trip over the cable, and should not be included in the model.

MODELLING THE WINDLASS

In modelling the windlass at $\frac{1}{16}$ in. scale it is impossible to do more than suggest the main features. The samson post, or the post which carries the lever, should be fitted in place, first cutting a square hole in the fo'c'sle deck and a circular hole in the main deck below to take it. It is 7/64 in. square × $\frac{1}{2}$ in. long and should project 7/32 in. above the fo'c'sle head. The lower end should be rounded to fit a corresponding hole in the main deck.

The mooring posts, which are 7/64 in. × 3/64 in. × 11/32 in. long, should next be glued in position, using the holes already cut in the fo'c'sle head. At the lower end the point broken off a needle should be inserted, after which the post can be pressed down on to the main deck. A notch should be cut in the after side of each post, $\frac{1}{8}$ in. from the lower end, to receive the spindle of the windlass barrel.

The windlass barrel could be turned from brass rod, but as it is so small and should be marked to represent the teeth of the ratchet, it would be better to make it by wrapping a strip of gummed paper $\frac{1}{2}$ in. wide around a piece of 20-gauge wire $\frac{5}{8}$ in. long, until it is about $\frac{1}{8}$ in. dia. Additional strips about $\frac{1}{16}$ in. wide should then be wound on about one third of the way along from each end until the ridges thus formed are almost $\frac{3}{16}$ in. dia. Thin paper should be used, preferably dark brown, as the barrel itself is dark in colour.

If lines are drawn on the raised diameters and on the portion between

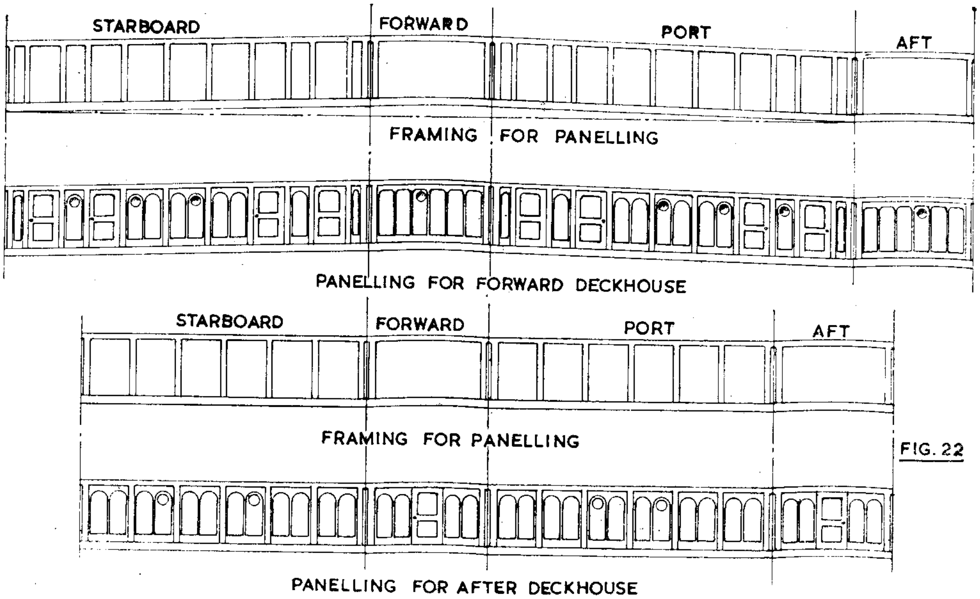


FIG. 22

them to represent the teeth of the ratchet it will add greatly to the realism of the fitting. These lines are shown in the deck plan Fig. 20 and should be done in Indian ink with a fine mapping pen. The whelps on the drums at each end of the windlass barrel could be ignored, as the anchor cable will cover them when it is in position.

Before putting the barrel in position the space under the fo'c'sle head should be painted a dark colour to give the effect of darkness as a background for the windlass.

The anchor cables should now receive attention. For these two lengths of chain should be procured each about 2 in. long having links $\frac{1}{16}$ in. or slightly less in length. The forward ends of these should be pinned to the vertical wall under the fo'c'sle head on each side of the samson post. To do this put a panel pin through the end link and, holding it in a pair of tweezers, push it in the end grain of the wood. A blob of adhesive on each will prevent their coming away later.

Now wind the cables once around the end drums of the barrel and, holding the cables in one hand, with the other twist the barrel so that it rolls forward until the ends meet the mooring posts. Glue the ends into the notches provided, and over them glue a tiny strip of card to represent the caps of the bearings and to hold the barrel firmly in place.

When the glue has set the cables should be led aft, over the fore hatch, over the cable lifters on the winch at the foremast, and down to the spurling pipes. These could be tiny blocks of plastic, suitably shaped, glued to the deck and with a hole in their vertical faces into which the cable is pushed and glued after having been cut off to the correct length. These are seen in the deck plan and elevation Fig. 20 in which the anchor cables are shown by dotted lines.

The blocks for the seamen's lavatories, or the heads which is the usual name for them, have already been fitted but they still require covering—the sides with paper and the roof with Bristol board. The panelling on the sides, which should be drawn on the paper in Indian ink, is shown in the photograph in the issue for March 20 and that for the door is shown in Fig. 20.

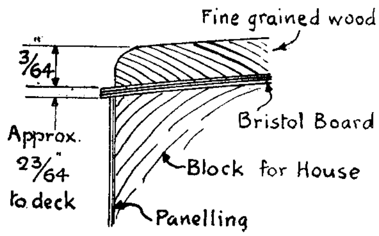


FIG. 23

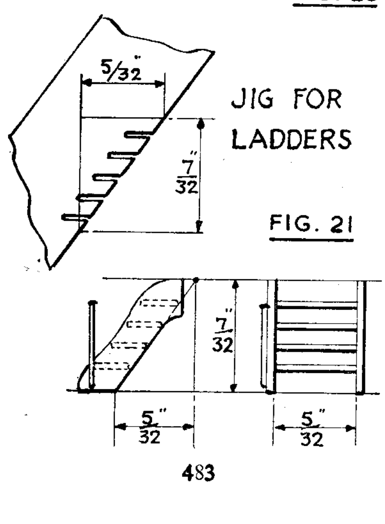


FIG. 21

The roof should overhang slightly on the front and sides. On the starboard head, a rack for eight capstan bars has been fitted. The hand pump on the side of the port head will be seen in the photograph.

The hen coops are situated at the break of the poop on each side of the mizen mast. They are approximately 8 ft long × 2 ft wide × 3 ft high. Their general appearance will be seen in the accompanying photograph, from which it will be seen that the floor is raised almost a foot above the deck and that the front is slatted and has a hinged door.

This could be drawn on paper and pasted on, using the black lines to represent the openings and leaving the white for the framing. The photograph shows also one of the rail winches and a pair of bollards. The boat skids and the chocks for the boats may also be seen. These will be dealt with later.

COMPANION LADDERS

The companion ladders from the poop and fo'c'sle head should be made and fitted at this stage. The height in each case is the same, being approximately 3 ft 6 in. or 7/32 in. in the model. In accordance with the spirit of the period the sides are slightly curved, as will be seen in the photograph in this issue and in Fig. 21.

As all four are alike it is advisable to make a simple jig for spacing the steps. Take a piece of wood $\frac{1}{8}$ in. thick × about $\frac{3}{8}$ in. wide and on one side mark out a triangle to the dimensions given in Fig. 21. This gives the correct angle for the steps. Cut five notches in one edge, making them parallel to the horizontal line and $\frac{1}{16}$ in. deep. To ensure equal spacing make five accurately spaced scores on the edge, otherwise the saw will slip on the slope and it will be difficult to space the sawcuts evenly. Use a fine fretsaw.

Cut a strip of Bristol board for the steps, $\frac{1}{16}$ in. wide, and cut off four pieces 5/32 in. long and one 7/32 in. Glue the long strip in the uppermost notch with the ends projecting equally and place the others in the four lower notches. Take a pair of sides, which have been shaped as shown on the drawing, give the inner sides a liberal coat of adhesive and lay them on the ends of the steps on each side of the jig, locating them against the ends of the longer strip.

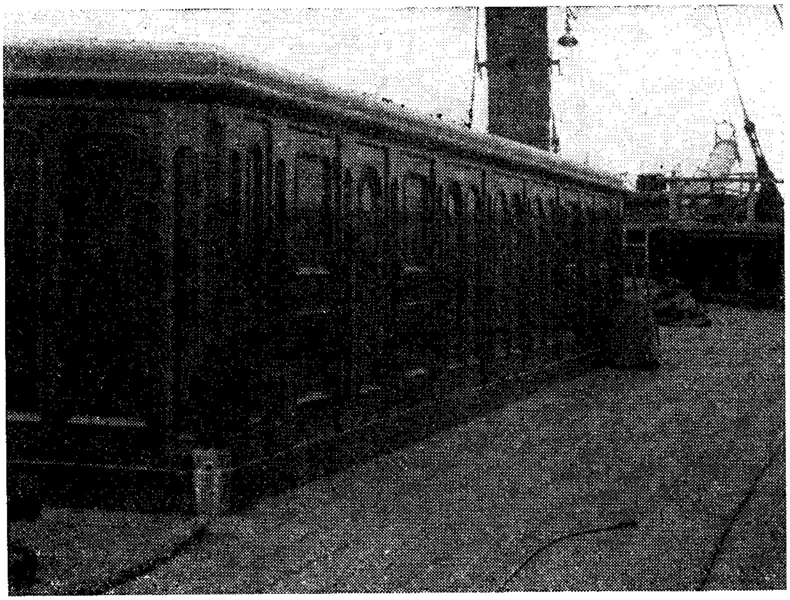
Hold them in position until the adhesive has set, when they can be removed complete with the steps and fitted in their respective positions on the model. Before doing so, however, a piece of wire 5/32 in. long should be glued on the side as shown; on both sides for the fo'c'sle ladders and on the inner side only for the poop.

DECKHOUSES

As originally designed I understand *Cutty Sark* had only one deckhouse, the one just aft of the foremast. She is shown thus in Rennie's sail plan and in Tudgay's famous painting of the ship.

This painting was the property of her owner, John Willis, and was his favourite painting of the ship. It is now on the ship in the 'tween decks and well repays close examination for its wonderful detail. One deckhouse was usual at that time, and this probably accounts for the crew accommodation in the bows with four portholes on each side which were provided. However, it was not long before the additional house was built, and in the restoration it was included.

The forward deckhouse is divided into three apartments, the forward and larger space, which is about 20 ft long, being furnished with 12 bunks and a mess table for the crew. The next is a narrow space with a door at each end and no portholes and was, I believe, the carpenter's shop. Possibly he found that most of his work was about the ship rather than in his workshop. The after space was the galley with the stove on its forward bulkhead and a table across the after side.



Starboard side of forward deckhouse

The galley chimney appears just aft of the transom of the boat stored on the roof. If the model is fitted with sails the galley chimney should be kept short, but if not it could be longer as an extension piece would be fitted when the ship was in port or at anchor. The photograph of the forward deckhouse, taken during the restoration of the ship, gives a good idea of its external appearance and of the style of the panelling.

The after deckhouse is divided into two, the forward space, which is 10 or 11 ft long, accommodating the "idlers" as they were disrespectfully called because they did not have to stand their four hours watch as did the others. These were the bo'sun, the sailmaker, the carpenter and the cook. The after portion was the halfdeck for the apprentices, and contained eight bunks.

The forward house had three doors on each side whereas the after house had one at each end. During much of the working life of the ship the panels on the deckhouses were painted white, but in Tudgay's painting the deckhouse is dark brown, presumably varnished teak, which is the condition in which they are today.

MODELLING THE DECKHOUSES

At our small scale of $\frac{1}{16}$ in. it is hardly practicable to show the panelling in accurate detail, and I consider the panels could well be simplified to that shown in the drawing Fig. 22. First make solid wooden blocks $1\frac{7}{8}$ in. × $\frac{5}{8}$ in. × $\frac{3}{8}$ in. for the forward house and 1 15/32 in. × $\frac{5}{8}$ in. × $\frac{3}{8}$ in. for the after house. They should be squared and the underside hollowed out to suit the camber of the deck. The top should be cambered similarly.

In squaring the blocks remember that the base and roof of the forward house slope upwards in line with the sheer of the deck, whereas the ends are upright. The after house is practically square all over, as the deck is more or less horizontal where this house is situated. The upright corners should be rounded off slightly, not more than $\frac{1}{16}$ in radius.

The sides of the blocks should then be covered with a strip of good quality, but thin, bond paper such as is used for business letters. The strip should be slightly wider than the wooden block so that the edges can be trimmed off neatly after the adhesive has set. This is especially necessary for the forward house owing to the angle of the ends. The strip should be butt-jointed on one of the sides with the joint so arranged as to be under one of the uprights of the panelling.

For each house the framing should be cut in four pieces, two for the ends and two for the sides. It must be of two-ply Bristol board and should show only the large rectangular openings formed by the pillars, the lintels for the doorways and the upper strip, and the deep strip along the bottom. In the forward house the pillars will appear to lean forward on the starboard side owing to the slope of the floor.

● *To be continued*

Nameplates and numberplates for models

Our Australian contributor, well known for his articles on sub-miniature working steam locomotives, gives a few hints on a current problem

By A. A. SHERWOOD

THIS article will, I hope, be of interest to those who prefer to do the whole of the work on their models themselves, but still like to finish the job off in a " professional " manner.

My method of production is rather time-consuming, but requires no special equipment beyond a vertical slide if, as in most cases, the lathe is the only machine tool available. Fortunate owners of vertical milling machines, will find this tool much more convenient for the purpose. I use a small all-purpose spindle, driven by an old vacuum cleaner motor, clamped vertically on the lathe cross slide.

The need for a nameplate for a small locomotive recently turned my attention to the problem. In this case the letters required were 0.08 in. high, and the cutter was necessarily very small. Since most modellers work in bigger scales than I do, the cutters required will normally be of reasonable sizes.

Principles

The usual engraving machine copies a master form and simultaneously reduces the size of the letter. This method is a generating operation and requires no master forms, so the user is not restricted to conventional forms of lettering and numbering.

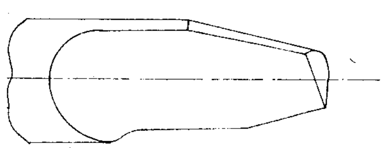
With sufficient patience, a nameplate in Chinese could be made by this method. The generation of letter forms is achieved by locating a series of points on the curve or straight line of each letter. If these points are close enough, the recesses formed by the cutter will merge together and the " scalloped edge " will not be noticeable to the naked eye (Fig. 1).

In the case of lines which are horizontal or vertical, the slide traverse can be used as in ordinary end milling, making the " spotting " process unnecessary.

The technique I adopted is as follows:

First, each letter is drawn out on graph paper to a very large scale; for the case mentioned in the first paragraph, letters 8 in. high were drawn on 1/10 in. square paper, every division on the paper, therefore, representing one thousandth of an inch on the final product. The centre line of each stroke of the letter is then drawn in, and the *X* and *Y* co-ordinates of selected points marked in (see Fig. 1).

Some trial and error may be needed in the selection of the points; for the 0.08 in. letters it was found that provided they were spaced at not



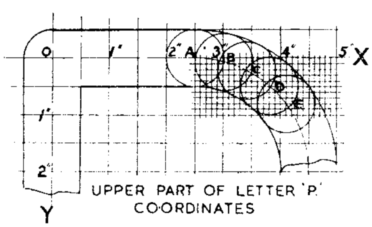
more than half the thickness of the strokes of the letter apart, the final appearance was satisfactory. The spacing in any given case depends—like beauty—on the eye of the beholder.

The cutters I used are based on those employed in the commercial engraving machines, and consist of single point end mills (Fig. 2). Old dental burrs can be ground into the required form and seem to be able to retain their edge very well, even when used on cast steel. For larger work ordinary slot drills may be used.

The actual cutting of the letters is performed by setting the *X* and *Y* co-ordinates for each point on the micrometer collars of the slides, and cutting straight into the required depth. If the final plates are required with sunk letters, the process is then complete.

Plates with raised letters, representative of the brass cast plates in full size practice, may be made by cutting a die with sunk letters in reverse, then hardening the die and forcing the impression into annealed brass. For very small plates the die may be pressed into fairly thick metal, using a heavy bench vice; for larger cases the force required for the impression is likely to be excessive.

An alternative in this case is to press the die into very thin annealed brass plate supported on lead sheet. It is worth noting that only one die is needed for many copies of the name-



UPPER PART OF LETTER 'P' CO-ORDINATES

Point	X	Y
0	0	0
A	0.02	0
B	0.030 in.	0.001 in.
C	0.034 in.	0.002 in.
D	0.038 in.	0.005 in.
E	0.041 in.	0.008 in.

plate. At least two plates are needed for most models, so it is quicker and easier to make close copies of the normal cast brass plates than to make two (or more) plates with sunk letters. ▣

LOCOMOTIVES I HAVE KNOWN

The 105 engines of this well-known class were built between March, 1897 and November, 1911; they were Dugald Drummond's standard design for LSWR suburban work, and were obviously derived from the very similar engines he had built for the North British and Caledonian Railways some years before.

I have always felt that these M7s have never attracted the widespread interest they deserve, though they are very popular with Southern Region enthusiasts. Without question, they must be placed among the best engines of their type, and I have no hesitation in claiming them as masterpieces. After all, their construction was in progress for more than 13 years; a long enough time in which to have designed and built a better type, had it been desirable; but basically, the last one built was the same as the first one, so there was obviously no need to make any alterations, except in very minor details.

The first three, Nos 242, 243 and 244, were completed at the Nine Elms works in March, 1897, and it is of interest to recall that No 244 was the 500th engine to be built at Nine Elms.

The class can be divided into two lots, the first of which consisted of 55 engines, all built at Nine Elms and finished by October, 1900. The second lot was made up of 40 engines built at Nine Elms between February, 1903 and March, 1906 and ten completed at Eastleigh by November, 1911.

This second lot differed from the first in having their total length increased from 35 ft 0¼ in. to 36 ft 3¼ in., the whole of the increase being in the leading overhang; also, the second lot were fitted with feed-water heaters in the side tanks.

These engines were the first to be designed by Drummond for the LSWR, and were not very popular when new, as Drummond placed the driver on the left-hand side of the footplate and so reversed a position that had been standard practice on the LSWR for 45 years. When the men eventually got used to the change, the M7 class became very popular and settled down to good steady work on suburban services for upwards of 40 years; the fact that so many of the class are still in service is its own testimony to the quality of the engines.

Some of the engines were to be found at almost every shed on the LSWR. In the Plymouth area, a few of them were employed for a while on secondary express passenger trains; but an accident at Tavistock, where one of these engines became derailed at speed while working an express train from Exeter to Plymouth, caused their relegation to local traffic, and a few were sent to Barnstaple to be tried out on the truly formidable Ilfracombe branch.

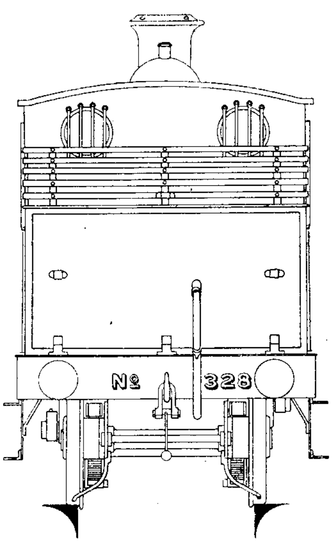
The line from Barnstaple to Ilfracombe abounds in sharp curves and some terrific gradients. The M7s did so well on this line that some of them were employed on it for many years. To be in a train of three corridor coaches behind an M7, climbing the terrific Mortehoe bank, was an experience which nobody with any love for locomotives could forget.

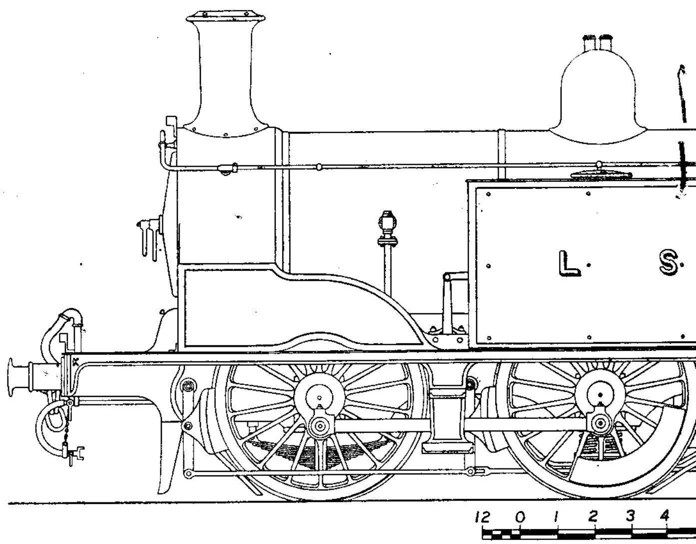
In the reverse direction, the trains were usually heavier and banking assistance was taken, because the 1 in 36 gradient at that end is entered almost immediately outside Ilfracombe station.

In whatever district they worked, it was the same story of good, steady reliability that gained the M7s popularity. And I must add that they were quietly and frequently put to work on fast, heavy outer-suburban trains; and so far as I know they never came to any harm after the Tavistock mishap.

Some of the London engines worked far afield, particularly to Reading and such places as Basingstoke, Alton,

DRUMMOND'S M
LSV





Leatherhead and Guildford; and I have even seen them at the head of semi-fast trains labelled "Portsmouth." These trains, of course, were not expresses, and stopped at the principal stations on the way; but the trip to Portsmouth and back entailed a total mileage of about 165 miles—a good day's work for a suburban tank engine, even if it *did* take about three hours each way.

On the 26 April, 1923, No 58 of this class had the unusual distinction —for a suburban engine—of working a Royal special, for she hauled the train conveying the then Duke and Duchess of York (afterwards King George VI and Queen Elizabeth) from Waterloo to Bookham on the first stage of their honeymoon.

In May, 1948, No 672 achieved distinction of a very different order, by falling down the lift shaft leading from a reception siding beside Waterloo station down to the Waterloo and City Line. Fortunately, the driver and fireman were able to jump clear before the engine plunged; but, as a result of the accident, there was no alternative but to scrap No 672 where she lay, and in this way she became the first of the class to be broken up, though she was not the first to be withdrawn.

The latter doubtful honour belonged to No 126. This engine had been rebuilt with an extended smokebox and Eastleigh superheater in 1921, and it added 2 tons 15 cwt to her total weight; nearly the whole of the increase came on the leading end. In this condition, and in spite of the addition of a heavy dragplate at the back end, the engine was unsatisfactory and was found to be too heavy for most of the suburban lines on which she was expected to work.

This episode shows that attempts to " modernise " a good design do not always bring the desired results.

The dimensions of the M7s were: Cylinders, $18\frac{1}{2}$ in. dia. × 26 in. stroke; wheel diameters, coupled 5 ft 7 in., bogie 3 ft 7 in.; wheelbase, 7 ft 6 in. plus 9 ft 7 in. plus 6 ft 6 in., total 23 ft 7 in.

The overhang in the second lot was 6 ft 7 in. in front and 2 ft 9 in. at the back. No 328 was one of the second lot, and, therefore, my drawing conforms to the dimensions just given; the engines of the first lot had a leading overhang of only 5 ft 6 in.

The boiler proportions of the M-7s were excellent and very closely followed Stroudley's practice, but on a larger scale. The two rings of the barrel were, respectively, 4 ft $5\frac{1}{8}$ in. and 4 ft 6 in. dia. outside, and the centre line was 7 ft 6 in. above rail level. The barrel length was 10 ft 6 in.; it contained 213 tubes of $1\frac{3}{4}$ in. dia. giving 1,067 sq. ft of heating surface.

With 124 sq. ft of firebox heating surface, the total amounted to the

A

SECOND SERIES

By

J. N. MASKELYNE

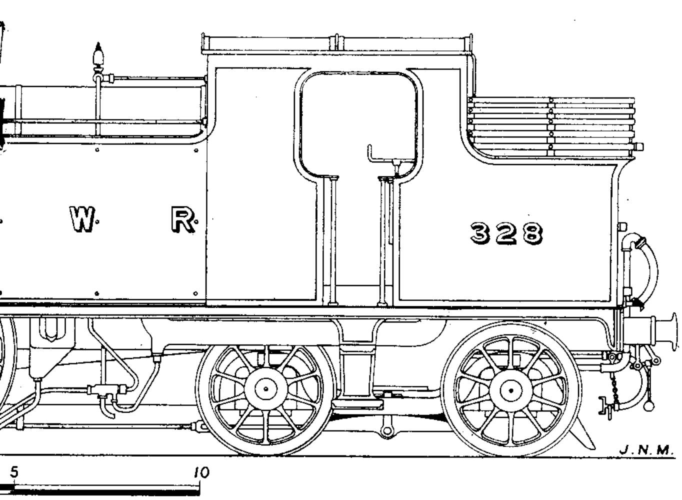
respectable figure of 1,191 sq. ft.

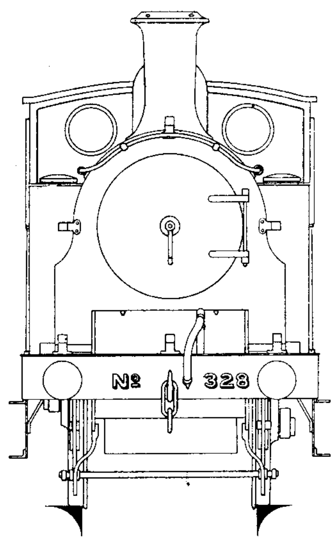
The grate area was 20.35 sq. ft, and the working pressure was 175 p.s.i., at 85 per cent. of which the tractive effort amounted to 19,750 lb. 1,300 gallons of water could be carried in the tanks, and 3 tons of coal in the bunker.

The weights, as given on the official diagrams are something of a mystery. Diagram No 29 for the first lot of M7s gives the following: on leading axle, 17 tons 8 cwt; on driving axle, 18 tons; on bogie, 24 tons 16 cwt, which adds up to 60 tons 4 cwt. Diagram 29A for the longer engines shows 17 tons 5 cwt on the leading axle, 18 tons on the driving axle and 24 tons 18 cwt on the bogie, which totals 60 tons 3 cwt. In other words, the engine with the longer and, presumably, heavier frame is 1 cwt lighter than the shorter engine. How does this come about when all the other dimensions of the two engines are alike ?

Some years ago, I put this poser to the Southern Railway's Locomotive offices at Waterloo, but nobody could supply the answer. I am still waiting for it. ■

M7 0-4-4 TANKS
WR





PANSY

LBSC's instalment this week deals with the crank axle and coupling rods of the 5 in. gauge GWR tank

Continued from 3 April 1958, pages 426 to 428

IF a 5 in. or larger self-centring chuck is available, machine up the wheel castings in the manner that I have described umpteen times already, viz. grip by tread, face back and boss, centre, drill and ream. Reverse in chuck, face rim and boss, cut rebate at edge of spokes.

Mount on an improvised faceplate, secure by nut on screwed spigot turned to fit the hole in the boss, turn the tread and flange, and finish the lot to the same diameter by taking the final cut on all six without altering the setting of the cross slide.

However, it is a different matter if the available chuck won't open its jaws wide enough to grip the wheel. In that case my pet antic was to mount the casting centrally on the faceplate, back outwards, with three bolts between the spokes, for the facing, drilling and reaming. I kept a few worn out or broken taper-shank drills which fitted the Morse taper in the lathe mandrel, and as these were standard sizes, there was always one which would fit the reamed hole in the wheel boss, and so locate it truly on the faceplate.

A wheel-centring tip

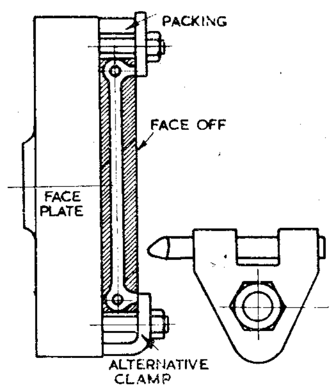
The wheel was then bolted to the faceplate with three pieces of parallel packing between the faced-off back and the faceplate, bolts between the spokes being used as before. As the bit of broken drill projecting through the hole in the boss kept the wheel central while tightening the bolts, the casting could be turned on flange, tread, rim and boss at the one setting.

Points to note are that the bits of packing should not project beyond the wheel, and the finishing cut over the tread should be taken with the " mike " collar on the cross slide screw at exactly the same reading for each wheel. Anybody whose cross slide has no collar can do the trick by bringing the handle forward to the same position for each final cut. Tip to beginners—never turn the handle backwards to set a cut; first turn it back a full revolution, then advance it to the required position.

Drill the crankpin holes by aid of a jig made from a piece of steel bar about 2 in. long with two 19/64 in. holes drilled in it at $\frac{7}{8}$ in. centres. Ease the end of a piece of $\frac{5}{8}$ in. steel rod held in the chuck, until it will just slide into the centre hole in the wheel boss without shake. Further reduce $\frac{1}{4}$ in. length to a press fit in one of the holes in the piece of bar, part off at $\frac{1}{2}$ in. from the shoulder, and press the spigot into the bar. Scribe a line down the middle of each wheel boss, cutting across the reamed centre hole. Put the peg in the hole, adjust the jig until you can see the line on the boss cutting across the hole in the jig, then clamp the jig to the wheel and put the 19/64 in. drill through the lot. Remove jig and ream the hole $\frac{5}{16}$ in.

The crankpins are a simple turning job, the spigots being turned to a press fit in the holes in the wheel bosses with the $\frac{3}{8}$ in. silver-steel rod held in the chuck. Part off at $\frac{5}{8}$ in. from the shoulder, then reverse in chuck and turn $\frac{3}{16}$ in. of the end to $\frac{1}{4}$ in. dia. For the collars, chuck a piece of $\frac{9}{16}$ in. steel rod, face, centre, drill $\frac{1}{4}$ in. and part off six $\frac{3}{16}$ in. slices.

If the three-jaw chuck is reasonably true, and the hole in the lathe mandrel will allow a $\frac{3}{4}$ in. rod to enter, the straight axles can be turned direct from $\frac{3}{4}$ in. round mild steel. If this cannot be done, turn the axles between centres from steel a little larger than $\frac{3}{4}$ in. Cut two pieces 6 in. long, centre-drill them, mount between centres, turn the middle part with a roundnose tool, and the wheel seat at the end with a knife tool, leaving it a shade over length.



ANOTHER METHOD OF MACHINING COUPLING RODS

Turn the rod end-for-end and turn the other wheel seat, leaving $4\frac{5}{8}$ in. between shoulders. The ends can be faced off to exact length in the chuck; the axle will project quite a lot, but if a fine cut is taken, the overhang will be no drawback, and it doesn't matter if the chuck is slightly out of truth for a facing job.

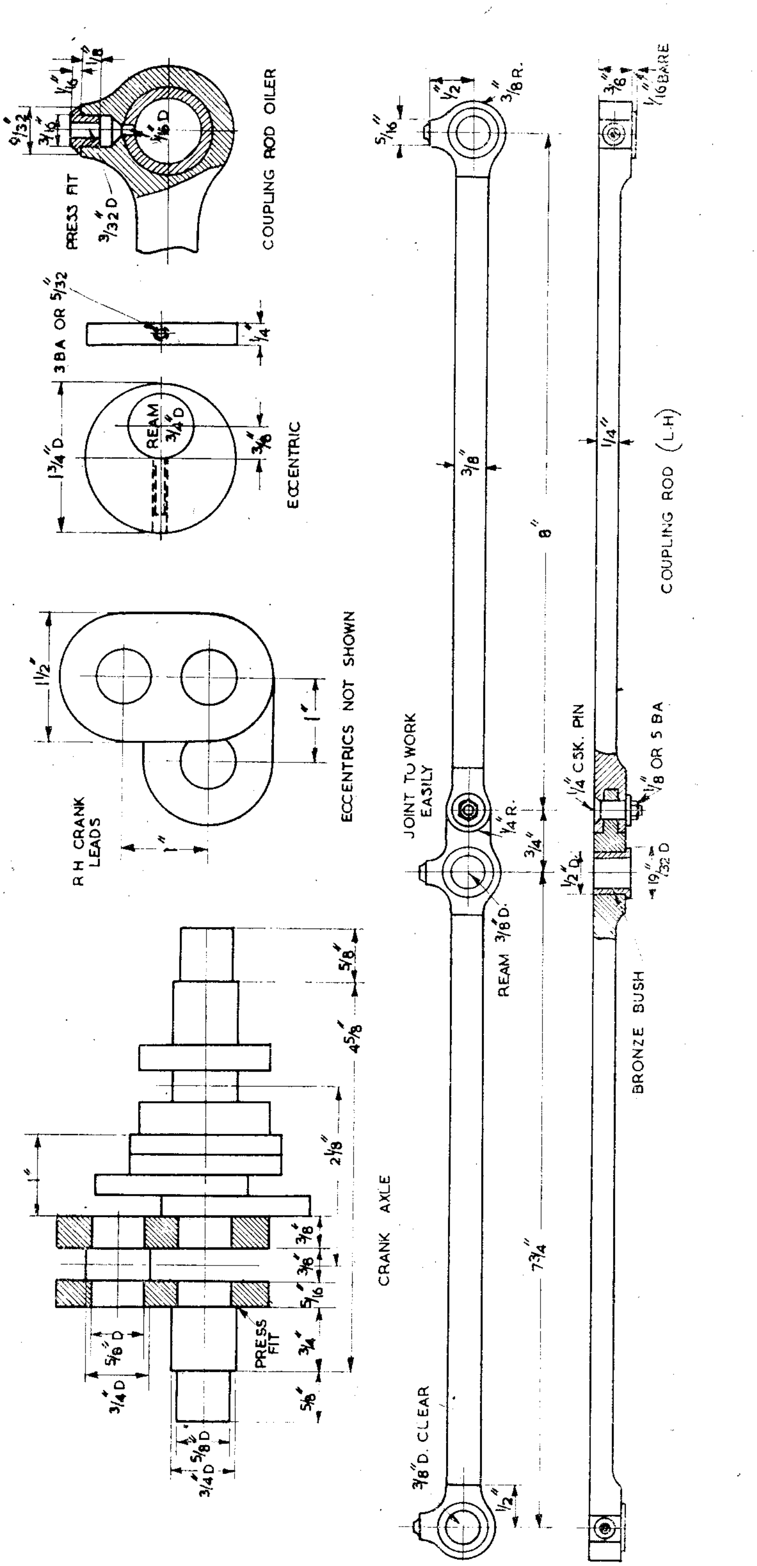
Crank axles for full-size locomotives are usually made from forgings, and for engines with link motion the eccentrics are usually made in pairs, each pair being in two halves bolted together and keyed to the axle. One of Billy Stroudley's pet tricks was to sink the boltheads below the surface and fill up the hole with white-metal. I never heard of one coming loose ! The shifting of eccentric-sheaves used to be a great source of trouble in the early days of locomotive history.

Making the crank axle

In later years certain locomotive engineers adopted the press-fit method of building up crank axles. For our small tank engine we can adopt either method, and any builder who fancies his skill as a blacksmith shouldn't find it a very difficult job to make the forging. The webs should be solid, and can be rough-slotted before turning the pins and axle.

The axle should be turned first with the forging between centres, then a plate with the crankpin centres centre-drilled in it can be attached to each end, and the crankpins turned. The eccentrics would have to be made in two halves as in the full-size jobs. The whole issue could, of course, be turned from the solid, but this would need a hefty lathe.

Personally I prefer the press-fit method, and the drawing shows a crank axle made in this way. I made *Grosvenor's* crank axle in a similar manner; the job was easy, and the result quite satisfactory. It will be noticed that the outer webs of the cranks are thinner than the inner webs, as in the full-sized engine, so two pieces of $1\frac{1}{2}$ in. × $\frac{5}{16}$ in. mild steel bar will be required, and two pieces of $1\frac{1}{2}$ in. × $\frac{3}{8}$ in. all a little over $2\frac{1}{2}$ in. long. Mark one out as shown in the end view, with the crank-



pin centres 1 in. apart; drill a $\frac{3}{16}$ in. hole at each centre, and use the drilled one as a jig to drill the others.

Open out all the holes to 39/64 in., then clamp the lot together and put a $\frac{5}{8}$ in. parallel reamer through. The holes should be perfectly round for proper press fits; if not, the crankpin and axle spigots may only be gripped in two or three places, and may soon work loose.

The ends of the webs can be rounded off by filing. Make a simple filing jig. Chuck a stub end of $1\frac{1}{2}$ in. round steel and turn down about $\frac{1}{4}$ in. of the end to a push fit in the holes in the webs. Push the peg into the hole, clamp the lot in the bench vice and file down the end of the web until level with the jig. Finish with emerycloth, or if you have a linisher, clamp all four webs together and apply each end to the emery belt, turning them over and over until the file marks have all disappeared. I do mine that way.

Tip for fitting crankpins

Each crankpin will need a piece of $\frac{3}{4}$ in. round steel $1\frac{1}{8}$ in. long. Ground silver steel is much the best for the job, but ordinary mild steel will do. If the three-jaw chuck is accurate or a $\frac{3}{4}$ in. collet is available, turn the ends to a press fit in the holes in the webs. As the webs are comparatively narrow, don't ream the end of the hole as I recommend for press-fitting wheel seats but drill and ream a $\frac{5}{8}$ in. hole in any odd bit of bar not less than $\frac{3}{8}$ in. thick. Broach the end of this to about $\frac{1}{8}$ in. depth and use it as a gauge for turning the whole lot of spigots and the wheel seats. They should just—and *only* just—enter the broached end of the hole very tightly.

If the chuck isn't true, try putting a piece of metal foil, or even paper, between the offending jaw and the pin. Alternatively use a split bush. Chuck a short bit of rod about 1 in. dia. then face the end, centre, drill through with $\frac{3}{16}$ in. drill, open out to about $\frac{5}{8}$ in. with a suitable drill, and bore just as if boring a cylinder, until a piece of $\frac{3}{4}$ in. steel will just slide in without shake.

Make a mark against No 1 jaw so that the bush can always be replaced in exactly the same position, then take it out of the chuck and slit it down one side with a thin sawblade. Scrape off any burring on the inside, replace in the chuck, put the piece of steel for the crankpin in it and tighten the chuck. The steel will then run perfectly true, no matter how much the chuck is out. Turn the ends to the dimensions shown, using the gauge.

The centre part of the axle will need a piece of the same kind of steel as the crankpins, but a full $1\frac{3}{4}$ in. long. Each end will require a piece barely

1¾ in. long. Turn a spigot ⅜ in. long on each end of the centre piece, leaving 1 in. between shoulders, and face off each end. Turn a ⅝ in. wheel seat on each of the end pieces, and a 5/16 in. spigot on the opposite ends, leaving ¾ in. between the shoulders. The whole lot must be turned to the gauge, and must be parallel or cylindrical.

If there should be any tapering of the spigots, you won't be able to get a proper press fit. Take off the arris or sharp edge of each spigot either with a file or a bevel-edge tool, to prevent the spigots scraping the holes.

Eccentrics

Before assembling the blobs and gadgets, turn up the four eccentrics, for which a piece of mild steel 1¾ in. dia. will be required. Chuck it in the three-jaw, face the end, part off a slice a full ¼ in. thick, and ditto-repeato three times. Rechuck each slice, parted side out, and face off to exactly ¼ in. in thickness. The four should make up the exact dimension of the middle part of the axle between shoulders.

The toolmarks on the side will indicate the true centre. At ⅜ in. from this, make a centrepop and chuck the disc in the four-jaw with the pop mark running truly. Run a 3/16 in. drill through first, to make a pilot hole, open out with 47/64 in. drill, and put a ¾ in. parallel reamer through. The drilling-machine can also be used for this job provided that the discs are held so that the drills and reamer go through dead square.

For jobs like these I use an old chuck as a machine vice. The disc is laid on the drilling machine table, the chuck jaws opened and placed over it, and the chuck tightened with both disc and chuck jaws resting on the table, so that the disc is gripped truly. The chuck is then turned over, and the drilling and reaming carried out in the sure knowledge that the holes will be dead square with the sides.

Make a centrepop in the edge of each disc midway between the sides and exactly opposite to the axle hole. Drill No 30 into the axle hole, open out with No 19 for about ¼ in. depth and tap the remainder 5/32 in. or 3 BA for a grubscrew. The Allen type of grubscrew (commercially obtainable) is much better than the usual slotted type; once properly tightened, they don't let go, and that is all-important in a valve gear. If home-made grubscrews are used, make them of silver steel with the business end pointed, and harden them so that they will bite into the axle and resist any tendency to slip.

A bench vice with 4 in. jaws is powerful enough to do the pressing; a piece of iron pipe can be put over the handle if extra leverage is required. The first job is easy enough. Heat up one of the thinner webs; it doesn't have to be red hot or anything near it, just hot enough to expand it a little and make the pressing easier. Press a crankpin spigot into one hole, and the spigot of one of the axle ends into the other hole from the opposite side.

Next heat up one of the thicker webs and press that on to the other spigot on the crankpin. All I do to line up the two webs, is to put a toolmaker's cramp over the outsides. If you haven't one big enough, improvise with two pieces of 1 in. × ¼ in. bar with a bolt at each end. Warning—don't forget that the crankpin spigots are of different lengths, so make sure that the shorter one is pressed into the thinner web. Once they are in, you won't be able to get them out (if at all) without a great deal of trouble, and maybe the ruin of the web.

The ceremony thus far performed is then repeated with the remaining webs, crankpin and axle end. Then before the thicker web has time to cool off, press one end of the middle part of the axle into the remaining hole. To prevent any distortion of the webs or closing of the gap between them, jam a block of steel ⅜ in. thick between the webs, opposite to the hole, so that it takes all the pressing thrust.

The final squeeze

Finally thread the four eccentric sheaves on the middle part of the axle, warm up the thick web on the other section, jam the block of steel in the gap, and press the spigot on the end of the middle part into the hole. Set the webs at right-angles by eye, right-hand leading, press just enough to hold them in place, check with a try-square, adjust if necessary and then squeeze right home. Not such a difficult job after all, is it?

It will be a "credit squeeze" all right if the axle runs truly, the credit being yours, and with average care in reaming the holes and turning the spigots, there is no earthly reason why the job shouldn't pan out OK even if it is a first shot. When the webs cool off, the whole lot will be as solid as a rock as far as axle and webs are concerned; the eccentrics should be just free enough to move stiffly for valve setting purposes later on.

Should any builder be dubious about his press-fitting, he can make assurance doubly sure, as the saying goes, by drilling No 32 holes through the thickness of each web and the crankpin spigots, and driving in pieces of ⅛ in. round steel, filing the ends flush with the webs.

On the full-size engines the coupling-rod pins in the driving wheels are set exactly opposite to the crankpins in the driving axle, and the balance-weights midway between the webs. The same arrangement is used in the little engine. Press on one of the driving wheels in that position; make sure that there is a packing block between each pair of crank webs before starting to perform the squeezing act, or you've had it. The inner and outer crankpins can be set quite well enough by sight; a degree or so out of line won't make the slightest difference to the working of the engine.

Simplest method

Many weird and wonderful devices have been described from time to time for quartering the coupled wheels of small locomotives, but personally I've never had any use for them, and just simply use a scribing block and square.

Put the second driving wheel on by sight, opposing the inner and outer crankpins as before, and press it on a tiny bit, just enough to make it stay put while you check the setting. Stand the assembly on something flat with a stop at each side to prevent it from rolling, and set the crankpin in the pressed-on wheel vertically by applying the square to it. Adjust the wheel until the edge of the blade crosses the centres of axle and crankpin.

Set the needle of the scribing-block to the centre of the axle on the other side, and adjust the wheel on the axle until the centre of the crankpin is at the same height when the needle is applied to it. What could be simpler? The wheel can then be pressed right home.

The leading and trailing wheels can be set in the same way, but before pressing the second one home, a further check can be applied which will ensure perfectly free running of the rods. Put the wheel-and-axle assemblies in the boxes, which is easily done as the boxes have separate keeps, and temporarily erect the lot in the frame. Make a pair of dummy coupling-rods, a few minutes' work. Take two strips of steel, 16-gauge will do quite well, about 18 in. long and about ⅝ in. wide.

Drill three ⅜ in. holes in each at the same centres as the axles, viz. 7¾ in. and 8¾ in. Clamp together while drilling. Put one on the crank pins of the pressed-home side of wheels, and the other on the side with the wheels not right home. If it goes on all right, and the wheels turn freely with both dummies on, the setting is OK and the pressing can be completed. If the rod won't go on, simply adjust the unpressed wheels on the axles until it does, and the wheels turn freely, and that's that!

● *To be continued*

A four-point steady

G. C. MOORE wanted a large capacity steady and he decided, therefore, to construct an accessory with four plungers

RECENTLY, two articles on the three-point steady appeared in ME; here are some notes on the construction of a four-pointer. In adopting the design described below several considerations were carefully weighed.

The resultant thrust from a tool in turning is "up and away from you." In a three-point steady there is no supporting plunger in just this direction. Hence I was led from this to the four-point type.

Secondly, my lathe is a 5 in. machine, which will pass the exceptionally large diameter of 1 in. through the mandrel. I soon found from the preliminary layout that, by starting with this large minimum diameter, I could extend the range in the other direction to as much as 3½ in. capacity. And with so large a maximum, it seemed to me that there ought to be four plungers, to reduce the likelihood of chatter.

I had this all the more in mind, because I proposed to place the plungers between frames, instead of on the outside, and this entails more than the usual overhang.

Thirdly, I meant to have the refinement of continuous lubrication, which demands free space for a drip fed lubricator at the top, a position rendered vacant by the four-point arrangement. Fourthly, a steady is a bearing, and should have a better approximation to that well-tried method of supporting a shaft than line contact on only three small-radius convex surfaces.

Fifthly, each plunger was to have a *concave* surface to present to the work, and was to be controlled by fine-screw adjustment. And last, the question of built-up steel construction, versus castings, was soon settled, since it was clear that a lower casting in one piece with an adequate foot support would form a job too large for my machining capacity, especially as I have no gap in my lathe.

It will be clear from the photographs that the side frames, cut from 6 in. × 3/16 in. b.m.s. plate, are screwed to four rectangular blocks, each housing one of the plungers. The blocks are of 1½ in. × 1 in. sections and 3 in. long; the diameter of the hole is 11/16 in., and passes right through. The 1½ in. width of these housings placed the sideplates needlessly far apart; I should have preferred a section of 1¼ in. × 1 in., but having only the other in stock, I decided to use it, knowing that I should certainly not want for lateral rigidity.

Great care was expended on the long 11/16 in. holes. Held in the four-jaw, they were first drilled through with a pilot of about ¼ in. dia. and opened up to 21/32 in. A boring tool, specially made for the purpose, was then used; it was of the maximum diameter possible, with the minimum projection of tool point, with a view to avoiding or reducing chatter.

For final finish, I relied on an expanding reamer to get the best finish on each hole, irrespective of minor variations from the set size. This was accomplished without resort to lapping. The plungers were subsequently finished to an individual fit for each hole.

The method of adjusting and locking had, of course, already received much thought. I found that, if the plungers were to be turned down and threaded, at their outer ends, they would have to be so long that the whole structure would turn out too large.

The pictures show how space was saved, by arranging the adjusting screws outside the housings, and to some extent overlapping the plungers. This necessitated slotting one side of the housing blocks, as in Fig. 1, to allow a brass fitting to be screwed to each plunger, to slide in this slot, and to engage the adjusting screw, threaded 9/32 in. × 40 t.p.i.

Each slot, which runs the greater part of the housing length, was made to serve a further purpose. On the side view picture you will see the hexagon heads of four tightening screws, near the edge of the main throughway; two of them appear just below the lubricator. When the plungers have been adjusted on to the work, these screws are used to clamp the side frames together, and hence to close the split housings on to their plungers and lock them in position; the movement required to do this is, of course, very small.

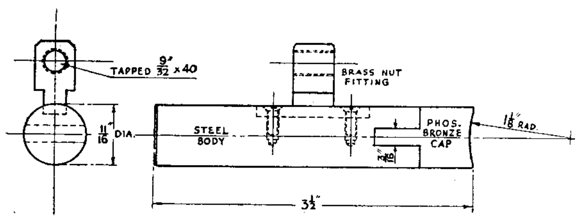


Fig. 2: Dimensioned drawing of one of the plungers

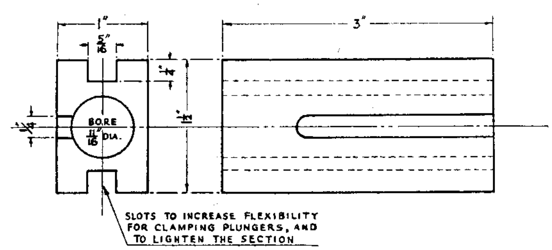
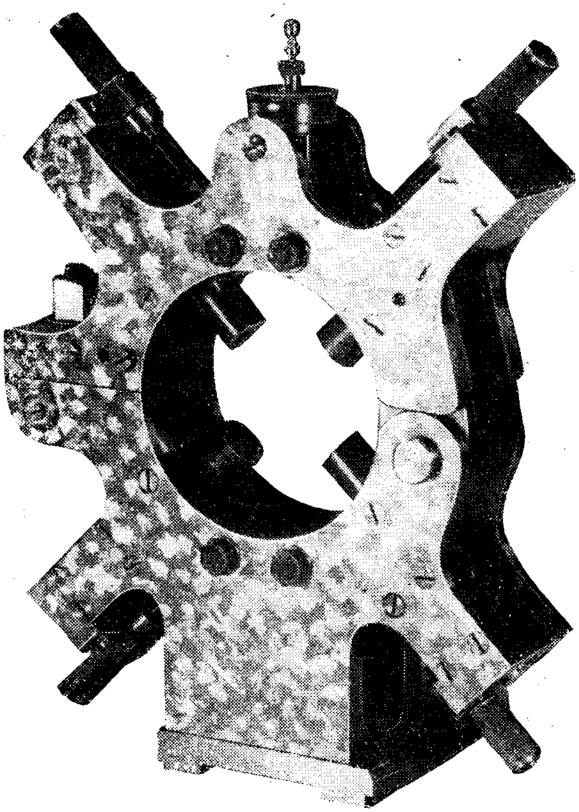


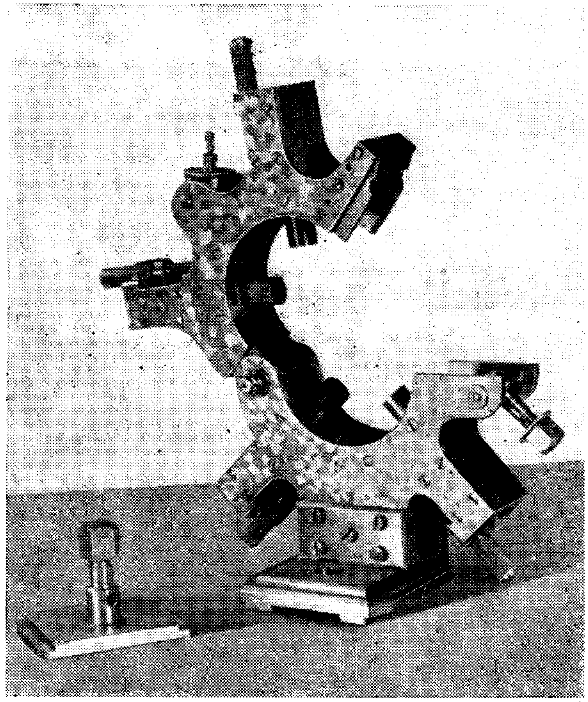
Fig. 1: Details of the housing block

Fig. 2 shows one of the plungers. Its steel body has a cross slot 3/16 in. wide, milled at the forward end, to receive the tongue of a phosphor bronze insert or cap, which was brazed in place on ¾ in. dia. stock, in preparation for reduction to 11/16 in.

At a much later stage, with the



Side and rear view of the completed steady



The steady with the hinge in an open position

steady mounted in its proper place, all four were adjusted and locked, as if to take a job 2¼ in. in diameter.

This size is the mean between 1 in. working minimum, and 3½ in. maximum capacity. In this position, their ends were machined out with a large boring bar, as may be seen from the photographs.

The effect is to give line contact support on each one below the mean size, and a total of eight contacts for diameters above 2¼ in. Moreover, all points of contact occur on *concave* surfaces, which is a better way of presenting a bearing surface to a shaft than the small convex ends of the usual steady points. It will be appreciated that the plungers cannot turn in their bores. Their hollowed ends are also better suited to retaining lubricant.

These considerations decided me in favour of round section plungers on the inside, instead of flat ones on the outside.

The contours of the sideplates, four pieces in all, were by now finished on the outside, but still rough and ragged on the inside edges, as a result of drilling out the semi-circular pieces for the main aperture, which was to be 3⅝ in. dia. In addition, the ends of the plunger housings were left projecting slightly on the inside.

Since I intended that all components surrounding the main aperture should be finished flush at the above diameter, I next began to make the hinge and front clasp. Two heavy lugs, made from ¼ in. bar, were shaped for the hinges, and mounted on the inside of the upper sideplates, each fixed with 5/32 in. snap head rivets, flush finished invisibly on the outside; the technique of this operation is within the scope of most skilled model engineers. Similarly, the rivets which fasten the base angles to the lower sideplates are finished invisibly.

The projecting parts of the lugs, with a 1 in. spacer between, were then drilled through ½ in. and reamed slightly over with an expander. The sideplates were then dismantled, and a phosphor bronze tube, made from $\frac{9}{16}$ in. stock, was turned down at each end to an interference fit in the holes. The lugs and shouldered tube ends were then pressed together in a 6 in. vice. The tube passes a ⅜ in. cheese-head screwed pin, with castellated nut.

At the front of the upper or hinged half, a thick-walled channel section was called for, and this had to be machined from the solid, an open slot for a swing bolt being provided in the web for it. The fixing of the channel piece is by three screws and two locating pins on each side.

A word on making the swing bolt. The boss has to be so much larger than the shank that it is wasteful of material to begin with a bar that will clean up to the appropriate size of head. Having decided that the maximum diameter should be about ¾ in., I selected a piece (in fact, ⅝ in.) less than this size. I turned down and threaded the shank $\frac{7}{16}$ in. BSF, and then parted off the bar and reversed the work piece in the chuck; the free end was then turned spherical.

A piece of tube about a foot long was tapped out with thread to match, and the job screwed into it; this made a convenient handle for heating up in the forge and protecting the thread and subsequently for hammering out the spherical end to form a flat on either side. The effect was to increase the remaining portion of the sphere to about 25/32 in. dia., after which the flat faces were milled and a hole provided for a ⅜ in. pin. Brass collars locate the bolt in its central position.

It was now possible to assemble the upper and lower halves (drawn tightly together as they would be under working conditions, though without the embarrassment of the foot or base) and to mount the whole on the faceplate, leaving a bare ⅜ in. to spare over the ways of the bed. Everything on the inside was then bored out to a smooth finish on 3⅝ in. diameter.

The two lower sideplates need angles on the inside, in preparation for fixing to the base. I decided to use two pieces of 1½ in. × 1½ in. × ¼ in. bright angle each with half the bottom flange cut away, making them, in effect, 1½ in. × ¾ in. × ¼ in. angles. Each is secured to its sideplate with 5/32 in. snap rivets, invisibly flush finished on the outside; eight No 0 BA screws fix them to the baseplates.

An external angle cleat is also mounted on the outside; it measures 2 in. × 1½ in. × ¼ in. and is cut from 2 in. × 2 in. black angle, finished bright all over.

The baseplate itself is 4 in. square, cut from 4 in. × ⅜ in. black bar and again finished bright all over without machining.

Two ¾ in. × ¼ in. bars, screwed and pinned beneath, give a close sliding fit between the hardened steel strips that form the ways of my lathe. The whole is held down in place by the clamp plate with a single stud, which is seen in the right-hand picture on page 492.

The lubricator is a special feature which merits comment. Comparison of the two pictures will show that it is mounted on pivots, so that, as the upper half of the steady is hinged open, the lubricator remains in the vertical, without spilling its reservoir of oil. Drip feed is by simple coned needle valve over a 3/32 in. orifice.

I was pushed for time as I completed this steady. Only a few weeks ahead was the 1954 Model Engineer Exhibition, where I intended to put it on show. I decided to finish the sideplates by scraping; a type of finish which might have been avoided if I had had more time at my disposal.

One small point sometimes troubles me. Why should a job supported in a steady and held in a chuck exhibit a strong tendency to come out of the chuck, despite the action of the tool which tends to force the job *into* the chuck? Perhaps a reader who has had similar trouble will write to ME Postbag about it. ■

Young men of the 'nineties

It was a tremendous year. War between Spain and the United States began unofficially with the sinking of the battleship *Maine* in February, and officially with Spain's declaration of hostilities in April. Britain had a war of her own. A month after the last shot had been fired in Cuba and the Philippines, Kitchener met the Mahdi at Omdurman and avenged the dead Gordon by taking Khartoum.

There was little of eventide quiet at the century's end. Although the old Queen, driving through cheering crowds or sipping her morning cup of cocoatina, seemed the perfect symbol of a nation's confidence and contentment, the tides of social and national unrest were pulsing everywhere. There were ugly scenes in Wales, where 100,000 miners had gone on strike, and violent scenes in the streets of Paris where Zola had been sent to prison for defending Dreyfus. In Geneva, by the lake, the Empress of Austria was stabbed to death with a weapon like a bradawl. Above all, the fear of a devastating war hung heavily, and Russia's suggestion for a disarmament conference did not entirely convince the nations that her intentions were without guile.

This was the world, far from untroubled, in which MODEL ENGINEER went out from Farringdon Street to meet its first readers. They were, for the most part, young men alert to the present and eager for the future. Above all the anxiety, above all the terrible hardships of the poor, burned that unquestioned belief in Progress which had lit the century.

Steam was victorious on land and sea; Marconi was putting electricity to yet another new use, more astonishing than any; and, as the miracles multiplied, Humphry Davy's idea of science as a single adventure descended to the common man.

If fresh territories were being opened up on the earth's surface, even greater ones were being explored within the mind. H. G. Wells wrote *The War of the Worlds* ten years before startling his own world with the fantastic notion of a war fought in the air. And Bernard Shaw, who hobbled to his wedding on crutches in 1898, was stirring up new ideas of society as well as of the arts.

For all but the poorest, it was a great time to be alive and young. The eager young men who read MODEL ENGINEER in 1898 (and some of them were angry young men, too) had a feeling of being in tune with the times. Fostering their interest in steam and electricity and in every kind of invention, the craft of modelling gave them an insight into all the details so that they had a knowledge of the prototypes which was unique among laymen. Long before a wireless set of any kind could be bought in the shops, they were making apparatus of their own to ME instructions.

Some of those young men are still reading ME. In adding 60 years to their age, time has taken nothing from their enthusiasm, and among all the readers of ME in 60 countries none will be keener to read the Diamond Jubilee Number which is being published on the first of May.

It is a far cry from Percival Marshall's little paper, sold in the 'nineties for twopence, to the handsome two-shilling issue with its 80 bright pages and its pictures in colour. But the solid core is still there.

Above all, this is an occasion for memories and meeting old friends. Edgar T. Westbury will be there, of course; and there with him will be J. N. Maskelyne, taking a long look down the railway arches of the years, while Edward Bowness orders the mainbrace spliced for some of the great ship models which he has known. As for LBSC—the Old Master goes steaming happily into the past, to bring back something for all of us.

The wise reader will make sure of two copies, one for himself and the other for a friend. Every copy of this handsome issue, no matter who reads it, is bound to help the movement. It will create enthusiasm but even more it will create respect for the movement; by showing the layman exactly what model engineering means. And if the friend becomes a regular reader you will have his lasting thanks.

He may have missed 60 years of ME, but the Diamond Jubilee Number is a good place to begin—and it is certainly better than not to begin at all! ■

Fine feed drive for a small lathe

In this second article in the series, EXACTUS discusses the details of the eccentric and the ratchet arm, with advice about assembly

THE first piece of material needed to make a start on the fine feed mechanism is a piece of 1⅜ in. dia. bright mild steel for the eccentric. Any odd scrap that will clean up at each end to ¾ in. in length will do.

Hold in a three-jaw chuck for facing the ends and when you have done this reduce the diameter to 1⅛ in. for ⅜ in. of its length. This is the diameter on which the operating arm runs so get a nice finish on the final cut; a light rub with a piece of fine emery-cloth will do the trick·

Also, make sure that you do not leave a radius at the shoulder; to be on the safe side I would suggest a small undercut, then there is no fear of the arm not coming right up to the side face.

In the centre of the eccentric cut a small oil groove—as shown in the drawing—with a round-nose tool.

For the next part of the job you will need a turning tool with a keen edge to enable you to scribe a line across the face of the 1⅛ in. dia. Set the tool exactly on the centre line and then draw it across the face of the piece of mild steel. This will give you a sharp thin line. Now give the chuck a quarter of a turn and scribe another line as before. Where the two lines cross is, of course, the exact centre of the diameter and from here you can mark off the throw of the eccentric.

First remove the job from the chuck, because it is far easier to mark off on the bench. Make a small centre-pop where the two lines cross and then set the points of your dividers ⅛ in. apart. Place one point in the centrepop then intersect either one of the lines and mark the position with the centre punch.

Having marked the position of the ⅝ in. hole you are ready for setting up. The three-jaw will be of no use for this job so remove and replace it with the four-jaw. Grip the job lightly in the chuck and adjust the jaws until you have the centre running true—the centre of the eccentric, not the centre of the bar. A hardened centre in the tailstock can be of assistance here by lining up your centrepop to it. The work is not that critical that it must be spot on to the thou.

When you have the job all set, start off by drilling in the normal way with a centre drill and then a small drill about ⅛ in. for a pilot hole. Open this up with the largest size drill you have for the lathe. Whatever size this is the remainder of the metal to be removed will have to be bored out.

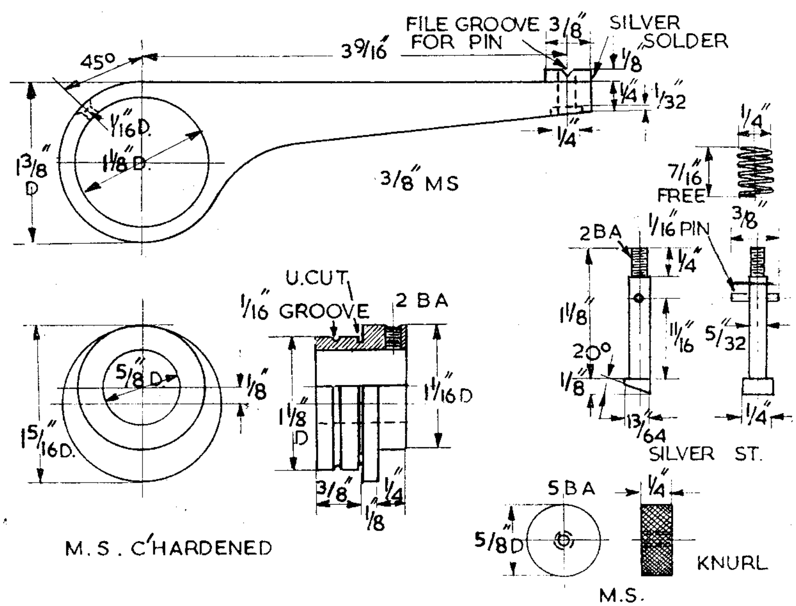
Before you start boring have a piece of ⅝ in. dia. bar handy that can be used as a gauge when approaching the final cut. Check the size of the bar with that of the lathe mandrel to make sure they are the same. It is wise to have such a gauge handy because if the eccentric doesn't slide on the mandrel when first tried a lot of time can be spent resetting it in the chuck to remove that little extra.

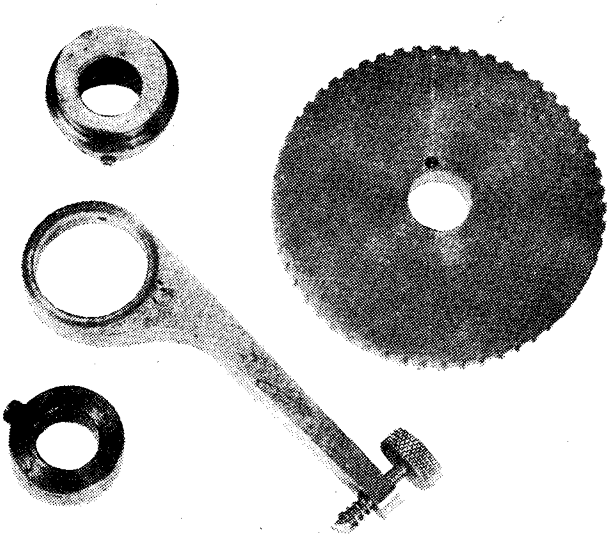
When you are satisfied that the bore is correct replace the boring tool with an ordinary turning tool and remove some of the metal on the outside diameter (Fig. 4). Remove all sharp corners and the finished job should be a very neat piece of work.

The eccentric is locked to the mandrel by a 2 BA Allen grubscrew, so to accommodate this, drill a No 26 hole as shown in the drawing and tap 2 BA. To protect it against excessive wear give it a hard skin by getting it red hot and then sprinkle some casehardening compound sver.

Bring it up to a bright red again and then plunge it into a tin of cold clean water. A word of warning about quenching anything out in cold water in a casehardening process. *Don't hold your face near the water.* Have the can of water on the floor and drop the work in.

That finishes the eccentric, so now we can make a start on the arm. It can either be made from one piece of material or fabricated from two pieces. The two-piece method may be favoured by many as it will be far easier boring the 1⅛ in. dia. hole in a piece of ½ in. b.m.s. 1⅜ in. square on a small lathe than from one piece 4½ in. long. To bore a hole in a piece of material of this length it





Components of a fine feed mechanism for an EW or small lathe

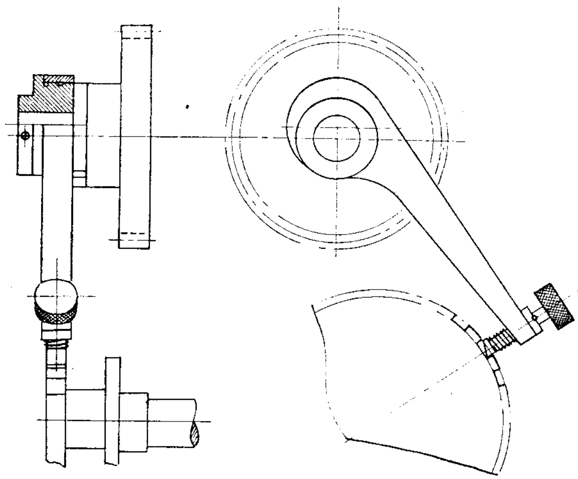
would have to be set up on the cross-slide on a small lathe.

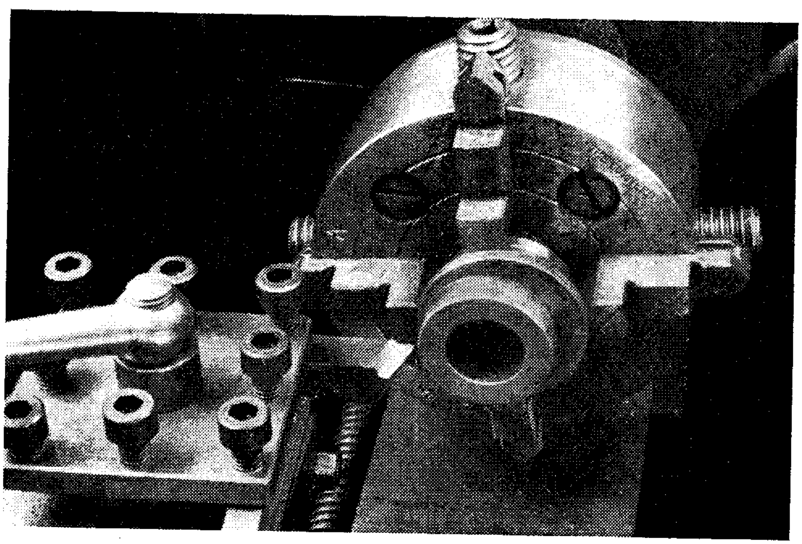
Mark off the hole for boring and then set it up ready to begin. Like the boring of the eccentric, start off in the same way and after running the largest drill you have right through bore out to suit the eccentric. When it is a nice fit remove from the lathe and, for those who are fabricating the arm, prepare for brazing or silver soldering the piece of mild steel to complete the arm.

At the end of the arm silver solder a piece of 3/8 in. dia. mild steel 1/8 in. thick. This gives more metal to act as a rigid guide for the pawl. Clean the work with a piece of emerycloth and mark off the position of the pawl as shown on the drawing. Drill and ream 5/32 in. and on the underside spot face a 1/4 in. dia. 1/32 in. deep for the spring to sit in.

On the topside file a small groove right across the centre of the hole for the 1/16 in. dia. pin to rest in. Drill one oil hole at the opposite end of the arm to lubricate the eccentric; but I think you will find this best if left to the very last. All that is required to finish the arm is to shape it up, taking off any sharp corners, and make it look like the one in the drawing.

That completes the two major items, now for the smaller items. The pawl is made from a piece of 1/4 in. dia. silver steel, a very straightforward turning job. When turning the 5/32 in. dia. check it with the hole in the arm and don't make it a sloppy fit. Reduce the end further for a 1/4 in. to 1/8 in. dia. and thread it 5 BA. Remove it from the chuck and drill the 1/16 in. hole for the pin as dimensioned in the drawing.





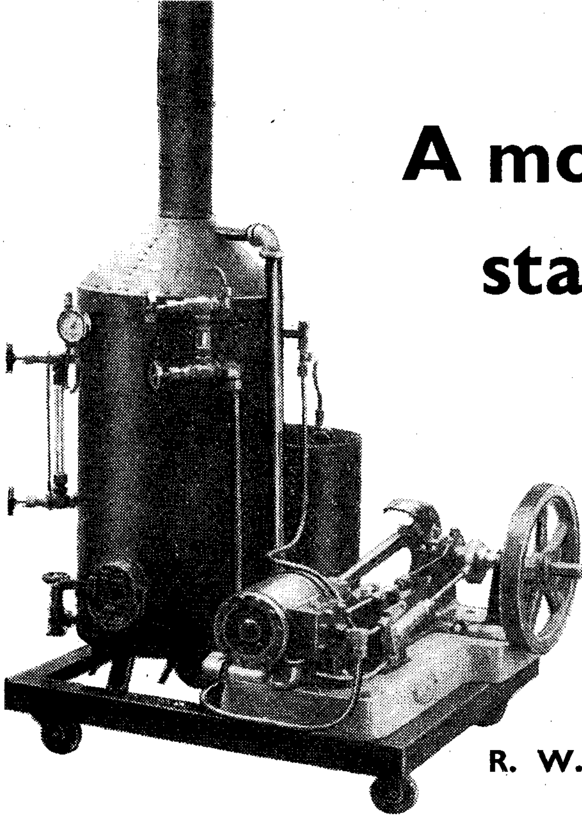
Below: *Finishing the eccentric*

The end to engage in the ratchet wheel is shaped up with a file. So as not to lose the sharp edge through riding continuously over the ratchet wheel harden and temper the pawl by getting it red hot and then dipping it in oil or water. Clean it up with emery and return it to the flame until it begins to change to a dark straw colour then quench it out in oil.

The knob can be made from any piece of odd material about 3/8 in. dia. Hold it in the three-jaw for drilling No 37 and then tap it 5 BA and if you have a knurling tool, knurl the outside.

Face off both ends to the finished length of 1/4 in. The spring can be made to suit. A piece of 22 s.w.g. will be quite satisfactory. When the pawl is assembled in the arm complete with spring and knob, insert a piece of 1/16 in. silver steel 3/8 in. long in the pawl so as to load the spring.

● *To be continued*



A monster in modern stationary steam engines

An American contributor has some fun wrestling with four sets of "giant" castings

BY

R. W. MAYNARD

IN constructing model steam engines, the question has often entered my mind: "Just when does a model cease to be a model?

Someone gave me castings for a large stationary engine, and like all true model engineers, I decided that the opportunity should not be rejected. It happened like this.

I spent the evening at the home of a friend and in the corner of his photographic darkroom I saw a set of castings for a rather large stationary engine. I knew he was mildly interested in this sort of thing, but from the covering of dust I knew there might be a chance to talk him out of using the castings himself. I hoped he might have lost interest in the project and would want to be rid of the pile of iron.

He was and he wasn't. It seems as though there were five sets of castings, and at that my ears grew a bit more keen; I could almost smell the coal smoke drifting lazily from the chimney stack. After some discussion he agreed to give me all five sets, provided that I finished one set for him. It wasn't a bad bargain as each set of castings weighed almost 35 lb.

I think the idea of a really large stationary engine rather appealed to me, as in my mind's eye I could see it coupled to a saw, pump, winch, and I even had visions of using this huge steam demon in some sort of a boat. The Federal Steamboat Laws popped into my mind and this lovely vision vanished in a maze of examinations and papers for engineers and pilots.

Of course, it was impossible to keep such good luck to myself, and mentioning the castings to my brother-in-law, an engineer, he set himself to worming into my good graces and I ended up giving him a set of castings, machined, in return for a certain amount of work he would do toward the task of completing the engines. We also picked up another helper along the way—a skilled toolmaker. At any rate the ratio was a little better as we now had three men and four engines to complete.

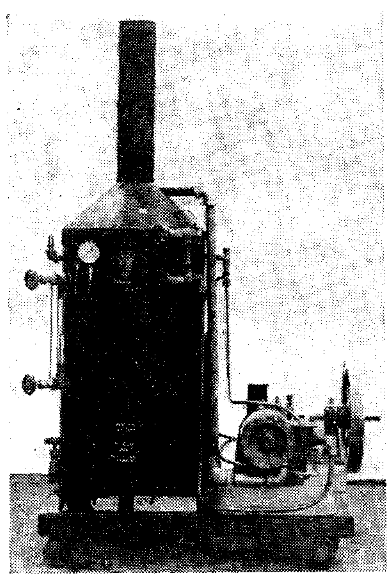
We found it necessary to have the engine beds machined by an outside shop on a large planer. This job was simply too large for anything we were able to use. In the process of machining, one of the beds came loose and was broken, but luckily we had the extra set of castings. This was the only real trouble experienced in construction of the four engines; unless you count the slow dimming of enthusiasm of my helpers, which I expected. These long term projects sometimes daunt the stoutest heart.

I did all the lathe work on my 9 in. home rebuilt, but I can't give the name as I do not know it. To turn flywheels 8¾ in. dia. is about the limit of a 9 in. lathe. We used a cast iron gear blank for the flywheels, the weight carefully calculated to the exact ounce.

I can safely condemn the original designer of these engines, for we were never able to figure out how he intended them to be built. The centre distances were never laid out to give sufficient space to allow crank pin bearings of good size to be used. It was a little discouraging upon finding this out, but somehow we managed to eke out enough to at least make it look like these engines were going to work.

After making a number of small model engines I did enjoy turning these cylinders, with a 2 in. bore, and 2¾ in. stroke. The engines completed, with the wood base, are just a shade under 40 lb. They are really stationary aren't they? The conventional slide valve was set for a 60 per cent cut-off.

At the time I designed these monsters practically everything was rule of thumb, but this was in 1949 and advancements have been made;



End view showing the boiler fittings

we now use both thumbs. Seriously the ME has been most helpful in my steam education, e.g. the engine driven pump on the engine base. This is LBSC type, enlarged directly from the *Live Steam Book*, and the mounting copied from one of the many photographs of stationary engines.

The boiler—and you will note the singular is used; two boilers were made at one time, but only one completed, the other stands finished but naked of fittings. The dimensions are 10 in. dia. × 18 in. high. The shell is ⅛ in. hot rolled steel, and was cut and fabricated into a cylinder at Huntington W.Va. and shipped 160 miles to Cincinnati, Ohio, by river steamboat.

The tubeplate and crown sheet are ¼ in. thick with 25 ⅝ in. dia. 16-gauge tubes. The firebox is 7½ in. dia. with a circular firedoor of 3 in. dia. This was welded together, with a couple of extra pops with an arc-welder to stop the "weeps."

I might add this operation was not a particularly difficult job, for one reason. I have done this type of work professionally for about eight years; and that made it easier!

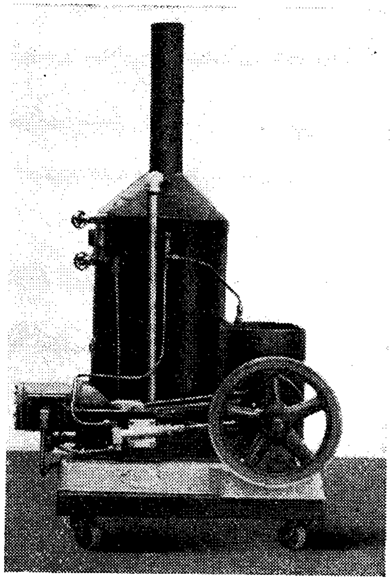
I really gave it the test, we ran the water pressure up to 300 p.s.i., and she leaked not a drop. A tip to makers of steel boilers. An arc-weld is porous. If upon the addition of a few pounds of air you notice bubbles seeping through the weld simply pour in some water, swish it around, and let it stand for a few days. Rust will do the sealing.

All the boiler valves are ⅛ in. standard bronze pipe valves. The water glass fittings are the same, with alterations for attaching the glass. The safety valve is standard LBSC design, as is the boiler check. I don't know if this is correct to say it is his design, but in my memory I see his drawings when I start to make anything, and any variations are due to a poor memory.

The exhaust is of standard ⅜ in. dia. galvanised pipe, and there is no special nozzle of any kind in the stack. The diameter of the hole in the blower is a No 60 drill, and the diameter of the stack is 2½ in. The tin cans used for the stack happened to be this size.

The top extension is removable for storage or hauling, but is necessary for good steaming. The diameter and stroke of the water pump is ½ in., and it will pump about 7½ oz. of water in 300 revolutions.

I would like to point out that the water pump assembly is an interesting experiment. All parts were machined out of S.A.E. 72 brass, ordinary screw machine stock, then nickelled by electrolysis. This makes a bearing that will outwear hardened and polished steel. Sounds unbelievable doesn't it?



The side view: Note the LBSC type pump!

I have seen a high-speed drill, plated, and run against a hardened plate, and the plating remain untouched. This process can be done in the home. I intend to do the cast iron cylinders of my Atlantic locomotive in this manner. This will outwear hard chrome.

In the operation of this power plant there are no bad habits. You just build a fire and there it is. I simply toss in some paper, kindling wood, soft coal, and wait. It takes about 20 min. to raise steam and then about five minutes to get 50 lb. on the "clock." The safety valve pops at 85 lb. and by putting a good load on the flywheel it's easy to hold this pressure. Without any induced draught the boiler will pop itself every few minutes. I think one could say that I'm well pleased with the steaming qualities of this pot.

The engine has no lubricator, so after about 15 min. steady running one must stop and pump some oil into the steam chest. A lubricator will be an addition at a later date, but for the time I will use the hand method, and it does give the engineer something to do.

One of the most tiring but honest questions put to me while building these engines was: "What are you going to use it for?" Most—and I include myself—model engineers dislike this one, and with good reason; but there it is. It is a little difficult for most people to understand the fun of building and the fun of running a steam engine. So one must endure. We do have an answer though. This particular engine and boiler will be used to instruct the sons of my friend, Mr J. A. Deye, the giver of castings, in the function of steam power.

Some final statistics on the size of this monster. From the base to the top of the stack is 36 in., the length of the engine is 22 in. and the weight of the entire unit is 120 lb. dry.

I named this unit *Puffin Joe*, and it was almost finished in time for a Christmas present. The i.h.p. at 80 p.s.i. turning at 300 r.p.m. is about 0.9, and some time in the future I'd like to find out just what the efficiency of *Puffin Joe* really is. ■

IN THE APRIL 24 ISSUE . . .

JOSEPH MARTIN, MODEL ENGINEER feature writer, has been in Manchester to cover the Northern Models Exhibition, one of the biggest events in the model engineer calendar. His report and comments on this show will appear in our next issue.

Also from the pen of this accomplished writer will be an article of special interest to officials of societies who have been searching for means of gaining some kind of rates exemption on club premises.

His diligent researches provided some very useful and surprising information for his brightly written story "Will Peel Act Bear Fruit?" Clubs which have held special meetings to discuss Mr Martin's two previous articles on the new Rating Act will find this latest contribution of even greater value and interest.

Following his introduction of *Jubilee*, the new ME 3½ in. gauge 2-6-4 LMS tank engine, Martin Evans gets down to the first constructional items with details about the mainframes, buffer beams and hornblocks. Also in the locomotive field, LBSC will contribute one of his inimitable Lobby Chats.

The first of a short series on modelling Severn trows will be presented by A. Field, and for our motoring readers, J. Nixon, a popular author in model engineering subjects, writes informatively about a handy car plug blasting device.

POSTBAG

The Editor welcomes letters for these columns, but they must be brief. Photographs are invited which illustrate points of interest raised by the writer

RAIL ADHESION

SIR,—With reference to LBSC's article [March 13], I feel that some comment on his remarks about rail friction and adhesion is necessary.

Let me state first of all that friction between any two surfaces is dependent upon three things: the nature of the surfaces; the reaction (or load) between them; and thirdly, the speed at which one surface passes over the other. This third factor can be counted as negligible at low speeds (1,200 feet per second is the speed beyond which it creates a problem—I think).

This can be shown quite simply by the schoolboy experiment with a wooden block which is placed on various surfaces (glass, leather, wood, sandpaper, etc.) and it can be shown that different forces are required to move the block over the different surfaces.

The block is furthermore shaped so that the area of one surface is different from the area of the other, and when the block is turned from one face to the other, it can be seen that the same force is required to drag it along (without acceleration of course).

I suggest that the reason why No 261 *Wigmore* slipped on the stiff climb up to Crystal Palace station was not that there was a difference in the area of contact between the wheel treads and the heads of the old and the new rails. I yield to the fact that it was because the rail heads had not worn in, but this does not mean that area of contact was the cause of slipping. It might mean, however, that the surfaces of the new rails were different (slippier) from the old rails. Perhaps the rolling process causes this; it might be worth looking into. If LBSC cares to carry out the experiment I have quoted he may understand.

Let me conclude by saying that in my opinion the conclusions LBSC has drawn from his little anecdote are wrong and do not " stultify the calculations made on a slide rule " because he himself admits that the slide-rule manipulators overlook the difference in friction when the wheel tread bears for its full width and when it has less area of contact.

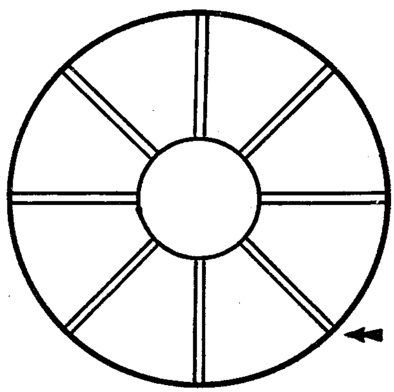
If this fact were omitted from the calculations, then quite obviously it could not be calculated, and hence the occurrence of this fact in actual practice does not stultify the said calculations. It does make the basis on which the calculations were made quite wrong however.

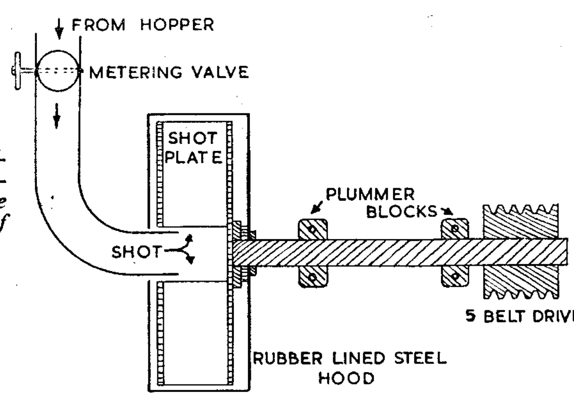
Kirkaldy, Fife. GERALD I. KINGHAM.

SANDBLASTING

SIR,—The makers of the American type sandblasters in this country are: Tilghmans Patent Sandblast Ltd, Atlantic Street, Broadheath, near Manchester.

I worked for this firm for a short period about 20 years ago. I am not in a position to give much information, but I may be able to help. Made in several sizes the sandblaster is a steel box with a shot wheel in the roof. The articles to be blasted inside are moved around on a broad endless chain. All mechanical parts inside are protected by thick rubber, and where this is not possible by thick cast plates, called wear plates.





Details of the sand-blasting machine described on this page by Mr Schofield, of Carlisle

The axis of the shot wheel is about 6 in. above the roof and covered on top by a sheet steel rubber lined hood. The wheel consists of two plates about 2 ft dia. and about 5 in. apart. The shot throwing plates are arranged like spokes (see sketch). These wheels are a nice piece of work and great care is taken to ensure their balance as they run very fast.

This type of machine can be a dangerous outfit, as it does its work in a matter of minutes. They are fitted with safety devices at the works to prevent their being opened while the shot wheel is running. The shot is fed into the hub of the wheel from a hopper above, the rate of feed and the speed of the wheel, I don't know.

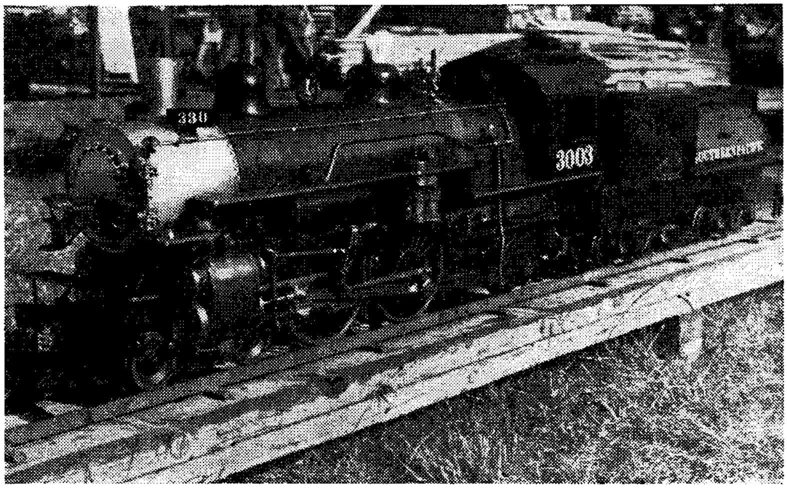
I'm writing chiefly to prevent anyone getting hurt. The makers may supply information about their unit. Wear is very rapid, especially of the wheel shot plates; about 10 hours, I believe, in the commercial machines.

Carlisle. F. Schofield.

GAUGE O

SIR,—LBSC's interesting article " Steam Mice " calls to mind the compression ignition weasel made many years ago by my grandfather for a farmer friend who was troubled by rabbits.

He originally had a real weasel named Jim, but it grew old so he asked grandfather to make him a mechanical one. It consisted basically of a fur-clad cylinder containing two free pistons each equipped with a pair of legs which projected through slots in the cylinder walls. These slots were sealed with leather flaps to



The 5 in. gauge 4-4-2 locomotive built by Mr A. B. Clancy, of Oregon

prevent the escape of hot gases. The initial explosion was caused by hitting it in the stomach with a small hammer, after which it careered along at terrific speed.

This diesel weasel never actually caught any rabbits, but apparently they were fascinated by the sight of it banging round the field and stood transfixed while grandfather went about picking them up by the ears and dropping them into a bag.

One day the local squire climbed through the hedge to see what was afoot, and the strange contrivance shot straight up his left trouser leg and blew a gasket.

Shortly afterwards grandfather moved to Cheam.

London, W.3. MICHAEL OXLEY.

ELECTROLYTIC ACTION

SIR,—Reference to the electrolytic action between dissimilar metals appears in print fairly frequently nowadays. How serious or dangerous is it? Any metallurgist can simply scare one stiff in a matter of moments if he likes.

Yet one sees every day in prototypes and models: Steel boilers with copper tubes; light alloy pistons in c.i. or p.b. cylinders; stainless steel and p.b. in contact (e.g. pistons and rods); bronze bushes in light alloy connecting rods; steel riveted up with copper rivets (horrible, get some steel rivets from Whiston—usual disclaimer); c.i. cylinders bolted to light alloy crank cases and cylinder heads and with copper gaskets interposed (still OK after 50 years of use as far as one can see); and I could go on for pages.

My small locomotive enjoys some good examples, e.g., copper boiler clad in stainless steel, separated (completely, I hope) by a cardboard sheet. Will the boiler or the cladding get a hole in it first? Will my dural or stainless handrail knobs fall out or will the m.s. cabsides disintegrate? And what is more—how rapidly?

Some time ago I inadvertently put a light alloy knitting needle in my box of silver steel stock. It "corroded" to about half its original diameter. Was this electrolytic action? Whatever it was I got a shock.

I am sure that a *detailed* article in the ME by some *practical* chappie who knows *all* about it theoretically would be worth a guinea a line to those of us who don't mind admitting that they are mystified about it all.

Birmingham 17 H. M. SAVAGE.

AMERICAN MODEL

SIR,—My photograph shows the 1 in. scale 4-4-2 locomotive which I have nearly completed. The tender springs and blow-off cock were temporary. However, the engine has completed 100 hours testing and proved quite satisfactory.

No 3003 is 6 ft long and weighs 300 lb.; working pressure 100 p.s.i.

Oregon. A. B. CLANCY.

BUILT TO WORK

SIR,—While in no way wishing to cast adverse reflections on the work of the late Henry Greenly in the field of small steam engines and locomotives, I feel that your correspondent of many years, Mr K. N. Harris, is a little too ready to spring to his defence.

In particular do I deplore the last paragraph of his letter in your issue of the 20 March 1958, as I feel sure that the majority of your older readers who remember the "Battle of the Boilers" and other similar encounters will have little difficulty in identifying the personality referred to by Mr Harris.

The late Henry Greenly devoted most of his life to the design of numerous model engineering works, notably the small steam locomotive, and no discerning student of his work would wish to detract from the value of his contribution in this field. Indeed his "principal detractor" has acknowledged this on more than one occasion.

To concede this should not, however, blind us to some of Greenly's more obvious failings. I do not think it would be ungenerous to say that his approach to these matters tended to be rather academic at times and I cannot altogether escape the conclusion that his attitude at times was that of the rather remote theorist somewhat isolated from the rough and tumble of the foundry and machine shop where his paper plans were transformed into reality.

I do not know what degree of mechanical dexterity and skill he possessed—he was certainly a most competent draughtsman. I do not recall ever seeing any work which he had himself produced to his own designs. It would, of course, be quite ridiculous to insist that such skill is an essential prerequisite to a successful designer, but from his own extensive experience Mr Harris will, I am sure, agree that it can be most useful.

So far as the ME is concerned I feel that one of its principal functions is to encourage the extension and development of the hobby. Some of Greenly's articles seem to me to leave a good deal to be desired in this direction. For example, in discussing the design of expansion links for Walschaerts valve gear in his otherwise excellent handbook published by Percival Marshall, he rather contemptuously dismisses the abilities of his readers as follows:

"While a mathematical solution of the problem is possible it is certainly beyond the scholastic attainments of the average amateur."

While no doubt in some measure true I feel that this and similar phrases are, to say the least, somewhat pompous and gratuitous and hardly likely to encourage the average amateur to venture far along roads apparently beset by such formidable mathematical barriers.

So far as Greenly's corrected valve gear is concerned there is no doubt that it represented a substantial improvement on the crude and incorrect apparatus which it was intended to replace on the early models. Nevertheless, despite the advocacy of Mr

POSTBAG . . .

Harris, it should be recognised that there are a number of mechanical objections to this device, and the scarcity of models fitted with it in existence lends some point to this.

Greenly's own instructions in connection with the adjustment of this gear, in his book *Model Steam Locomotives* run as follows:

"A serious error in the writer's gear may be corrected by bending the swing link, or in Joy's gear by a similar operation on the connecting-rod."

While such manipulation may be acceptable in the case of small gauge toys it will hardly commend itself to the builders of models intended for serious work.

Greenly's influence on the hobby was very considerable and his memory is perpetuated in many ways and in many places. I do not think, however, that it would be an overstatement to say that the work of his "principal detractor" has had even wider consequences. I am confident that it would be true to say that the majority of successful small working steam locomotives in existence today have been built in accordance with the principles developed and publicised by the latter gentleman rather than by Greenly. Indeed many of these ideas were actively denounced by Greenly as unsound when they were first put forward.

Louth, Lincs. — A. G. BURDETT. B.Sc.(Eng.) A.M.I.C.E.

SIR,—I cannot refrain from commenting on the rather pointless statement by K. N. Harris [Postbag, March 20] about the old Greenly-LBSC arguments.

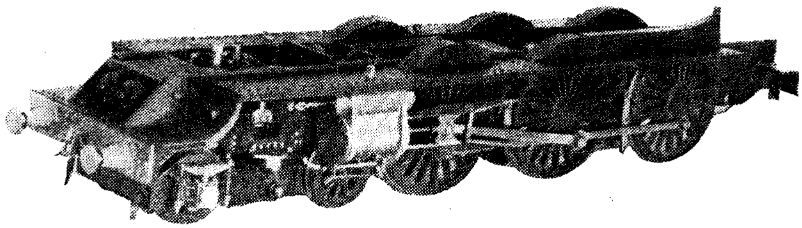
The reasons for the fact that nothing of the work of LBSC has been shown in the Science Museum are probably: *working* steam locomotives which do not pretend to be scale models are not exactly what would be used in the museum in any case; and LBSC prefers to *use* his locomotives rather than stick them in a glass case.

My own opinion is well expressed by the fact that I have seen very few locomotives to Greenly's plans; and the ones that I did see are very inefficient.

When a locomotive on the Romney Hythe and Dymchurch was altered from the Greenly design to include a superheater and one or two other things, the performance improved out of all proportion.

Yet "expansion in small cylinders is rubbish." When I consider that the many engines that I have driven would all notch up with corresponding economy in fuel, etc., I am led to wonder exactly what theory made Greenly make such a statement.

I consider that a really good locomotive should first work like the full-size one (or better) and then that it should be a replica. The enclosed photograph of my own 5 in. King chassis will show that there is not much left to be desired, and when things like lagging, etc., have been finished there will be almost no difference in appearance at all from full size.



A 5 in. King class chassis under construction by Mr K. E. Wilson

Whatever others may say, a 5 in. King is well within the capacity of a small workshop which has a lathe at least the size of a Myford; my own locomotive is being made in my bedroom, which is the only place in the house at all suitable! I have no machine tools apart from an ML7 and a small portable electric drill.

Hanwell, London W7. — K. E. WILSON.

A SIMPLE O GAUGE STEAM SHUNTER

Continued from page 477

The sump is made from brass channel ⅜ in. deep × ½ in. wide × 16-gauge. The ends are closed by 18-gauge angle pieces filed to suit and silver soldered. Rivet the buffer sockets, and then leave the buffers for the moment.

Drill and tap 3/16 in. × 40 t. for the feed pipes and fixing bosses. Screw on the fixing bosses and assemble the buffers with 10 BA nuts and springs. Line off and drill the bolt holes in the bottom of the smokebox front.

Make up the gland pieces and fibre washers—they prevent a high spirit level in the sump leaking along the buffers—and construct the burners by drilling ⅜ in. brass rod 11/32 in. Leave the bottom ¼ in. thick, drill 5/32 in. and tap 3/16 in. × 40 t. for the feed pipes and make sure there is a clear channel for the spirit.

Make up the feed pipes from 3/16 in. o.d. thin wall copper or brass tubing, screw the ends and tin them, then assemble in the burners and sump.

The main tank is made up from a slice of 2⅛ in. o.d. × 16-gauge brass tubing. Anneal and shape on a 1 in. dia. rod. Drill the ¼ in. and 5/16 in. holes in the top, drill 5/32 in. and tap 3/16 in. × 40 t. in the bottom for the valve body. Make up the spindle guide plate and drill and tap the top 10 BA to suit. Make up the endplates from 22-gauge brass and fit them inside. Before fixing, rivet a small piece of brass angle to the underside for locating the sump.

Rivet the endplates in position by a small piece of brass angle at the bottom of each. Turn up and fit a filler cap boss and sweat this in place with soft solder, also the edges of the front and rear plates.

The needle valve is made from a piece of 4 BA screwed steel rod. Turn the valve end to 3/32 in. dia. and form the seating in the lathe by a few strokes with a fine file. File a flat on the first ⅜ in. of thread to allow the spirit to flow. Turn the top to an easy fit in the guide plate, drop the guide plate on and turn up a knurled steel knob, pressing this on the spindle tightly. Make up the valve body to the dimensions given and screw this into the tank.

Line off, drill No 50 and tap 8 BA the hole in the sump for locating the tank lug.

You should now be all set for running. Fill the burners with loosely-packed asbestos string. The boiler should be filled with 4 cu. in. of hot water (you can easily make up a vessel containing this amount).

The lubricator should contain rather more than half its capacity of steam cylinder oil (Stuart's works very well). The spirit tank can be filled to the brim and the needle valve opened.

The correct setting of this will have to be found by trial.

In about three or four minutes the safety valve will blow, and it is then a good opportunity to top up the spirit tank. Open the lubricator valve about one quarter of a turn and the throttle halfway and you are off.

I can only think of one "don't," and that is *don't* forget to shut off the lubricator when the engine is still, even if the throttle is closed.

This free advice service is open to all readers. Queries must be of a practical nature on subjects within the scope of this journal. The replies published are extracts from fuller replies sent through the post: queries must not be sent with any other communications: valuations of models, or advice on selling cannot be given: stamped addressed envelope with each query. Mark envelope clearly "Query," Model Engineer, 19-20 Noel Street, London W11

READERS' QUERIES

DO NOT FORGET THE QUERY COUPON ON THE LAST PAGE OF THIS ISSUE

On Netta

I am building a 3½ in. gauge *Netta* and wish to know if 16 gauge copper plate will be suitable for the throatplate and smokebox tubeplate.

Could you also give me some information on the boiler casing? LBSC does not seem to have mentioned it.—J.C., Manchester.

▲ *Sixteen s.w.g. is really a bit on the thin side for this gauge smokebox tubeplate and throatplate. You may have difficulty in getting sufficient threads in your "Leader" fitting in the former, also for the nipples at the ends of the longitudinal stays.*

From a safety point of view you are not advised to employ over 70 *lb. pressure. You may be able to get in extra stays. If you can, obtain* 14 *or* 12 *s.w.g. rather than rely on the* 16 *s.w.g. material.*

If by boiler casing you refer to lagging and cleading, LBSC does not usually describe this. But if you have sufficient room for it use $\frac{1}{16}$ *in. asbestos sheet for the former and hard-rolled brass sheet, about* 26 *s.w.g., for the latter.*

Building Bat

I am considering the construction of the gauge O 4-4-0 steam locomotive *Bat*, to LBSC's design (Southern Schools class). This engine was described in ME during 1940.

The original design calls for *sprung* axleboxes on the coupled axles, but some of LBSC's other gauge O engines simply have plain bronze bushes instead (e.g. *Mollyette*).

Is it permissible to use plain bushes instead of sprung axleboxes on *Bat*?

I would like to fit a dummy set of outside Walschaerts valve gear while still retaining the loose eccentric gear between the frames, and would welcome your advice as to how this could be arranged.—B.H.M., Wollaston, Northants.

▲ *Although unsprung axleboxes can be used properly sprung axleboxes with live steam locomotives are always recommended owing to the improved adhesion obtained.*

A dummy set of outside Walschaerts gear could be fitted, but would need some means of supporting the top joint of the combination lever and the front joint of the radius rod without fouling the "real" valve spindle.

Such a dummy set could be built up from nickel-silver strip about $\frac{1}{16}$ *in. thick.*

Steering a sailing ship

I have rather a problem on my hands and I wonder if you could help me. I am building a working model sailing ship and I want a "man at the helm." I have thought of radio control but as I know nothing of radio I do not like the idea. I wonder if there is any chance of steering by the spanker if I rig it as a barque. If possible I don't want any out of scale gear on deck.—R.M., Horsley, Derbyshire.

▲ *Radio control is probably the ideal solution as it need not interfere with deck detail, but not every sailing man has the knowledge of radio or the interest in such things, and a more mechanical arrangement is called for. The spanker might be sufficient to work a Braine gear with a barque rig as the gaff topsail would help. The quadrant might be difficult to hide unless it could be placed underneath the poop and bring out the lines through the break of the poop, leading them to the boom by guide pulleys. In one successful ship-rigged model the builder has put a boom on the mizzen staysail and taken additional lines from this to the Braine quadrant.*

For the EW lathe

I am enjoying very much and deriving much benefit and pleasure by improving my EW lathe by Martin Cleeve's "additions." I have, however, two questions to ask. I am making the lathe stand but do not know how to make and fit the loose/fast pulley striking gear. Has it been previously described, or is there an article on its making due to appear in future?

The fabricated cross-slide is a very attractive project but here again I need to know more about how to make it. Do I refer to a back number, please, or await a future one?—J.P., Ruislip.

▲ *Fast and loose pulleys with striking gear to the lathe drive is not a very usual arrangement unless it is desired to employ a line shaft to enable more than one machine to be driven from a single motor. Where individual motors are employed, it is generally quite satisfactory to control the motor on the switch alone so long as it is not started under load. However, there is very little difficulty in fitting a fast and loose pulley and the striking gear consists simply of a fork with some means of moving it to shift the gear from one pulley to the other. The fork must, of course, be on the leading side of the pulley. A description of a fabricated cross-slide which is essentially similar except in detailed dimensions as that recommended for the EW is published in the issue of* MODEL ENGINEER *dated* 21 *March* 1957. *A copy of the issue is obtainable, if required, from the Postal Sales Dept., price* 1*s.* 4*d. post paid.*

Arc welder

I would like to know if you could supply me with drawings for an arc welder to plug into a 10-15 amp socket, 220 volt a.c., as I am interested in building one myself.—E.S., Kitwe, Kenya.

▲ *Drawings or any data on the subject of the construction of welding transformers would not be supplied by any maker. As these transformers are of a special nature, there are no publications on this subject. A transformer that should suit the application can have a core* 3 *in. square and measuring* 9 *in. overall. This style of transformer does not have the usual centre limb, and it can be built up from either L-shaped pieces of a suitable measurement, or from cut strips. The assembly is with two outer limbs, and the respective coils are wound, one on each limb. The reason for this arrangement is to give the transformer the necessary characteristic of a drooping voltage. For the transformer, the primary can be wound with a total of* 120 *turns of* 10 *s.w.g. enamel covered copper wire. The secondary may be wound with a total of* 40 *turns of* 4 *s.w.g. double cotton covered wire. The transformer is preferably mounted in a metal tank, oil filled, using ordinary switch oil. If assembled for air cooling, it should be assembled in a well ventilated casing. The oil immersion will give a better performance so far as loading is concerned.*